Work and Performance Feedback in a Digital World: How Social Software Facilitates Feedback Exchange

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Abstract

Today, organizations are challenged to setup digital work environments that facilitate more frequent and continuous performance feedback cycles. As a key element of digital work design, performance feedback is essential for employee motivation, learning and development. However, despite its strategic relevance, research on how digitalization reshapes the exchange of performance feedback is scarce. Consequently, scholars call for research that examines digital work tools and investigates the use of technology for performance management as well as for informal day-to-day feedback. While prior research suggests the value of social software to create digital interaction possibilities, it remains unclear how social software facilitates performance feedback exchange.

Against this backdrop, the cumulative dissertation at hand investigates the impact of digitalization on the nature of work with a focus on the exchange of performance feedback through social software as a particular form of digital work tools. To create a theoretical basis to understand the changing nature of work in the research context, the first article develops an InsurTech innovation model that explains firm-level value creation in the digital world. The subsequent two articles lay the conceptual foundation to explain the roles of information systems to facilitate feedback as well as to describe action potentials of social software. While the second article highlights seven feedback domains in information systems research, the third article proposes a taxonomy to classify action potentials of enterprise social software. The next two articles of this dissertation comprise rich empirical insights. The fourth article investigates social software in the form of a feedback app in a global naturalistic pilot study to elaborate on use practices and social-technical context factors that influence the realization of value. The fifth article investigates the use of enterprise messengers such as Slack and explains how chatbots augment social software with action potentials of traditional enterprise systems, thus, facilitate computer-generated as well as computer-mediated feedback.

Thereby, this research contributes to theory (1) by presenting a model that explains value creation in the digital world through InsurTech innovations, (2) by reducing complexity and providing means to describe roles of information systems to facilitate feedback exchange, (3) by highlighting the value of social software as digital work tools that facilitate computer-mediated and computer-generated feedback, and (4) by elaborating how socio-technical context factors influence the perception and realization of value from social software. For practice, this dissertation offers guidance on how to setup digital work environments with more frequent and continuous feedback cycles.

Zusammenfassung

Unternehmen stehen heute vor der Herausforderung, digitale Arbeitsumgebungen mit kurzen und kontinuierlichen Feedback-Zyklen zu schaffen. Dabei ist Performance Feedback ein Schlüsselelement der digitalen Arbeitsgestaltung und von zentraler Bedeutung für die Motivation, das Lernen und die Entwicklung von Mitarbeitern. Trotz dieser strategischen Relevanz ist die Forschung darüber, wie die Digitalisierung den Austausch von Performance Feedback verändert, rar. Vorhandene Literatur fordert sowohl den Technologieeinsatz für Performance Management also auch den informellen Austausch von Feedback im Arbeitsalltag genauer zu untersuchen und neue digitale Arbeitsinstrumente zu erforschen. Bisherige Literatur zeigt wie soziale Software digitaler Interaktionsmöglichkeiten schafft, es bleibt jedoch unklar, wie im Speziellen soziale Software für den Austausch von Performance Feedback eingesetzt werden kann.

Vor diesem Hintergrund untersucht diese kumulative Dissertation die Auswirkungen der Digitalisierung auf die Art der Arbeit mit einem Schwerpunkt auf dem Austausch von Performance Feedback durch soziale Software. Der erste Artikel präsentiert ein InsurTech-Innovationsmodell, mit dem die Wertschöpfungslogik von Unternehmen in der digitalen Welt erklärt wird. Die beiden nachfolgenden Artikel legen dann die konzeptionelle Grundlage. Der zweite Artikel zeigt sieben Feedback-Domänen auf, während der dritte Artikel eine Taxonomie entwickelt, um die Handlungspotenziale von sozialer Software zu klassifizieren. Die nachfolgenden beiden Artikel dieser Dissertation umfassen empirische Erkenntnisse. Der vierte Artikel untersucht eine Feedback-App in einer globalen Pilotstudie und geht dabei auf Nutzungspraktiken und soziotechnische Kontextfaktoren ein, welche die Realisierung von Mehrwert beeinflussen. Der fünfte Artikel untersucht soziale Software in der Form von Instant Messenger wie Slack und zeigt, wie Chatbots diese mit Nutzenpotenzialen traditioneller Unternehmenssysteme erweitern.

Diese Forschung trägt zur Theorie bei, indem sie (1) die digitale Wertschöpfungslogik anhand eines InsurTech-Innovationsmodells erklärt, (2) Werkzeuge bietet, um zu beschreiben wie Informationssysteme den Austausch von Feedback fördern können, (3) den Wert von sozialer Software als computergestützte und computergenerierte Feedbackinstrumente hervorhebt, und (4) aufzeigt, wie soziotechnische Faktoren die Wahrnehmung und Realisierung von Mehrwerten aus sozialer Software beeinflussen. Für Praktiker bietet diese Dissertation wertvolle Hinweise für die Gestaltung von digitalen Arbeitsumgebungen mit kürzeren und kontinuierlicheren Feedbackzyklen.

List of Abbreviations

ESS .... Enterprise Social Software

FinTech .... Financial Technology

GRQ .... Guiding Research Question

RQ .... Research Question

InsurTech .... Insurance Technology

IS .... Information Systems

IT .... Information Technology

PromO .... Promotionsordnung

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Part A - Summary

Research Motivation and Objective

The volatility, uncertainty, complexity and ambiguity of today's digital world demands for more frequent and continuous performance feedback cycles (Saleh & Watson, 2017; Schrage, Kiron, Hancock, & Breschi, 2019). Yet prior research on how digitalization is changing the exchange of performance feedback is scarce and the value of technology for performance management remains unclear for scholars and practitioners alike (Lechermeier & Fassnacht, 2018; Levy, Tseng, Rosen, & Lueke, 2017). Consequently, research is needed that examines novel digital work tools (Mrass, Li, & Peters, 2017; Richter, Heinrich, Stocker, & Schwabe, 2018) and investigates the value of technology for performance management as well as for informal day-to-day feedback (Ashford, Blatt, & Walle, 2003; Ashford & Cummings, 1983; Levy et al., 2017).

The existing body of knowledge highlights the strategic value of performance feedback as an essential driver of employee motivation, learning and development (Farr, 1993; Ilgen, Fisher, & Taylor, 1979). On the one hand, performance feedback enables performance improvement as employees anticipate, seek, receive, process, react to, and finally use feedback to adjust their performance (London & Smither, 2002). On the other hand, performance feedback is a key element of (digital) work design, since feedback comes from the job as well as from others such as superiors or peers (Hackman & Lawler, 1971; Hackman & Oldham, 1976; Humphrey, Nahrgang, & Morgeson, 2007). Consequently, work and feedback are continuously interdependent. Digitalization not only (1) changes the nature of work so that organizations need to shorten their feedback cycles, but it also (2) creates new possibilities to exchange performance feedback.

First, digitalization shifts the nature of work towards digital work, which denotes "[an] effort to create digital goods or that makes substantial use of digital tools" (Durward, Blohm, & Leimeister, 2016, p. 283). Hence, the way work is performed and organized within and across firms is changing (Fichman, Dos Santos, & Zheng, 2014; Yoo, 2010). Digital technologies enable and result in digital innovations, which are often characterized as distributed and combinatorial innovations (Ciriello, Richter, & Schwabe, 2018; Nambisan, Lyytinen, Majchrzak, & Song, 2016; Yoo, Boland, Lyytinen, & Majchrzak, 2012). As traditional value chains are breaking down, employees increasingly need to collaborate across geographic, functional and organizational boundaries (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2014). Against this backdrop, the value of traditional performance management processes such as once-a-year goal setting and annual performance review is questioned in academia (Levy et al., 2017; Meyer, 1991; Pulakos, Hanson, Arad, & Moye, 2015) as well as in practice (Armitage & Parrey, 2013; Buckingham & Goodall, 2015; Cappelli & Tavis, 2016; Goler, Gale, & Grant, 2016). The ongoing discourse can be summarized as “the world isn’t really on an annual cycle anymore for anything” (Nisen, 2015). Accordingly, end-of-year feedback is less valuable than feedback in the moment of actual performance and formal processes are too long, assess the past rather than guide future action, and lack in immediate visible outcomes (Buckingham & Goodall, 2015).

Second, digitalization creates novel possibilities to respond to these changing work conditions by setting up digital work environments with digital work tools (Durward et al., 2016; Mrass et al., 2017; Richter et al., 2018; Riemer, Schellhammer, & Meinert, 2019). In particular, organizations increasingly rely on variations of social software (e.g., social networks such as Jive and Yammer and instant messengers such as Slack and Microsoft Teams). In fact, it is estimated that more than 90 percent of the Fortune 500 companies implement internal social networks (Lee, Duncan, & Canugar-Pop, 2013). By doing so, organizations create novel digital interaction possibilities that change the way how employees can communicate and collaborate (Aral, Dellarocas, & Godes, 2013; Sundararajan, Provost, Oestreicher-Singer, & Aral, 2013). These digital interaction possibilities are not limited to opportunities to perform work but include possibilities to exchange feedback. As such, information systems (IS) research (Leonardi, 2017) as well as performance management research (Levy et al., 2017) suggests that social software can play a role in the exchange of feedback, however, little is known about such action potentials of social software at work.

Given these novel possibilities to facilitate digital interactions and the increasing need to shorten feedback cycles, this dissertation poses the following overarching goal:

> This dissertation aims at understanding
> the **impact of digitalization** on the **nature of work**
> with a focus on the exchange of **performance feedback** through **social software.**

To address the stated dissertation goal, this doctoral thesis is divided into three parts. Part A defines the research scope, introduces the theoretical underpinning with key concepts, outlines the dissertation project and summarizes its results and contributions. Part B, then, comprises the five constituent articles of this cumulative dissertation. Finally, Part C includes a complete list of publications and a curriculum vitae.

Theoretical Foundation

Performance Feedback in a Digital World

The concept of feedback is central to this dissertation and has been investigated "in various ways, in various domains, and for many years" (Levy et al., 2017, p. 164). Consequently, a vast body of literature reviews have been published across fields such as management (Ashford et al., 2003; DeNisi & Smith, 2014; Lechermeier & Fassnacht, 2018; Levy & Williams, 2004), psychology (Kluger & Denisi, 1996), and education (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Mory, 2004; Shute, 2008).

Key Concepts. Feedback is broadly understood as performance-related information (Farr, 1993). More specifically, it includes "information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding" (Hattie & Timperley, 2007, p. 81). Information systems, then, can be harnessed to mediate and generate this information (Ang, Cummings, Straub, & Earley, 1993). Building on prior literature, it is distinguished between feedback that comes from the job, that is, on task level (Hackman & Oldham, 1976) and feedback that comes from others (Hackman & Lawler, 1971). In case of the latter, feedback is conceptualized more precisely as a "dynamic communication process occurring between two individuals that convey information regarding the receiver's performance in the accomplishment of work-related tasks" (Baker, Perreault, Reid, & Blanchard, 2013, p. 260).

Formal and Informal Feedback. To ensure progress, organizations often enforce formal feedback, e.g., yearly goal setting, performance appraisal, 360-degree reviews (Levy & Williams, 2004). Opposed to formal feedback, informal feedback events take place during day-to-day work (Farr, 1993; Mulder, 2013). Scholars also refer to it as "in the moment" feedback exchanged independently of formal mechanisms (London & Smither, 2002, p. 88) through seeking and giving feedback (Farr, 1993).

Relevance of Social Context. Performance management research has shifted from measurement-oriented studies towards an emphasis on the social context in which performance is assessed (Levy & Williams, 2004). Overall, three factors influence the behavior of raters and ratees as they engage in the exchange of feedback (Levy & Williams, 2004). First, distal factors indirectly affect rater and ratee behavior, e.g., technological developments and economic conditions (Levy & Williams, 2004). Second, process factors directly affect rater and ratee behavior, which has led to numerous debates, e.g., on the accuracy of feedback, which is exposed to rater and ratee errors and biases (Levy & Williams, 2004). Feedback not only has positive implications on performance, but also negative (Kluger & Denisi, 1996). For example, attribution theory suggests negative effects of feedback if recipients of negative feedback belief that they had little control over the assessed performance (Ilgen & Davis, 2000). Further, social cognitive theory suggests negative effects if feedback lowers the task specific self-efficacy (Wood & Bandura, 1989). Accordingly, feedback differs in its effectiveness (Ilgen et al., 1979). Ideally, feedback should be timely, specific, relevant for the performer, accurate, and easy to understand (Baker, 2010). Third, structural factors describe how organizations approach performance assessments. In this regard, organizations are moving towards more frequent and continuous feedback exchange (Levy et al., 2017; Meyer, 1991; Pulakos et al., 2015). At the same time, there is a shift towards a more cyclic understanding of performance management that considers all steps from performance to learning and development (London & Smither, 2002). Consequently, informal feedback methods that go beyond the traditional employee-supervisor relationship gain traction, since they are often more timely (Baker, 2010; Levy & Williams, 2004; Van der Rijt, Van den Bossche, & Segers, 2013), more contingent on the situation (Baker et al., 2013; Farr, 1993) and enable informal learning (Tannenbaum, Beard, McNall, & Salas, 2010).

A Social Software Perspective on Performance Feedback

This dissertation adopts a social software perspective on the exchange of performance feedback at work. As a type of digital work tools (Mrass et al., 2017), social software suits particularly well, since the flexibility of performance management processes is increasing (Schrage et al., 2019) and the responsibilities of employees for their development is growing (Ashford et al., 2003).

Key Concepts. Prior research has investigated a multitude of organizational social software (e.g., social networks, blogs and instant messengers) and has fabricated a significant ambiguity of concepts. Among others, the concepts of enterprise social software (e.g., Herzog, Richter, & Steinhueser, 2015), enterprise social media (e.g., Leonardi, Huysman, & Steinfield, 2013) and enterprise social network (e.g., Behrendt, Richter, & Trier, 2014) have been used in literature. However, at the very core, the concept of social software refers to information systems that amplify the social capabilities of human actors by offering interaction possibilities to form communities and exchange information (Kaplan & Haenlein, 2010; Kim, Jeong, & Lee, 2010; Shirky, 2003; von Krogh, 2012).

Characteristics. Social software takes a bottom-up approach and relies on voluntary participation instead of top-down enforcement (Koch, 2008). Even though certain interaction potentials are created (and others not), social software is open to various use contexts, which scholars refer to as being “malleable” (Richter & Riemer, 2013). Accordingly, affordances such as visibility, persistence, edit ability, and association emerge for employees (Treem & Leonardi, 2012). Hence, social software differs from traditional enterprise systems such as enterprise resource planning, which afford control, efficiency, interoperability and alignment (Mettler & Winter, 2016). At the same time, social software differs from adjacent fields that rely on more process-oriented and top-down enforced ways of working together (e.g., Computer Supported Cooperative Work, Groupware, Collaboration Engineering and Crowdsourcing).

Social Software and Feedback. From a feedback perspective, prior research discusses three roles of social software. First, organizations may exploit public social software to obtain feedback from consumers (Hildebrand, Häubl, Herrmann, & Landwehr, 2013), which is not in the scope of this research. Second, social software facilitates feedback through the possibilities to respond to shared content through likes and comments (Guy, Ronen, Zwerdling, Zuyev-Grabovitch, & Jacovi, 2016; Guy, Steier, Barnea, Ronen, & Daniel, 2013). Such feedback mechanisms are considered to have a reinforcing impact on continuous use and contributions in organizational blogs and enterprise social media (Brzozowski, Sandholm, & Hogg, 2009; Wattal, Racherla, & Mandviwalla, 2010). For example, reactions to contributed knowledge and advice (e.g., likes, comments, suggestions) provide authors with direct feedback on the value and usefulness. Scholars find that the more positive feedback an employee receives on contributed knowledge, the more frequently and proactively he or she shares knowledge (Leonardi, 2017). Third, social software may be designed and used to facilitate performance feedback exchange. For example, in the form of mobile apps that provide employees with possibilities to exchange more frequent and continuous feedback (Levy et al., 2017).

Affordance Theory as Theoretical Lens

As an overarching theoretical lens, this dissertation draws on the theory of affordances. The theory emerged in ecological psychology and puts the emphasis on the perceptions of possibilities that objects in a particular context offer to an animal (Gibson, 1977). Applied to technology, it underlines the different action possibilities and constraints an artifact offers to different actors in different contexts.

Key Concepts. It is referred to affordances as "possibilities for goal-oriented action afforded to specified user groups by technical objects" (Markus & Silver, 2008, p. 622). Figure 1 illustrates the distinctions between affordance emergence, perception and actualization (Bernhard, Recker, & Burton-Jones, 2013; Pozzi, Pigni, & Vitari, 2014). First, emergence describes the goal-oriented action potentials that arise from the relation between a specified actor (given its goals and capabilities) and a specific IT artefact (given its properties). Affordances are real in the sense that a possibility to achieve a goal offered by an artifact exists whether or not a user exploits it (Gibson, 1977). Second, perception is the recognition of these action potentials, which may or may not be perceived (as well as misperceived) depending on the available information (Bernhard et al., 2013). Third, actualization reflects the realization of actions potentials, which may lead to effects. This decision is determined by the actor depending on expected outcomes and perceived efforts required (Bernhard et al., 2013). Here come constraints into play, i.e., affordances offered by artefacts to specific users are not always enabling, but also constraining depending on the user's goals and capabilities (Hutchby, 2001).

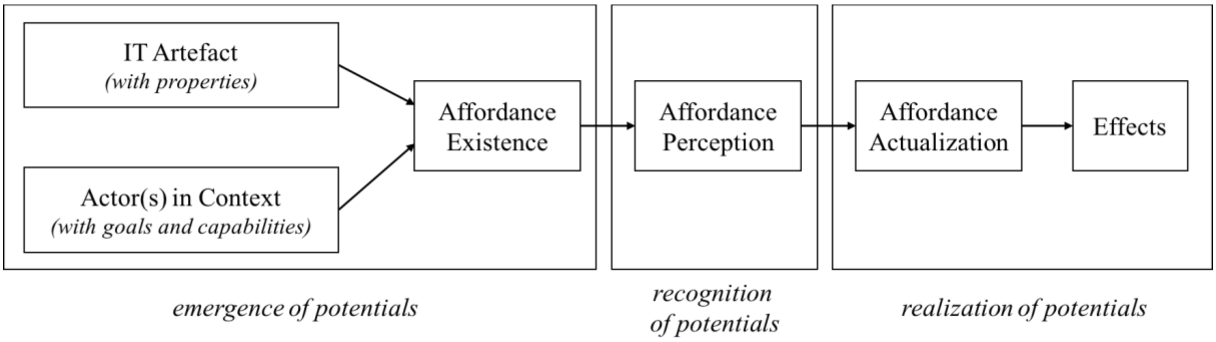

Figure 1. Affordance-Related Concepts (Bernhard et al., 2013; Pozzi et al., 2014)

Value for Dissertation. Looking at the world through an affordance theoretical lens gives "equal play to the material as well as the social" (Faraj & Azad, 2012, p. 238). This has proven to be useful in IS research (Markus & Silver, 2008; Pozzi et al., 2014; Strong et al., 2014), because it reflects the relevance of theorizing the human and technical aspects of IS. This is especially relevant in the feedback context, because activities such as sending feedback always include per se human aspects. At the same time, it addresses the problem that "researchers have too often accepted vendor-based categories of technology, reduced it [it to] features, and avoided facing differences in the same technology over time" (Faraj & Azad, 2012, p. 238). Thus, this theoretical lens emphasizes the relevance of contextual factors and guides the research to mutually investigate (1) the properties of IT artefacts and (2) the goals, motivations, characteristics and capabilities of actors.

Dissertation Outline and Results

Anchored in the interdependence of work and feedback, this dissertation is structured along three guiding research questions (GRQ) addressed in five articles (see Figure 2).

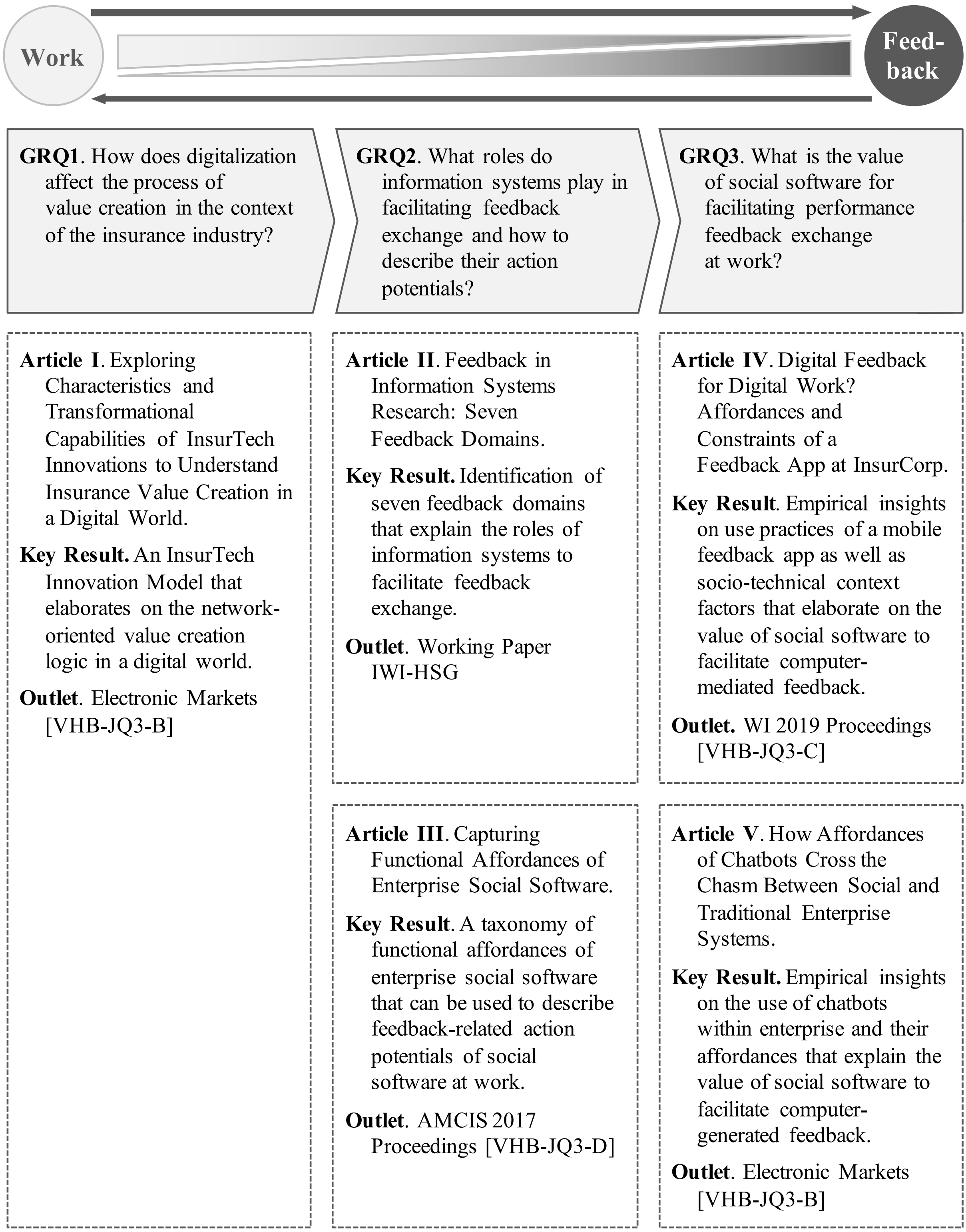

Figure 2. Overview of Cumulative Dissertation Project

Considering the key statements of the theoretical foundation in the light of the dissertation goal (i.e., to understand the value of social software to facilitate performance feedback) brings forth a central point that guides the structure of this research. In essence, both the affordances theory and performance management literature emphasize that the realization of value from technology for performance management highly depends on the social context in which this technology is introduced. The same technology may offer different value potentials and constraints to humans (and users) with different goals and in different contexts (Gibson, 1977). At the same time, different contextual factors influence the choice of appropriate performance management processes and technologies (Levy & Williams, 2004; Murphy & Cleveland, 1995).

Consequently, it is first examined how digitalization affects the way work is performed and value is created, before studying the exchange of feedback through social software.

Guiding Research Question 1 – Value Creation in a Digital World

> *GRQ 1*. How does digitalization affect the process of value creation in the context of the insurance industry?

The first guiding research question creates a theoretical basis to understand the changing nature of work in the research context, i.e., the insurance industry. Incumbent insurance companies hesitated for a long time to respond to digitalization (EY Global Insurance, 2013). More recently, a wave of Insurance Technology (InsurTech) innovations have started to put traditional insurers under pressure to innovate (Alt & Ehrenberg, 2016; Puschmann, 2017). With a large share of knowledge workers for which exchanging feedback is a key activity (Reinhardt, Schmidt, Sloep, & others, 2011), the insurance industry suits particularly well to pursue the dissertation goal. However, prior research lacks structured assessments of the growing number of InsurTech innovations and fails to explain how digitalization affects the way value is created in the insurance industry.

Article I applies the grounded theory method to develop an InsurTech innovation model with 52 characteristics, 14 transformational capabilities and 6 overarching themes. By integrating this emergent model with existing literature on value networks, firm-level value creation in a digital world is elaborated in the light of InsurTech. The results suggest that traditional sequential value chain models fall short to explain the potential that emerges from InsurTech. Instead, a network-oriented understanding of value creation is proposed, which emphasizes the alignment of the identified transformational capabilities along three interdependent primary activities, i.e., infrastructure operations, service provisioning, and network promotion (see Figure 3). In addition, this research highlights that novel digital intermediaries enter the personal insurance market. On industry-level, the roles they take are discussed by integrating these results with intermediation literature to contribute a systematic understanding of the InsurTech.

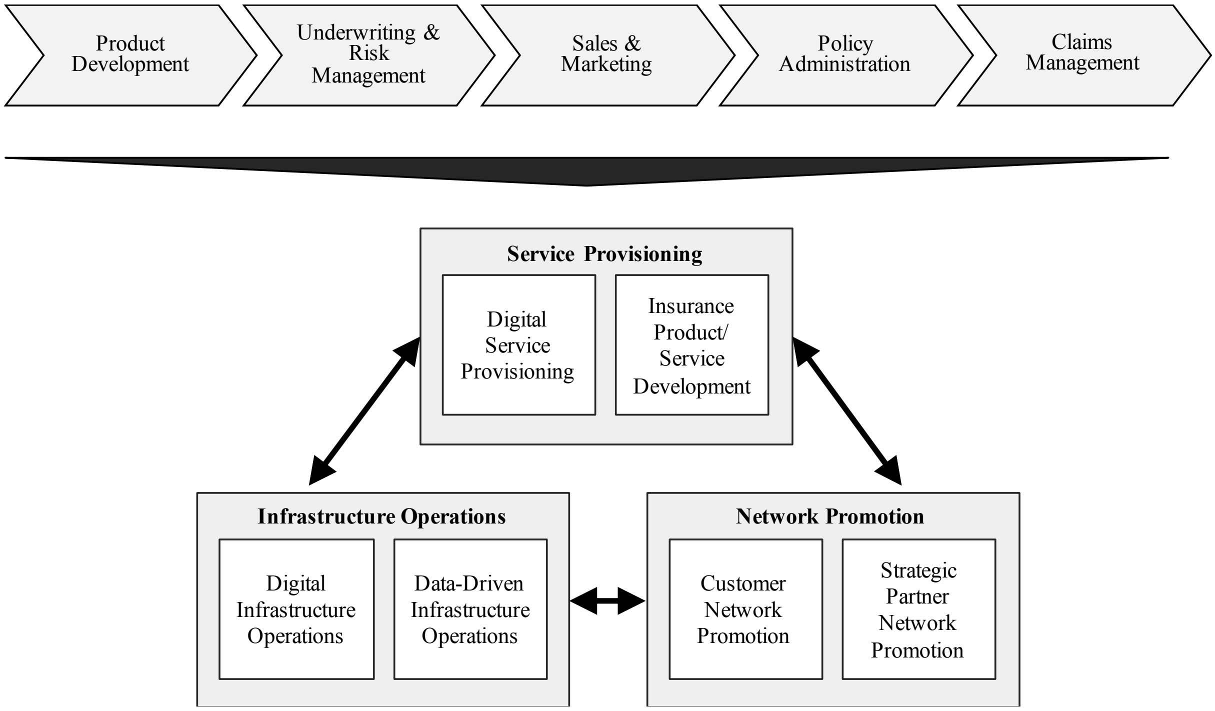

Figure 3. Key Result of Article I: InsurTech Innovation Model (simplified version)

Against the backdrop of these results that demonstrate a shift in the value creation logic towards value networks, traditional performance management approaches fall short to provide employees with the timely and actionable feedback needed for learning, development and performance improvement. Accordingly, organizations have started to rely on technology to address this issue (Buckingham & Goodall, 2015; Cappelli & Tavis, 2016). In turn, scholars call for research to investigate how technology aligns performance management with contemporary organizational needs and employee expectations (Levy et al., 2017). While information systems (Leonardi, 2017) and performance management research (Levy et al., 2017) suggests that social software can play a role in the exchange of feedback, little is known about these potentials.

Guiding Research Question 2 – Feedback and Social Software

GRQ 2. What roles do information systems play in facilitating feedback exchange and how to describe their action potentials?

The second guiding research question lays the conceptual foundation to explain the different roles of feedback as well as to describe action potentials (i.e., affordances) of social software. GRQ2 is approached with two articles that address the following research gaps. On the one hand, information systems research on feedback is fragmented and lacks coherence. Specifically, the feedback concept is used for various purposes in various fields so that the roles of information systems for the exchange of feedback remains unclear. On the other hand, research lacks structured classification models to describe and analyze action potentials of social software (e.g., to exchange feedback).

Article II presents a systematic literature review (vom Brocke et al., 2009) that explores different domains within information systems in which the concept of feedback is adopted. Analyzing 144 articles yields an overview of seven feedback domains (see Figure 4): (1) product and service feedback, (2) machine performance feedback, (3) human performance feedback, (4) community contribution feedback, (5) educational feedback, (6) everyday life activity feedback, and (7) system (use) feedback. Further, the article reveals the roles of feedback in these domains and elaborates how information systems can facilitate computer-mediated and computer-generated feedback.

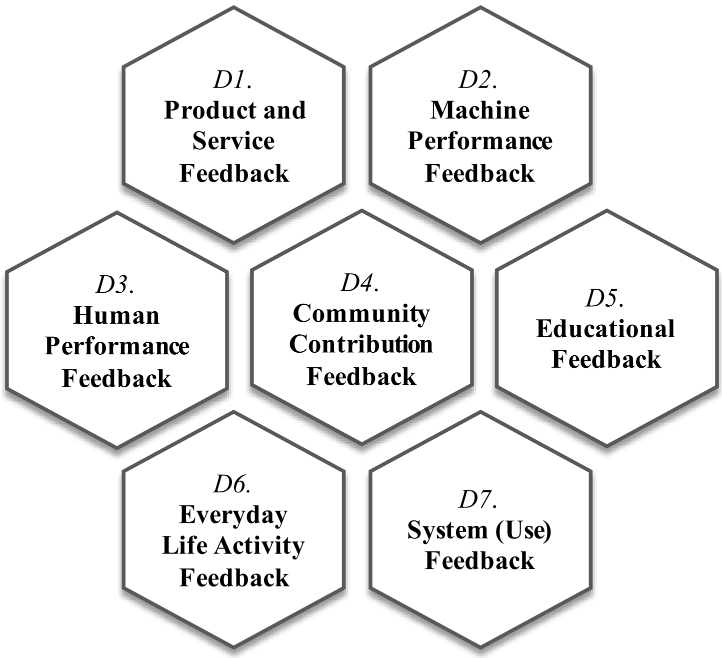

Figure 4. Key Result of Article II: Seven Feedback Domains in IS Literature.

Article III follows the structured taxonomy building method of Nickerson et al. (2013) and identifies eight dimensions with subordinate characteristics to classify affordances of social software within organizations. This article presents the resulting taxonomy (see Figure 5), which was built and evaluated over six iterations. It can be used as a descriptive tool to assess the possibilities for goal-oriented action offered by social software as well as to spot differences among them. The taxonomy supports practitioners to assess social software and inspires the innovation and development of social software.

Dimensions		Characteristics							
Action Potential	**D1. Type of Action**	C1.1 View	C1.2 Search	C1.3 Request	C1.4 Create	C1.5 Update	C1.6 Share	C1.7 Delete	C1.8 Build on
Action Potential	**D2. Actualization Constraints**	C2.1 None	C2.2 Time	C2.3 Space	C2.4 Quantity	C2.5 Mixed			
Action Potential	**D3. Actualization Disclosure**	C3.1 Undisclosed	C3.2 Anonymous Disclosure	C3.3 Disclosure of User Attributes	C3.4 Disclosure of Identify	C3.5 Configurable			
Action Potential	**D4. Interaction Scope**	C4.1 Oneself	C4.2 Individual	C4.3 Group	C4.4 Organization				
Content	**D5. Type of Content**	C5.1 Profile	C5.2 Group / Community	C5.3 First-Order Relationship	C5.4 Second-Order Relationship (Reaction)	C5.5 User-Generated Content	C5.6 Platform Extension		
Content	**D6. Granularity**	C6.1 Individual	C6.2 Multiple	C6.3 Aggregated					
Context Diversity	**D7. Malleability**	C7.1 General-Purpose	C7.2 Purpose-Specific						
Context Diversity	**D8. Adaptability**	C8.1 None	C8.2 To Configuration	C8.3 To Social Data	C8.4 To User Context				

Figure 5. Key Result of Article III: A Taxonomy of Functional Affordances of ESS.

To sum up, Article II suggests that information systems can be designed and harnessed to facilitate computer-mediated and computer-generated performance feedback and discusses the corresponding roles. Then, Article III points out action potentials of social software by means of a resulting taxonomy (Figure 5), which allows for a structured assessment of feedback-related dimensions and characteristics (e.g., feedback in the form of reactions, feedback as type of user-generated content and feedback as a consequence of actualization disclosure). With these results, the conceptional foundation to describe the roles of information systems to facilitate feedback exchange and to identify feedback-related action potentials of social software is laid.

Nevertheless, empirical research that explores value potentials of social software for performance management in practice is almost non-existent (Levy et al., 2017).

Guiding Research Question 3 – The Value of Social Software to Facilitate Performance Feedback Exchange in a Digital World

GRQ 3. What is the value of social software for facilitating performance feedback exchange at work?

The third guiding research question aims at understanding the value of social software to facilitate performance feedback by gathering rich empirical insights from organizational contexts. GRQ3 is approached with two articles that address two main research gaps. On the one hand, research on the use of technology for managing performance is scarce and research on informal day-to-day feedback is needed (Ashford et al., 2003; Ashford & Cummings, 1983; Levy et al., 2017). On the other hand, literature on digital work calls for research that investigates novel digital work tools (Mrass et al., 2017; Richter et al., 2018). As described in the following, Article IV investigates the value of social software to facilitate computer-mediated feedback, while Article V particularly examines the value of social software to facilitate computer-generated feedback through chatbots.

Taking a computer-mediated perspective on feedback exchange, a user-centric Design Thinking approach was followed in a project with a multinational insurance company. From October 2015 to June 2016, approximately 70 prototypes have been built, tested and used as a basis for next iterations (the author of this doctoral thesis has taken the role of a coach/ teaching assistant of a team of four master students). This resulted in a final prototype, which can be described as a type of social software artifact with the purpose to facilitate feedback exchange between employees. Similar feedback apps are used by organizations such as Amazon, Deloitte, GE, and IBM (Buckingham & Goodall, 2015; Cappelli & Tavis, 2016). Later, the feedback app has been implemented by the insurance company, which sets out the foundation for Article IV.

Article IV presents the results of a case study in which the mobile feedback app as a social software artifact is put into the naturalistic context of a large multinational insurance group. Namely, it provides employees with action potentials to request and send feedback. Based on these potentials, it is investigated how and why the feedback app is actually used in practice (or not) by 568 pilot users in 21 locations and what affordances and constraints emerge in different contexts. Multiple data sources are triangulated such as qualitative data from 21 semi-structured interviews, 69 user reviews in the form of responses from pilot participants to feedback requests, and basic quantitative analytics data. The results are threefold. First, the article reveals use practices in the form of four use scenarios and five use trajectories that illustrate how employees navigated back and forth between digital and physical means to exchange feedback. Second, the article elaborates how the app affords exchanging operational-level feedback on specific subjects (e.g., feedback on a specific presentation). In contrast, employees still prefer to exchange general feedback on sensitive and controversial topics in person. It is then explained how the actualization of the identified first-order affordances and constraints enables the emergence of higher-level affordances and constraints such as enabling personal development and feeling recognized and appreciated (see Figure 6). Third, the article explains how the decision to actualize these affordances depends on socio-technical context factors from the organizational work system that represent facilitators and barriers of actualization.

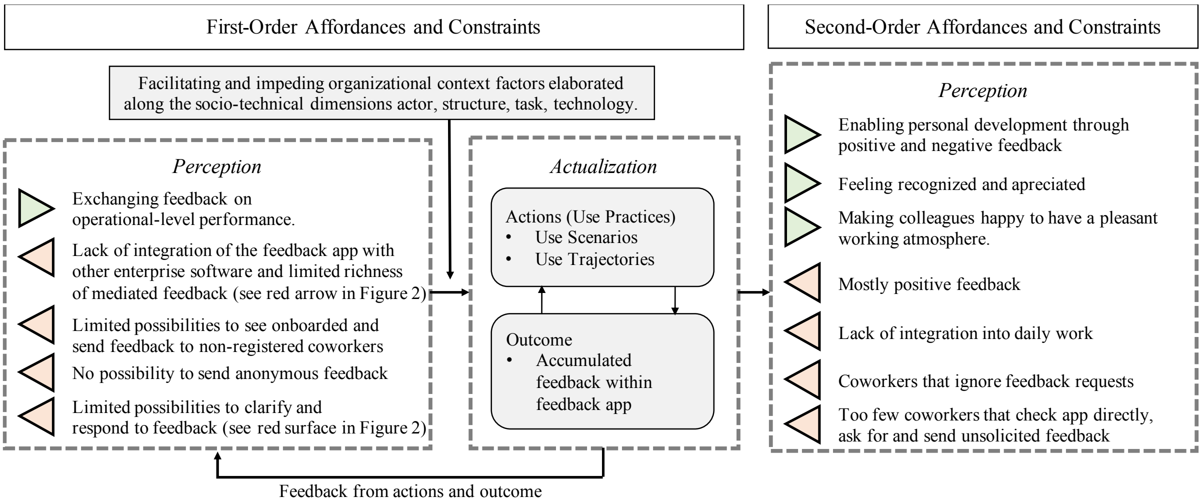

Figure 6. Key Result of Article IV: Feedback App affordances and constraints.

The results of Article IV elaborate how the value of social software to facilitate feedback is influenced by socio-technical factors. As such, it is of utmost relevance to take into consideration alternate socio-technical developments that facilitate feedback exchange. In particular, agile practices facilitate feedback by design through iterative processes and work practices (Krancher, Luther, & Jost, 2018; Tripp, Riemenschneider, & Thatcher, 2016; Vidgen & Wang, 2009). Such organizational work settings are characterized by self-organizing and cross-functional teams (Conboy, 2009; McHugh, Conboy, & Lang, 2011; Tripp, Riemenschneider, & Thatcher, 2016; Wang et al., 2012). From a social software perspective, these teams widely use enterprise messengers such as Slack and Microsoft Teams (Riemer, Schellhammer, & Meinert, 2019). Thereby, opportunities arise to use chatbots to link social interactions within instant messengers (e.g., feedback exchange) with business processes and third-party systems in which employees perform their (digital) work. Accordingly, chatbots facilitate not only computer-mediated, but also computer-generated feedback. However, though many companies use chatbots, little is known about their affordances and constraints.

Article V adopts a three-stage mixed-method research process to investigate affordances and constraints of enterprise messengers such as Slack and Microsoft Teams. First, a preliminary study crawls the Slack App Directory to obtain an understanding of existing chatbots, their evolvement over time and possible user groups. Second, the article builds on rich qualitative data from 29 interviews from 17 organizations to inductively gain contextual insights. Specifically, 14 affordances and constraints of chatbots within enterprises are identified along four categories (see Figure 7). Third, taking the identified affordances and constraints as input, a mixed-method Q-Methodology study quantifies the perceptional differences among employees and highlights five viewpoints on chatbots (see Figure 7). It is then elaborated how chatbots augment social software with affordances of traditional enterprise systems, thus, bridge the gap between these so far separated system landscapes. In regard to feedback, the results show how chatbots enable bottom-up driven organizational automation, for example, to receive feedback in the form of metrics. In turn, chatbots that post messages to group channels enable higher-level affordances such facilitating feedback through reactions and discussions.

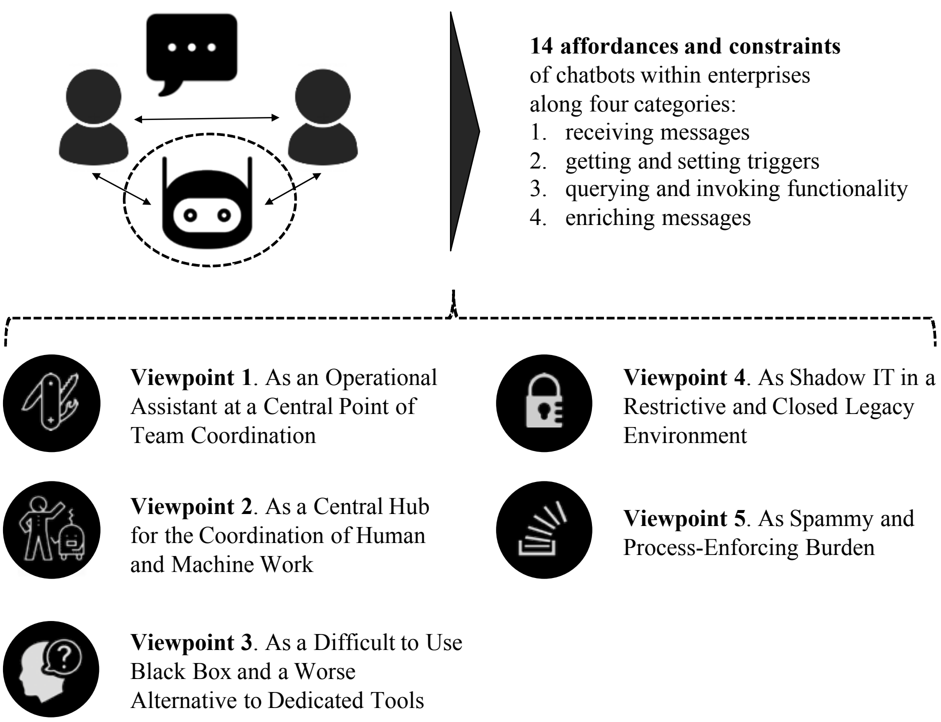

Figure 7. Key Result of Article V: Five Viewpoints on Chatbots within Enterprises.

Conclusion

Digitalization enables and demands for more frequent and continuous performance feedback exchange through technology. Anchored in the interdependence of work and feedback, the present dissertation (1) provides an advanced understanding of how digitalization affects value creation, (2) builds the conceptual foundation to describe roles of information systems to facilitate feedback, and (3) offers a unique empirical view on the value of social software to facilitate the exchange of performance feedback. In the following, the key contributions, practical implications and limitations of this dissertation are summarized.

Theoretical Contributions

Contributions to theory are fourfold. First, this dissertation contributes to literature on Financial Technology (FinTech) and on value creation by answering GRQ 1. The body of knowledge is advanced through the presented systematic model of InsurTech Innovation that is integrated in value network and intermediation literature. The novelty of this contribution is given by providing original insights into a novel and so far, undertheorized phenomenon. The scientific utility is given by pointing out and addressing the limited ability of traditional value chain models to theorize firm-level value creation in the light of InsurTech.

Second, this dissertation contributes to literature on performance feedback by answering GRQ 2 and GRQ 3. The novelty of this contribution lies in the unique perspective on the value of social software to facilitate computer-mediated as well as computer-generated feedback. A social software perspective reflects a bottom-up approach that relies on voluntary participation, which is especially valuable in a digital world, since there is a “growing responsibility of individuals for their personal and career development” (Ashford et al., 2003, p. 795). The scientific relevance is given by addressing calls for research to better investigate informal day-to-day feedback (Ashford et al., 2003; Ashford & Cummings, 1983; Levy et al., 2017), to “create systems that are better aligned with current business cycles” (Levy et al., 2017, p. 163), to examine the use of technology in managing performance (Levy et al., 2017), and to reduce the still existing gap between practice and science (Levy et al., 2017). Senior scholars in the field of performance management underline that it is here where “the extant literature is almost nonexistent“ (Levy et al., 2017, p. 168).

Third, this dissertation contributes to literature on digital work and social software by answering GRQ 2 and GRQ 3. The novelty of this contribution is twofold. On the one hand, with the feedback app, a new type of social software is designed and introduced in a naturalistic setting. This extends the scope of existing IS research on social software within organizations, which mainly focuses on multi-purpose software such as social networks and mostly takes the IT artifact for granted. On the other hand, it contributes by bridging the existing frontier between enterprise systems and social software by showing how chatbots augment social software with affordances of traditional enterprise systems. The scientific utility is given, since literature on digital work emphasize the need for research on "(a) the process of studying and designing tools and digital work environments, (b) how appropriate digital support for workers can be introduced, and (c) the context in which DWD [digital work design] is happening" (Richter et al., 2018, p.5). Prior research lacks to explain the roles of digital work tools for exchanging performance feedback, since "a major part of the current literature in the realm of digital work deals with the possible influence on employment and certain jobs" (Mrass et al., 2017, p.2516).

Fourth, this dissertation contributes to affordance literature. On the one hand, Article IV contributes to actualization models (Bernhard et al., 2013; Glowalla et al., 2014) and extends prior research (Dremel et al., 2018; Seidel et al., 2013) by elaborating how socio-technical context factors affect the actualization process of individuals situated in organizational work environments. On the other hand, Article V discusses novel affordance-related peculiarities of chatbots, which can be dynamically added to different social contexts. The view on affordance dependencies is extended by offering a novel perspective of dependencies between actors. For example, a chatbot that is added to a conversational group channel by one user can trigger the emergence of affordances and constraints for other members of this channel. In addition, the actualization of an affordance by one user in shared channel can facilitate its perception by other users.

Practical Implications

Four main contributions made to theory can be highlighted as being particularly useful to address problems of practitioners.

First, practitioners often face difficulties to grasp the potential that arises from InsurTech, which is addressed with the structured model of InsurTech innovation and the discussion of its implications on value creation and industry structure. Showing how the activities of insurers in the light of InsurTech are increasingly interdependent, and how social software can help to facilitate timely feedback exchange in this context, provides a foundation for managerial decisions.

Second, practitioners already question the value of formal performance reviews for a long time, however, yet empirical investigations of novel technological solutions are scarce. This dissertation provides unique empirical insights from introducing a social app dedicated to feedback exchange in the naturalistic context of a multinational insurance group. Existing practitioner-oriented work focuses on consultancy services and digital leaders. Therefore, contextual details on affordances and constraints from the insurance industry are useful for practitioners as well.

Third, the value of chatbots is often reduced to cost savings in the customer interaction. This research goes beyond and provides guidance on how chatbots can be used to enable bottom-up driven organizational automation (such as feedback flows) by augmenting social software with affordances of traditional enterprise systems.

Fourth, the taxonomic framework enables to assess existing and inspires the development of future social software.

Limitations

Contributions always have to be seen in the light of their limitations. This dissertation draws on multiple research paradigms and methods. However, as the phenomena of interest is closely related to human performance, the use of research methods is limited through regulations and works councils. Further research in less regulated environments might verify and extend the results of this dissertation, which to a large extent grounds in the interpretative paradigm and relies on qualitative research (Klein & Myers, 1999; Walsham, 1995). While the respective qualitative research design comes with the strength of providing rich contextual insights, it lacks in generalizability.

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Part B – Articles of Dissertation

Article I: Exploring InsurTech to Understand Value Creation in a Digital World

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Exploring Characteristics and Transformational Capabilities of InsurTech Innovations to Understand Insurance Value Creation in a Digital World

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Abstract

Recent developments in the insurance industry embrace various "Insurance Technology" (InsurTech) innovations. To date, there is a lack of structured assessments of InsurTech. Prior research on FinTech fails (1) to clarify how InsurTech can be characterized and what capabilities are employed, and hence, (2) to reveal implications for value creation on firm and industry level. We address this by inductively building a model of InsurTech innovation adopting the grounded theory method. Our empirical data includes 208 InsurTech innovations from a market analysis based on Twitter data and a multiple-case study. The resulting model comprises 52 characteristics and 14 transformational capabilities and is integrated with extant value networks and intermediation literature. The former explains how InsurTech affects firm-level value creation and suggests that disruptive potentials emerge from aligning the transformational capabilities along three interdependent activities. The latter explains the entrance of digital intermediaries and their roles in the personal insurance market.

Keywords

InsurTech, FinTech, Digitalization, Insurance, Insurance IT innovations.

Introduction

Today, the manifestation of the digitalization is already far progressed and goes beyond shifting from analog to digital information. Its disruptive nature leads to and requires contemporary strategies, processes, organizational structures, products, and services throughout different industries, but at different pace (Fitzgerald, Kruschwitz, Bonnet and Welch, 2014). In this regard, incumbent insurances struggle to become digital leaders with clear digital business cases, despite the intangible nature of their products and services (EY Global Insurance, 2013). However, in a world of increasing uncertainty and dynamics, the economic and social importance of being insured seems undisputed and even gains in importance. Accordingly, the potential to harness information technology (IT) to innovate the traditional insurance industry is tremendous for both incumbents and new market entrants (Puschmann, 2017). Against this backdrop, rising start-up companies such as Trōv, Bought By Many, and Knip are drawing on simplicity, flexibility, and customer centricity and, thereby, reach a broad audience (Alt and Ehrenberg, 2016). This puts traditional insurers in danger (Alt and Ehrenberg, 2016); their role, besides being pure risk carriers, is challenged.

In these premises, the field of Financial Technology (FinTech) and Insurance Technology (InsurTech) is gaining attention from scholars (e.g., Alt & Ehrenberg, 2016a; Puschmann, 2017a; Zavolokina, Dolata, & Schwabe, 2016a) and practitioners (e.g., PricewaterhouseCoopers, 2016a) alike. Due to the novelty of the topic and the scarcity of scientific literature on FinTech and InsurTech, prior research on this emerging phenomenon lacks structured empirical assessments (Puschmann, 2017). In fact, most prior research is “not grounded in empirical evidence” (Muthukannan, Tan, Tan and Leong, 2017, p. 4). Hence, two research gaps are apparent.

First, recent research on FinTech has yield taxonomic models that describe FinTech business models (Eickhoff, Muntermann and Weinrich, 2017) as well as consumer-oriented service offerings (Gimpel, Rau and Roeglinger, 2017). In contrast, structured empirical assessments of the insurance-specific branch of FinTech, that is InsurTech, are non-existent. It remains unclear how InsurTech innovations can be characterized and what capabilities they employ. In particular, we consider capabilities as abilities of organizations to utilize their organizational resources to perform a corresponding activity (Helfat and Peteraf, 2003), which are transformational in the sense that they affect incumbent cost and value structures. Accordingly, we pose the following research question:

RQ1: What are the characteristics and transformational capabilities of InsurTech innovations?

Second, it remains unclear how contemporary InsurTech innovations affect firm-level value creation of insurances. Since decades, such analyses are approached by decomposing firms into strategically critical activities and representing these activities in an integrated form to assess the impact of IT on their cost and value structures. Having identified the characteristics and transformational capabilities of InsurTech innovations constitutes the foundation to integrate them in a holistic form that fits the underlying nature of value creation and analyse implications on industry structure. This is relevant, because incumbents need to respond not only to evolutionary changes in their markets through sustaining innovations, but also to revolutionary changes through disruptive innovations (Christensen and Overdorf, 2000). As such, we pose the following second research question:

RQ2: What are the implications of InsurTech on firm-level value creation and industry structure?

Analyzing the InsurTech market in a structured way promises to provide insight into FinTech in general, and InsurTech in particular. To do so, this research inductively builds a model of InsurTech innovation by following a grounded theory method approach. The empirical data consists of a list of 208 InsurTech innovations from a market analysis based on Twitter data, a multiple-case study, and additional sources of evidence. The emergent model is integrated with existing value network and intermediation literature. While the former reveals implications on firm-level value creation, the latter explains the entrance of digital intermediaries on industry-level.

The remainder of this article is structured as follows. First, we conceptualize InsurTech. Second, we introduce and elaborate on the research methodology. Third, the emergent model of InsurTech innovation is presented. Fourth, the model is integrated into and discussed in the light of literature on value networks and intermediation. At last, the paper ends with conclusions illustrating contributions, limitations and future research.

Background on InsurTech and FinTech

At its core, insurance arrangements consist of a risk transfer (Trowbridge, 1975). To put it simply, a customer transfers a risk to an insurance coverage provider, which in return evaluates the risk and charges a corresponding amount of money. Technological innovations have to be seen against the backdrop of the ongoing digitalization. At the risk level, IT alters risk parameters, e.g., objects get enriched with sensors and connectivity (McKinsey, 2015). In particular, vehicles, houses, and factories are digitally equipped and embrace properties such as being programmable, addressable, sensible, communicable, memorable, traceable, and associable (Yoo, 2010). In regard to the insurance customer, studies show that customers have changed their behavior in the course of digitalization. For example, 21% of consumers in the US are said to own wearable technology products (PricewaterhouseCoopers, 2014). Moreover, 37% of daily communication is now digital, almost half the decision-relevant shopping information comes from digital sources, and consumers own 2.5 Internet-ready devices on average (Esche and Hennig-Thurau, 2014). In the insurance industry, a significant part of customer interactions is said to be digital by 2020 (Maas and Janesch, 2015). The financial industry is moving toward customer orientation with a growing consideration of all states of the customer journey (Alt and Puschmann, 2012). On the risk assessment level, IT and data enable a more fine-grained risk assessment by insurance provider. For example, the above described change in the behavior of customers to use wearable technology for self-improvement and self-monitoring creates new opportunities for health and life insurance. Today, most data arising from connected products is not even used by the manufacturer itself (McKinsey, 2015); hence, much of the potential remains unexploited supporting the growing relevance of InsurTech within the insurance industry. In summary, the customer, the risk, the insurance provider as well as their intersections are affected (e.g., the relationship of customers to the risk, the assessment of the risk by insurers, and the relationship between customers and insurance).

Although the body of literature on FinTech and InsurTech is scarce, prior research comprises attempts to conceptualize the term FinTech (Puschmann, 2017). Therefore, we build on existing conceptualizations to derive a definition of InsurTech and to clarify how the term is understood in the present research acknowledging that “most of the approaches focus on banking […] while only a few consider insurance“ (Puschmann, 2017, p. 71). For this endeavor the structured review on FinTech conducted by Zavolokina et al. (2016) provides a comprehensive foundation (see Table 2). At first, “solutions for the insurance industry are often more specifically named ‘InsurTech’” (Chuang, Liu and Kao, 2016, p. 3) and InsurTech is seen as the “insurance-specific branch of FinTech” (PricewaterhouseCoopers, 2016, p. 2). Thereof, we build on the definition of Arner et al. (2015) describing FinTech simply as technology use for financial solutions. While they include any use of technology to deliver financial solutions, we limit the scope to innovative and IT-based solutions as suggested by Alt and Ehrenberg (2016). Moreover, we incorporate the emphasis that InsurTech innovation can have its origin in both traditional financial service providers and non-traditional companies, such as start-up companies and companies from other industries, which is in line with Puschmann (2017). In summary, we consider InsurTech as part of FinTech and conceptualize it as follows:

A phenomenon comprising innovations of one or more traditional or non-traditional market players exploiting information technology to deliver solutions specific to the insurance industry.

Concept	Definition (Source)
FinTech	"Financial technology or FinTech refers to the use of technology to deliver financial solutions." (Arner, Barberis and Buckley, 2015, p. 3)
	Fintech or financial technology describes innovative information technology solutions, which are utilized by financial service providers or players new to the industry to design business models in the financial service sector (translated from German). (Alt and Ehrenberg, 2016, p. 12)
	"As an umbrella term, fintech encompasses innovative financial solutions enabled by IT and, in addition, is often used for start-up companies who deliver those solutions, although it also includes the incumbent financial services providers like banks and insurers." (Puschmann, 2017, p. 70)
InsurTech	More specific conceptualizations such as "Banking Innovations", "Insurtech" for insurance technologies or "Regtech" for regulatory technologies are domain-oriented but have not yet become as established as FinTech (translated from German). (Alt and Ehrenberg, 2016, p. 10)
	"The insurance-specific branch of FinTech, InsurTech, is emerging as a game-changing opportunity for insurers to innovate, improve the relevance of their offerings, and grow." (PricewaterhouseCoopers, 2016, p. 2)

Table 2. Selected definitions of FinTech and InsurTech

Against the background of our conceptualization, we acknowledge the extant body of literature describing different kinds of innovations. On the one hand, sustaining innovations are distinguished from disruptive innovations (Christensen, 1997; Christensen and Overdorf, 2000). The former represents evolutionary changes leading to incremental improvements of products and services, while the latter describes revolutionary changes leading to entirely new markets with different value propositions (Christensen, 1997; Christensen and Overdorf, 2000).

Similarly, incremental innovations are distinguished from disruptive innovations (Hacklin, Raurich and Marxt, 2004; Puschmann, 2017). In fact, the different kinds of innovations go along with changing capabilities required to succeed in corresponding markets (Henderson and Clark, 1990). In the context of FinTech, innovations often comprise novel platforms and ecosystems (Dapp, 2015; Tan, Pan, Lu and Huang, 2015; Breidbach and Ranjan, 2017; Leong et al., 2017; Muthukannan et al., 2017). In particular, the development of ecosystems requires organizations to enact IT capabilities in order to evolve from an initial assessment phase, over an acceleration phase to an augmentation phase (Muthukannan et al., 2017).

While some scholars associate FinTech innovations with disruptive technologies (Muthukannan et al., 2017), others argue that considering "the previous development in electronic markets, the FinTech phenomenon is a logical evolutionary step" (Gimpel et al., 2017, p. 1). In this regard, Puschmann (2017) acknowledges that FinTech comprises both incremental and disruptive innovations. However, we root our research on InsurTech innovations in our empirical data without limiting our analysis either on disruptive or incremental innovations to prevent being preconceived (Urquhart, Lehmann and Myers, 2010), which is also in line with our understanding of InsurTech.

Research Methodology

Due to the lack of existing research on the insurance-specific branch of FinTech and the novelty of InsurTech, a grounded theory methodology (GTM) is chosen to develop theory inductively from rich empirical data (Corbin and Strauss, 1990; Strauss and Corbin, 1997; Glaser and Strauss, 2009). In line with the flexibility of GTM (Birks, Fernandez, Levina and Nasirin, 2013), we adopt an exploratory research design anchored in the interpretivist paradigm, i.e., humans socially construct the nature of reality.

Data Collection

According to GTM, data can come from various sources and can be coded in the same way as interviews (Corbin and Strauss, 1990). Accordingly, our approach to data collection consists of a systematic InsurTech market analysis based on Twitter data, a multiple-case study to collect in-depth insights on the implications of these innovations for the insurance industry, and additional sources of evidence (i.e., observations from innovation projects, an insurance congress and practitioner feedback to the emergent model).

InsurTech Market Analysis on Twitter

Empirical data of InsurTech innovations were collected from publicly available Twitter tweets associated with the keywords #insurTech and #insureTech. We accessed the data through the advanced search function offered by Twitter[2]. By utilizing the date range and hashtag filters, tweets were collected iteratively over different time frames (i.e., from October 2015 to August 2016 after each month). Considering the primary goal of exploring InsurTech innovations, we successively conducted the following workflow:

In the first step, a tweet was reviewed to determine if it includes a potential name, description, or link to an InsurTech innovation. Aside from textual content, we considered images, e.g., illustrations of the InsurTech landscape with various InsurTech start-up company names. In the second step, we enriched this data by collecting information from the corresponding web page (i.e., a description of the InsurTech innovation, its mission, its type of insurance, and its originating country).

InsurTech innovations were included if they matched the following criteria: insurance specificity (i.e., industry independent innovations were excluded), technology support, and novelty (e.g., deprecated technology utilization such as creating insurance leads via phone were excluded). InsurTech innovations were excluded if no project or company website was available.

In each iteration, we followed this workflow until theoretical saturation in the given time frame was reached, i.e., additional tweets did not lead to new empirical data on InsurTech innovations (Morse, 2003). In total, a list of 208 InsurTech innovations was collected.

Multiple-Case Study

Guided by the objective to understand the impact of InsurTech innovations, we conducted a multiple-case study (Yin, 2017) to inductively ground our research in empirical data (Eisenhardt, 1989). From October to December 2015, we conducted 10 explorative semi-structured interviews that lasted between 30 and 60 minutes. They were conducted by the same interviewer, and with one person at a time. Participants

[2] https://twitter.com/search-advanced

with operational and strategic backgrounds and from different divisions of the insurance companies were selected (see Table 3).

Case Company	Position	Interview Details
Alpha Insurance (DACH, 1000-5000 employees)	Strategy	Participant 1, face-to-face
	Strategy	Participant 2, face-to-face
	Collaboration	Participant 3, face-to-face
	Strategy	Participant 7, face-to-face
	IT Management	Participant 8, face-to-face
	IT Architecture	Participant 9, face-to-face
Beta Insurance (South America, ~ 50’000)	Innovation	Participant 4, Skype
Delta Insurance (DACH, > 100’000 employees)	IT Strategy	Participant 5, face-to-face
Gamma Insurance (DACH, > 100’000 employees)	Security	Participant 6, face-to-face
	IT Management	Participant 10, face-to-face

Table 3. Case and interview details

The structure of our interview guideline followed Myers and Newman (2007) and was reviewed by two senior scholars leading to a few corrections pertaining to the wording of the questions. In line with our GTM approach (Strauss and Corbin, 1997), interviews within the earlier stages of the research solely involved open-ended questions from the mentioned areas of interest. Later in the research process, we focused more narrowly on the emerging concepts. Specifically, in the end phase of the interviews we employed card sorting (Fincher and Tenenberg, 2005) to categorize the emerging characteristics and transformational capabilities of InsurTech innovations into groups depending on their relevance. That is, (1) the threat interviewees see for their insurance company, and (2) the opportunities interviewees see for their insurance company.

The set of open questions probed two areas of interest. First, the interviewer asked general questions about the impact of the digitalization on the insurance industry. Example questions were “What is the role of digitalization on the value creation of insurance companies?” and “What opportunities/challenges will arise today/in five years from digitalization?” Second, we asked about the impact of InsurTech innovations on the traditional insurance industry. Example questions were “How do innovative InsurTech start-ups affect the value creation in the insurance industry?” and “How do you respond to the innovative exploitation of information technology?”

Additional Sources of Evidence

Empirical observations from innovation projects at University of St.Gallen were included. Over nine months, project teams of four graduate students cooperated with insurance companies (two teams from September 2014 to July 2015 and three teams from September 2015 to July 2016). We considered multiple sources of evidence (Yin, 2017), namely their explorative analysis of stakeholders, prototypes, documentations, and interviews with customers and employees of insurance companies.

Additionally, notes and observations from an insurance congress in Germany in autumn 2015 led to further insights about InsurTech and the digitalization in the insurance industry. To make the evolving model tangible, we created a web application that offers a visual filter of the collected InsurTech innovations and maps the emergent model. We continuously shared the tool with practitioners from the insurance industry to gather their opinion on our interpretations. Their feedback refined the emergent theory and confirmed the practical utility. In particular, minor changes in the wording of our model were made and practitioners added suggestions for missing InsurTech innovations.

Data Analysis

Upon completing the qualitative interviews, we anonymized, transcribed, and analyzed the recordings using the computer-assisted qualitative data analysis software NVivo. Along each step, the codes were independently double-checked by a second researcher. In alignment with GTM (Urquhart et al., 2010) and interpretive research (Klein and Myers, 1999), we systematically collected and analyzed our empirical data until theoretical saturation was reached. Specifically, we iterated until "no new data appear[ed]" (Morse, 2003, p. 1) and a coherent picture of InsurTech innovation emerged. To ensure quality, we followed the suggestions of Corbin and Strauss (1990) and the guidelines of Urquhart et al. (2010).

Specifically, their guidelines comprise (1) constant comparison of new data with the emergent model, (2) iterative conceptualization by abstracting and elaborating relations between categories, (3) theoretical sampling, (4) upscaling to increase the generalizability, and (5) theoretical integration of the emergent theory (see Table 4).

Data Source	**InsurTech Market Analysis based on Twitter data** (Primary Data)	**Multiple-Case Study** (Primary Data)	**Insurance Congress** (Primary Data)	**Innovation Projects** (Secondary Data)	**Exchange with Experts** (Primary Data)
Details	*208 InsurTech innovations with #insur(e)Tech were collected and enriched with information from their websites.*	*10 semi-structured interviews with participants and observations from different divisions of four insurance companies.*	*17 pages of notes and observations from an insurance congress on IT innovation and digitalization in the insurance industry.*	*Stakeholder analyses, prototypes, documentations, and interviews from 5 university innovation projects with insurances.*	*Feedback for the emergent model was gathered by sharing it with experts and within a workshop.*
Theoretical Sampling – Selecting data sources that advance and strengthen the emergent theory					
Rationale of Use	*Collection of a broad range of InsurTech initiatives.*	*Gaining rich details from people working in the target industry.*	*Data triangulation and verification.*		*Refinement and verification.*
Constant Comparison and Iterative Conceptualization – Building and refining the emergent theory					
Open Coding (52 characteristics as 1st order concepts)	*Categorization and comparison of the collected InsurTech innovations*	*Categorization of the interviews and comparison with the emergent characteristics*			
Axial Coding (14 transformative capabilities as 2nd order concepts)	*Interviews, notes and observations enabled us to identify commonalities and provided us with relationships between the 14 transformative capabilities.*		*Comparison of the data with the emergent model and the interview statements provides an additional perspective on the phenomenon at hand.*		*Refining and enriching the emergent model using the feedback*
Selective Coding (6 themes as 3rd order categories)	*Going through the data and codes again enabled refinement and upscaling* (Urquhart et al., 2010).				
Outcome and Theoretical Integration					
Outcome	*An emergent model* (Wiesche, Jurisch, Yetton and Krcmar, 2017) *of InsurTech innovation grounded in the coded characteristics, transformational capabilities and themes (see Table 5).*				
Theoretical integration	*First, the transformational capabilities are related to the primary activities of value networks* (Stabell and Fjeldstad, 1998)*, so that the impact of InsurTech on firm-level value creation becomes apparent. Second, the transformational capabilities are related to the roles of intermediaries in electronic markets* (Bailey and Bakos, 1997)*, so that the impact on industry-level becomes apparent.*				

Table 4. Research approach to data collection and analysis at a glance.

The Emergent Model of InsurTech Innovation

Grounded in empirical data, we now present the emergent model of InsurTech innovation comprising 14 transformational capabilities across 6 overarching themes elaborated with 52 characteristics (see Table 4). Each capability is transformational as that it affects the cost and value structure. As such, they represent building blocks, which can be exploited individually or in combination resulting in either sustaining or disruptive innovations.

Theme	Transformational Capability (TC)	Characteristic of InsurTech Innovation	Example
Digital Infrastructure Operations	TC1. Establishing digital service provisioning and distribution infrastructure, i.e., the capability to establish digital infrastructure that lower cost through self-service, while increasing differentiation through value adding services and new points of contact.	Web portal	*SwissLife myWorld*
		Mobile app portal	*Clark*
		Interfaces (e.g., plugins, add-ons, widgets, API)	*Simplesurance*
		White-label infrastructure	*IptiQ*
		Digital signing and identification	*Certtrack*
		Digital transactions and processing	*Dynamis*
Data-Driven Infrastructure Operations	TC2. Exploiting data for risk assessment and underwriting, i.e., the capability to access and exploit data related to the insured risk to calculate accurate risk models and inform underwriting decisions.	Driving data	*Kroodle*
		Vitality and nutrition data	*WeSavvy*
		Sensor data of properties and products	*Roost*
		External data, Social Media data	*FitSense*
		Real-Time data	*AnalyzeRe*
		Advanced data science	*QuanTemplate*
	TC3. Exploiting data for claims handling, i.e., the capability to access and exploit data to lower the transaction costs of handling claims.	Automated claims processing and verification	*Fizzy (AXA)*
		Advanced fraud detection	*Everledger*
Digital Service Provisioning	TC4. Offering services digitally, i.e., the capability to offer insurance services digitally to lower cost through self-service and increase customer value through lower transaction costs.	Digital claim submission and notification	*Haftpflichthelden*
		Digital policy administration and adjustments	*WeFox*
		Digital conversations	*Asuro*
		Digital advisory, robo-advisory	*Insurify*
	TC5. Complementing insurance with prevention and recovery services, i.e., the capability to offer services aside from reimbursement to lower cost and increase customer value through loss prevention or recovery.	Predictive prevention, proactive warnings	*Sanitas Active*
		Loss mitigation, recovery service	*Allianz & Panasonic*
	TC6. Integrating insurance with related services, i.e., the capability to integrate insurance services with related services to increase customer value.	Service provisioning at the point-of-demand	*Lemonade*
		Aggregation across insurers and/or insurance products/services	*Clark*
		Integration with financial services	*Moneymeets*
		Integration with employee benefit services	*Bayzat Benefits*
		Integration with health services	*MyDoc*

Insurance Service Development	TC7. Developing services that fulfil customer needs, i.e., the capability of understanding customer needs and developing insurance products and services accordingly to achieve competitive advantage through differentiation.	Situational product, on demand	*Cuvva*
		Flexible period of insurance coverage	*Trov*
		Simple convenient product	*Snapsure*
		Individualized product	*FounderShield*
		Niche product	*Bought By Many*
		Peer-to-peer (P2P) insurance	*Friendsurance*
		All-in-one allround-care	*Knip*
	TC8. Adopting to changes of insured risks, i.e., the capability to adjust insurance products/services to the changing nature of the insured risks.	Digitized object (e.g., car and home)	*Kiwi.ki*
		Adjusted behavior/ needs (e.g., virtual business)	*DigitalRisk*
	TC9. Covering new risks, i.e., the capability to develop insurance products and services that offer coverage of new risks.	Coverage of risk based on new data sources	*MeteoProtect*
		Coverage of risk arising from new phenomenon	*Zurich Cyber Insurance*
	TC10. Offering risk-adjusted pricing, i.e., the capability to assess risks dynamically to offer products and services at competitive prices.	Usage-based pricing (e.g. pay-per-mile)	*Metromile*
		Behavior-based pricing (e.g. pay-how-you-drive)	*Ingenie*
		Rewards-based pricing	*Drive like a girl*
Customer Network Promotion	TC11. Distributing insurance digitally, i.e., the capability to design and decide on digital distribution channels.	Online distribution	*GetSafe*
		Distribution at the point-of-sale	*Simplesurance*
		Multiple distribution channels	*eBaoTech Multichannel Integration*
		Offline distribution with digital support	*Softfair FinanzLotse*
	TC12. Harnessing digital marketing opportunities, i.e., the capability to acquire and select the right customers through digital marketing channels.	Customer acquisition, affiliate/predictive marketing	*Contactability*
		Online presence	*Allianz Social Media for Agents*
		Multiple marketing channels	*Multichannel*
	TC13. Acting as digital broker, i.e., the capability to exploit digital channels to sell insurance coverage to customers with some degree of independence from the insurer.	Comparison platforms	*Check24*
		All-in-one insurance manager	*Esurance*
		Insurance-as-a-Service	*Kasko.io*
		Online broker	*OnlineVersicherung.de*
Partner Network Promotion	TC14. Forming strategic partnerships, i.e., the capability to build competitive advantage from inter-organizational relationships.	Co-created product or service	*Allianz & Panasonic*
		Cooperation ecosystem	*Rakuten Ecosystem*

Table 5. The Emergent Model of InsurTech innovation.

Theoretical Integration

To further advance the understanding of InsurTech in a wider theoretical context, we relate the emergent model to extant literature as suggested by Urquhart et al. (2010). In doing so, the model, first, proves to be a powerful lens to understand insurance value creation in a digital world in the light of InsurTech. Considering the transformational capabilities individually, reveals sources of competitive advantage that lead to incremental innovations. In turn, disruptive potentials emerge from the combination and the alignment of these transformational capabilities. Second, we take up an industry perspective and link our identified transformational capabilities to literature on intermediation. Hence, elaborating how they enable taking in intermediary roles and, thus, industry level changes.

Impact on Firm-Level Value Creation - Sources of Competitive Advantage

The impact of IT on value creation becomes apparent through assessing its impact on cost and value structures of strategically critical activities (Porter and Millar, 1985). For this purpose, the value chain model represents value creation in a sequence of activities (Porter, 1985; Porter and Millar, 1985). However, both (1) our empirical data and (2) prior research suggests that a sequential representation is less helpful to gain an understanding of InsurTech. Accordingly, we draw on the primary activities proposed in value network literature (Stabell and Fjeldstad, 1998). Specifically, we link the identified transformational capabilities to the activities 'infrastructure operations', 'service provisioning' and 'network promotion' (Stabell and Fjeldstad, 1998).

First, our InsurTech-specific empirical data shows that the identified transformational capabilities and their underlying activities are interdependent. For example, developing services that fulfil customer needs (i.e., TC7) and exploiting data for risk assessment and underwriting (i.e., TC2) goes along with customers contributing data instead of creating value sequentially. In addition, increasing customer engagement by integrating insurance with related and complementary services (i.e., TC5) is often only possible in a whole network of service providers.

Second, prior research emphasizes that digitalization promotes network-oriented value creation in general (Tilson, Lyytinen and Sørensen, 2010; Rai and Tang, 2013; Autio, Nambisan, Thomas and Wright, 2017; Koch and Windsperger, 2017) and in the context of FinTech in particular (Dapp, 2015; Tan et al., 2015; Breidbach and Ranjan, 2017; Muthukannan et al., 2017; Schreieck and Wiesche, 2017).

As such, we not only adopt lens that fits our empirical data, but also a lens that is in line with the foundational tenets of the digital world. Figure 1 summarizes our empirical results and illustrates the alignment of the primary activities as proposed by Stabell and Fjeldstad (1998). After presenting the transformational capabilities, we discuss how the disruptive potential of InsurTech emerges from a network-oriented alignment of the transformational capabilities based on these three primary activities.

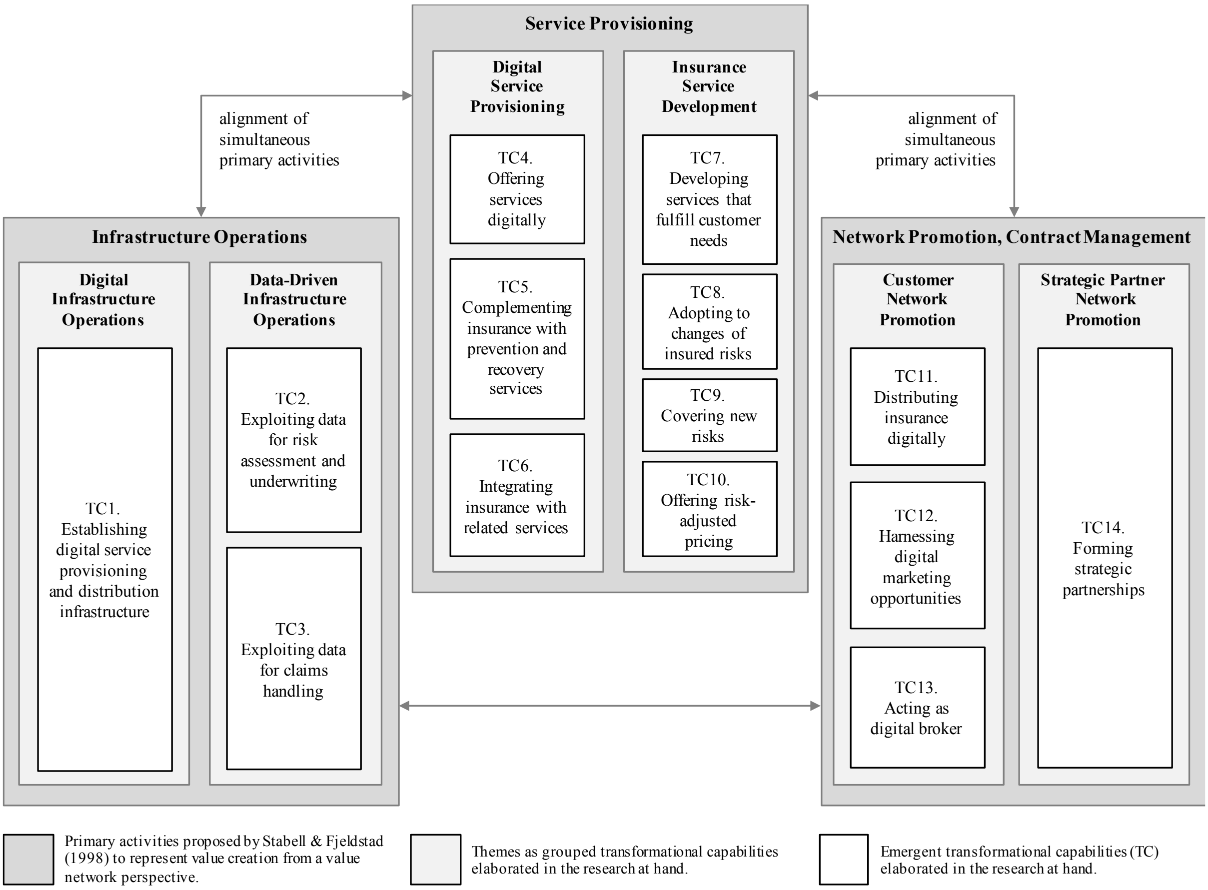

Figure 1. Transformational capabilities of InsurTech innovations linked to the primary activities of value networks.

Digital and Data-Driven Infrastructure Operations

The purpose of insurances is "the organization and management of a risk pool to provide insurance coverage to multiple clients" (Fjeldstad and Ketels, 2006, p. 116). Therefore, infrastructure is required to exchange corresponding services within the network (Stabell and Fjeldstad, 1998). Our empirical data shows that the impact of InsurTech on infrastructure operations manifests itself in their digital (see TC1) and data-driven (see TC2-3) nature. While the latter is InsurTech-specific, the former shares similarities with FinTech as well as with digital innovation in general. Through a sophisticated balancing of flexibility (openness) and stability (control), digital infrastructures are known for their generativity that facilitates distributed innovation (Tilson et al., 2010; Yoo, Richard J. Boland, Lyytinen and Majchrzak, 2012), e.g., through FinTech platforms and ecosystems (Dapp, 2015; Tan et al., 2015; Breidbach and Ranjan, 2017; Muthukannan et al., 2017; Schreieck and Wiesche, 2017).

TC1. Establishing digital service provisioning and distribution infrastructure. Web portals and mobile apps serve as first point of contact for customer-facing insurance processes (e.g., sales, policy administration, and claims handling). Thus, the capability to establish digital infrastructures becomes critical. Aside from isolated customer portals, InsurTech innovation often relies inter-organizational collaboration through interfaces or distributed infrastructures. Specifically, the identified InsurTech innovations harness application programming interfaces, plugins, widgets and add-ons that allow integrations into third-party systems (e.g., Simplesurance offers plugins that can be easily integrated into e-commerce shops to sell product insurances). Based on that, various white-labeling solutions have been identified (e.g., iptiQ, snapsure, and Simplesurance). Moreover, IT is leveraged to facilitate policy administration efficiency and enable digital signing and identification (e.g., Certtrack offers cloud-based management of insurance certificates). Infrastructure technologies such as Blockchain enable distributed and immutable digital transactions and processing. InsurTech innovations particularly rely on smart contracts, e.g., Dynamis develops smart contracts for P2P insurance.

TC2. Exploiting data for risk assessment and underwriting. InsurTech has a tremendous impact on risk assessment activities. Given, the increasing availability of data (e.g., risk data and customer's behavior data), data can be exploited to assess risks more precisely and accurately. For example, driving behavior data may be gathered using driving recorders attached to cars (e.g., AXA Drive Recorder) and with location-based apps on the customer's smartphone (e.g., Kroodle). Having the right data and expertise to make sense of this data is key (e.g., QuanTemplate provides a platform for insurance data integration and analytics to improve underwriting performance). In this respect, managing external data and ensuring its quality becomes relevant.

TC3. Exploiting data for claims handling. The more risk data is available, the more possibilities emerge to monitor risks in real-time. As such, data science technologies can be harnessed for fraud detection. An interviewee pointed out that the first notice of loss shifts from the customer to the insurer, which might become aware of latent risks before the customers. Combined with distributed infrastructure (i.e., TC1), IT is leveraged to automate claims processing and verification. For example, Fizzy (AXA) offers a

Blockchain-based insurance solution against delayed flights, which automatically triggers the compensation upon flight delay (i.e., no need to submit a claim).

Digital Service Provisioning and Insurance Service Development

The second primary activity of service provisioning comprises "establishing, maintaining, and terminating links between customers and billing for value received" (Stabell and Fjeldstad, 1998, p. 429), e.g., payments and claims (Fjeldstad and Ketels, 2006). The impact of InsurTech manifests itself in digital service provisioning (see TC4-6) and in the development of contemporary insurance services (see TC7-10). The former relates to research on IT-enabled digital service provisioning. For example, prior research reveals that self-service may lead to positive effects such as higher efficiency, cost reduction, and increased convenience (Bitner, Brown and Meuter, 2000; Barrett, Davidson, Prabhu and Vargo, 2015), but also negative effects such as lower customer satisfaction (Ba, Stallaert and Zhang, 2010). However, the identified transformational capabilities have to be seen in the context of the relatively low frequency of interactions in the insurance domain, which differentiates InsurTech from FinTech. The latter is insurance-specific, however, certainly relates to increasingly flexible, personalized and diversified products and services in the context of FinTech (Eickhoff et al., 2017; Gimpel et al., 2017) and digital innovation (Fichman, Dos Santos and (Eric) Zheng, 2014).

TC4. Offering services digitally. Manifold efforts to handle claims digitally can be observed (e.g., RightIndem offers specific tools and techniques along the customer claims journey from first notification of loss until the settlement). In particular, we identify innovative designs for claims submission procedures (e.g., Haftpflichthelden and RightIndem enable the visual selection of the damaged car parts). Aside from increased efficiency in claims submissions, digital service provisioning provides transparent and timely status updates of claims and policies. Policies are either digitized or the corresponding details are made available digitally, thus, providing customers with possibilities to have an overview of their policies, to query the covered benefits and to make policy adjustments. In this regard, incumbents have started to offer service provisioning on insurance-specific portals (e.g., my.Allianz and myCSS), while digital brokers often aggregate service provisioning (i.e., TC6). Furthermore, IT is harnessed for having digital conversations and providing advice digitally, however, with a varying degree of human involvement. On the one hand, advisory services are provided in form of conversations (e.g., chat). On the other hand, advisory services are offered on digital platforms (e.g., Brolly shows a status of coverage visually and offers a policy checkup that reveals the percentage to which a customer is insured). In both cases, artificial intelligence minimizes human involvement to offer so-called robo-advisory (e.g., Insurify and Sure), which can be observed in the broader context of FinTech as well (Jung, Dorner, Weinhardt and Pusmaz, 2017).

TC5. Complementing insurance with prevention and recovery services. Increasing efforts are identified to complement traditional insurance service provisioning (e.g., financial reimbursement) with prevention and recovery services. On the one hand, predictive prevention and proactive warnings can be seen as important cornerstones to lower claims costs. On the other hand, we see a move towards educating the customer (e.g., to drive safer or live healthier), which improves the value proposition. With an increasing amount of data, the first notice of loss is shifting towards the insurance. For example, Panasonic's smart home solution coupled with the home protection service of Allianz detects water leaks, notifies the user and initiates the first steps. In case of loss, IT enables loss mitigation and recovery, which not only reduces costs for the insurer, but also improves the customer value (i.e., impact on differentiation). For example, through providing customers with novel information (e.g., CarKroodle provides insights into speed, brake performance, time, and calculates a score after each ride).

TC6. Integrating insurance with related services. Given the relatively low frequency of interaction between insurance service providers and their customers, InsurTech increasingly integrates the digital service provisioning with related services to increase the customer engagement and value. On the one hand, all-in-one insurance managers aggregate service provisioning across insurances and across insurance products/services in a single portal. On the other hand, our empirical data reveals integrations of insurance with financial services, health services, and employee benefit services, which broadens the value proposition towards the customer.

TC7. Developing services that fulfil customer needs. InsurTech enables to provide insurance customers with situational insurance products (i.e., on demand) and flexible selectable periods of coverage (e.g., buying flight insurance and flight accident insurance from Airsurety before entering a plane or insuring a car driver for one hour at Cuvva). Many of our identified InsurTech innovations amplify product simplicity and convenience (e.g., understanding and ordering a smartphone insurance within minutes). At the same time, differentiation occurs through highly customized insurance products and coverage of insurance niches (e.g., pet insurance for rescue dogs and health insurance for cyclists). In contrast to traditional business models where insurance companies pool risks and withhold premiums if no claim occurs, we identify various peer-to-peer (P2P) insurance approaches (e.g., Friendsurance, insPeer, Lemonade). Specifically, they allow peers to share risks partly with each other and everything that exceeds a certain limit is usually covered by a traditional insurer. As such, understanding customer needs and developing products and services accordingly offers opportunities to achieve competitive advantages through differentiation (Shah et al., 2006).

TC8. Adopting to changes of insured risks. On the one hand, traditional insurance products and services are affected by digitized objects (e.g., household insurance is affected by homes equipped with sensors). On the other hand, behavior and needs of insurance customers changes (e.g., needs of virtual businesses differ from traditional companies). Against this backdrop, differentiation can be achieved by adjusting the insurance products and services accordingly to the changing nature of the underlying insured risks.

TC9. Covering new risks. Based on new data sources and new needs that arise from new phenomena, new risks can be covered. For example, a Chinese insurance company (PICC) offers virtual product insurance to insure losses that gamers experience as they buy virtual properties and equipment online. Also, cyber risks become a critical business risk (e.g., Zurich Insurance insures corporate companies against data loss and cyber-attacks).

TC10. Offering risk-adjusted pricing. Grounded in more accurate risk assessments, differentiation through new risk-adjusted pricing models becomes possible (e.g., pay-how-you-drive offerings with usage-based rewards, and pay-per-mile pricing). Besides traditional incumbents like AXA, new competitors have entered the market (e.g., Drive like a girl from the UK). Similar potentials provide vitality, nutrition, sensor, and other internet of things data. For example, smart home solutions that exploit access and data from connected doors, surveillance, thermostats, and smoke detectors. Regarding health insurance, Generali and Discovery for example have collaboratively developed a product that is advertised with the promise “Know your health - Improve your health - Enjoy the rewards”.

Customer and Strategic Partner Network Promotion

The third primary activity of network promotion aims at “inviting potential customers to join the network, selection of customers that are allowed to join and the initialization, management, and termination of contracts governing service provisioning and charging” (Stabell and Fjeldstad, 1998, p. 429). In fact, it further includes monitoring of contracts as well as attracting and selecting customers (Stabell and Fjeldstad, 1998). The activities of monitoring, attraction and selection of customers are where the impact of InsurTech manifests itself the most within this primary activity. Namely, it puts the emphasis on a shift from linear sales and distribution activities towards the management of customer as well as strategic partner networks.

TC11. Distributing insurance digitally. The prevalence of IT in today's world facilitates to sell insurance digitally. In particular, the identified start-up companies exploit their digital nature and draw on digital distribution. However, traditional insurers follow this path and start leveraging digital channels as well. An interviewee pointed out that some incumbents have already been selling insurance electronically for a long time (e.g., CosmosDirekt). As such, we see large differences within this transformational capability. More precisely, distributing insurance digitally is not limited to getting quotes online but includes designing innovative systems that offer smooth and customer-oriented processes (e.g., Trov streamlined their mobile app in a way that enables customers to turn insurance protection on or off by using a simple switch button). In regard to innovative approaches to digital distribution, we identify Insurance-as-a-service providers, which bring insurance services to the point-of-demand. For example, Simplesurance offers integrations into e-commerce systems at the point of sale allowing for cross-selling insurance policies for various types of products. Aside from pure digital ways to distribute insurance, differentiation can be achieved by supporting manual processes with digital devices (e.g., mobile and tablet advisory based on USU-POS and Softfair FinanzLotse 3.0), which the interviewees perceived as particularly relevant for complex insurance products and services (e.g., corporate insurance).

TC12. Harnessing digital marketing opportunities. Further potential lies in digital approaches to customer acquisition, lead generation and multi-channel management. For example, Amodo exploits, among other data, driving behavior data that enables targeted marketing and sales campaigns. Accordingly, it is wisely combined with gaining access to data (i.e., TC2) and integrating insurance with related and complementary services (see TC5 and TC6). As such, potential future customers of insurance services may already be users of related services.

TC13. Acting as digital broker. A plethora of identified InsurTech innovations ground in digital brokerage models, i.e., sell insurance policies with some degree of independence from insurers. Aside from general online brokers (i.e., traditional brokerage model through online channels), we particularly identified comparison platforms (e.g., Comparis, finanzchef24, Check24), all-in-one insurance managers (e.g., Knip, GetSafe, Clark, WeFox) and Insurance-as-a-Service providers (e.g., Simplesurance, kasko.io, Virado, Pablow). The latter is not only interesting from a digital distribution point of view (i.e., TC11) but also from the perspective of whom they enable to offer insurance services. Namely, they enable third-parties to offer insurance services within a few minutes (e.g., Simplesurance enables e-commerce shop providers to integrate a plugin to offer product insurance services). While they give away part of their commission, they still control the process end-to-end.

TC14. Forming strategic partnerships. Many InsurTech innovations are cooperative actions from adjacent market players. In line with Dyer and Singh (1998), our results emphasize the relevance of forming strategic partnerships to achieve competitive advantages from inter-organizational relationships, i.e., partnering with the right organizations in the right way. For example, the partnership between Panasonic and Allianz to offer Panasonic smart home device users access to the home protection services of Allianz. However, partnerships are not limited to bilateral cooperation but include ecosystems (i.e., networks of interdependent actors). For example, the Japanese Rakuten Group pursues a one-of-a-kind business model and includes one player of each industry (including an insurance company). This builds the foundation for offering a convenient shopping and service experience (e.g., through a shared membership database and a reward system).

Discussion on the Linkages and the Emergence of Disruptive Potentials

At first glance, many of the identified transformational capabilities seem to result in incremental innovations. In this regard, the term InsurTech may evolve similar to how Weil and Vitale (2002) delineated e-business a decade ago: "The term 'e-business' will disappear, but many of the fundamental tenets of e-business (that is, 24/7 online transaction processing and information provision, and single point of customer contact) will become part of the management toolkit. 'Business' will include 'e-business'" (p. 18). However, we see evidence that the disruptive potential of InsurTech emerges from the combination and alignment of the three interdependent activities 'infrastructure operations', 'service provisioning' and 'network promotion'. More precisely, disruptive potentials emerge through (1) the continuous alignment of infrastructure operations (i.e., digital and data-driven infrastructure operations) with service provisioning (i.e., insurance service development and digital service provisioning), (2) the continuous alignment of infrastructure operations and network promotion (i.e., towards customers and strategic partners), and (3) the continuous alignment of network promotion and service provisioning.

First, for instance, Trov harnesses a mobile app infrastructure to only to offer insurance services that fulfill customer needs (i.e., a simple and situational product insurance with flexible period of insurance coverage), but aligns them well with digital service provisioning possibilities along the entire customer journey: (1) a simple way to insure properties by adding a photo or receipt, (2) a designated switch button to flexibly turn protection on and off, (3) a way to check the protection status of all the insured properties at a glance, and (4) a way to submit claims by sending text messages. In contrast, traditional incumbents are slowed down by their existing infrastructure operations (e.g., operating claims hotlines or operating branches that physically processing and storing policies). Given their legacy IT systems, they have, for a long time, hesitated to digitalize service provisioning. However, incumbent insurers make first steps to establish data-driven infrastructures, which in turn enables innovation in terms of insurance services (e.g., Sanitas Active, AXA Drive Recorder, Allianz and Panasonic).

Second, digital infrastructures enable or prevent network promotion in terms how and from whom these activities can be performed. The digital risk-carrier Lemonade allows to integrate their insurance services into websites and apps by providing third-parties with an API and widgets. Thus, providers of platforms such as e-commerce, real estate, and smart home are able to offer insurance at the point of demand. Interestingly, a similar approach comes from a reinsurance company. Namely, Swiss Re has launched IptiQ to develop a digital platform that includes an (automated) underwriting system, policy administration and front-end systems such as an online portal. Thus, enabling organizations to sell life and health insurance products online using a white-labelling approach. Based on their insurance licenses, they enable not only insurances but also other corporations to sell insurance digitally (i.e., engage in network promotion), while still taking over service provisioning. In contrast to the latter examples of Lemonade and iptiQ, Simplesurance has a similar approach but acts as a digital broker. They offer plugins for well-established e-commerce software and work together with incumbents to cover the risk. So far, we demonstrated how infrastructure operations affect network promotion.

Third, Simplesurance is also able to gain expertise in selling insurance online by evaluating on a large basis (e.g., through A/B split-tests with different visualization templates) across insurance products, across e-commerce shops and across insurance carriers. Consequently, the knowledge gained through network promotion can be continuously exploited to improve the infrastructure as well as service provisioning. In turn, building on digital service provisioning promotes the network towards digital affine customers (e.g., Knip, Esurance and Clark attract customers interested in having a single app for managing all policies, submitting claims and receiving digital advisory). The same applies for integrating insurance services with related services (i.e., TC6), which enables to promote the network of insured customers in a certain domain (e.g., employee benefits services).

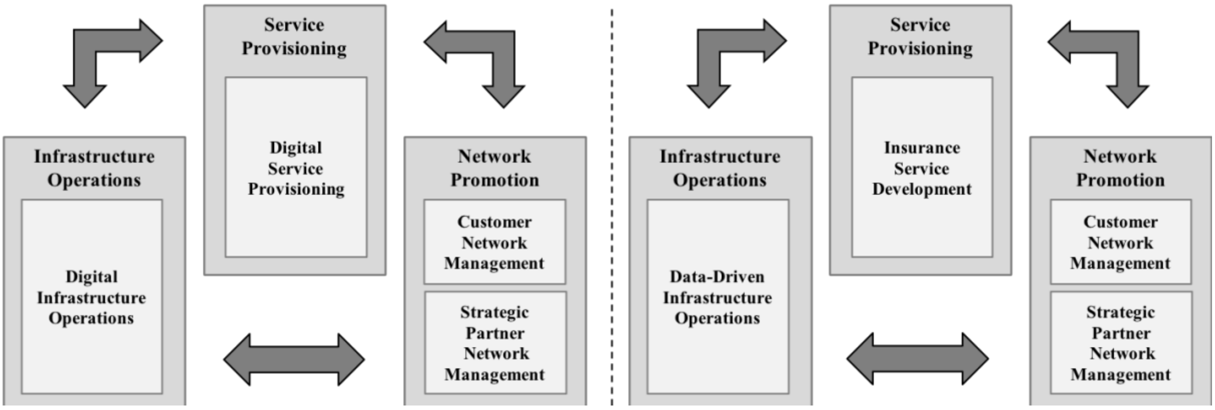

Figure 2. InsurTech enables both innovation cycles decoupled (left) and coupled (right) to the underwritten insurance product.

Considering the alignment of these three primary activities together allows to infer two different kinds of innovation cycles (see Figure 2). First, the product development of insurances is commonly tightly coupled to actuarial modelling and underwriting. In contrast, InsurTech enables innovations, which are decoupled from the underwritten insurance product (i.e., left cycle in Figure 2). For instance, a given insurance product (based on a particular actuarial model) may be integrated in various contexts and in combination with complementary services (e.g., by means of employee benefits services as illustrated above). Second, InsurTech enables innovations that are coupled to the underwritten insurance product. For instance, data-driven infrastructures enable the development of insurances based on a fine-granular assessment of the insured risk (i.e., right cycle in Figure 2). Imagine an insurer that exploits car usage data (i.e., infrastructure operations) to offer pay-how-you-drive insurance services (i.e., service provisioning) to car enthusiasts (i.e., network promotion). In turn, however, car enthusiasts (i.e., network promotion) may be interested in driving insights (i.e., service provisioning) based on a mobile application (i.e., infrastructure operations). Hence, both cycles are linked together.

Summarizing the above aspects, our integrated model (see Figure 1) offers an alternate and holistic lens to understand the impact of InsurTech on insurance value creation. In particular, it provides a foundation for decisions on where to strive for competitive advantages and where to give up sovereignty. The identified transformational capabilities reveal sources of competitive advantage through their impact on cost and value. By aligning them, disruptive potentials emerge, which is in line with research showing how the "convergence of several well-known, incrementally developing technologies can result in innovations with highly disruptive character" (Hacklin et al., 2004, p. 1). Nevertheless, two main factors may hinder the exploitation of the transformational capabilities.

First, organizations have different regulatory conditions. On the one hand, regulations can inhibit the exploitation of the identified transformational capabilities (e.g., utilization of risk-related data by insurers depends on privacy and data protection regulations). On the other hand, governmental actions can have a positive impact. In China, Kenya, and United Kingdom government support and less regulation has led to major growth of FinTech and InsurTech (Allayannis and Cartwright, 2017). Furthermore, different insurance systems facilitate the exploitation of certain transformational capabilities. For example, the employment-based private health insurance system in the United States enables the integration of health and life insurance service provisioning together with a wide range of employee benefits services (e.g., Bayzat and Zenefits). However, integrating insurance with services, which are less affected by regulation might be an efficient way to increase customer engagement.

Second, organizations originate from different insurance markets, which differ in the frequency of customer interactions (e.g., health insurance is usually associated with more frequent claims and policy adjustments than life insurance) and the duration of contracts (e.g., short term general insurance contracts, long term life insurance contracts). This influences the potential to exploit the identified transformational capabilities. For example, the potential to lower costs through digital service provisioning portals is smaller in markets with a low frequency of customer interactions, while the potential for differentiation is lower in low engagement markets. However, integrating insurance with related services (i.e., TC6) and forming strategic partnerships (i.e., TC14) may offset initial competitive disadvantages such as infrequent use or low customer retention. Furthermore, the prevalent insurance penetration as well as the ratio between distribution through insurance-dependent captive agents and independent brokers differs between countries influencing the exploitation (e.g., around two third of the non-life personal insurance lines in Switzerland rely on agents). For example, although many incumbents offer insurance-specific customer portals for service provisioning, they differ in the way they involve their insurance-dependent agents (e.g., while the Swiss insurer CSS integrates a messaging system into their customer portal, Mobiliar has put emphasis on their agents by referring to their email and phone number).

Impact on Industry Structure - The Rise of Novel Digital Intermediaries

Based on the changing nature of value creation on firm level, we further find empirical evidence of changes on industry structure. In particular, we see a wave of intermediation in the personal insurance market. Specifically, a plethora of new market entrants position themselves in between the insurance buyer and seller, with varying degree of independence from insurers (Cummins and Doherty, 2006).

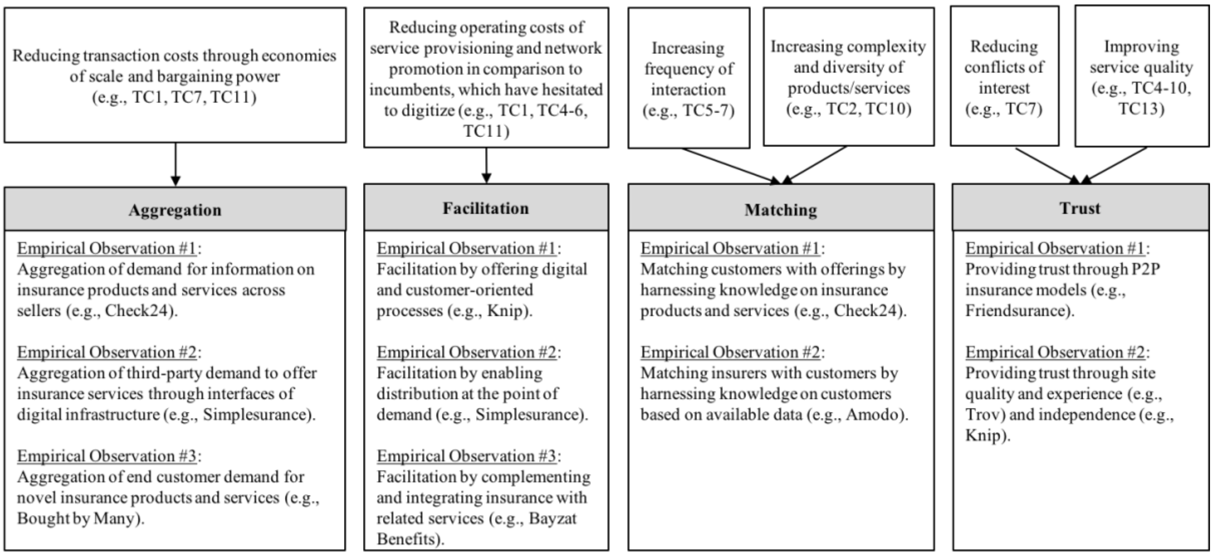

Figure 3. Transformational capabilities linked to intermediation roles and empirical observations.

One way to interpret this wave of intermediation is to consider it as insurance-specific manifestation of the potential of FinTech to reorganize the value chain by enabling new business models and new market entrants (Puschmann, 2017). To further elaborate on the roles they take, we build on prior literature that proposes four roles of intermediaries in electronic markets, i.e., aggregation, facilitation, matching, and trust (Bailey and Bakos, 1997; Sarkar, Butler and Steinfield, 1998). Accordingly, we relate the transformational capabilities to these roles and illustrate how these roles are observed empirically (see Figure 3).

Aggregation

Intermediaries aggregate the products of sellers or the demand of buyers to achieve economies of scale or scope, and to reduce bargaining asymmetry (Bailey and Bakos, 1997). Three manifestations of this role are reflected in our empirical data.

First, the role of an aggregator of sellers' products is reflected by the rise of price comparison platforms (e.g., Comparis, finanzchef24, Check24) and all-in-one insurance managers (e.g., Knip, Esurance, Clark, WeFox). As content aggregators, they aggregate insurance products and services of many insurance companies. At the same time, the larger the customer base of aggregators the more they gain in bargaining power to demand product and price information from insurance companies.

Second, aside from aggregating insurance products and services, we identify intermediaries, which aggregate the demand of third-parties to offer insurance services to their customers. Insurance-as-a-service intermediaries such Kasko.io, Simplesurance, Virado, and Pablow build and optimize their digital infrastructure to enable third-parties to offer insurance (e.g., through API's, plugins, add-ons). For example, instead of having the situation in which each e-commerce shop provider has to negotiate individually with an appropriate insurance, they can integrate the corresponding plugin within minutes. This way, shop providers are not only able to offer insurance for their products but also benefit from earning a commission. Another intermediary is Pablow, which does the same with travel insurance.

Third, we find empirical evidence of intermediaries that aggregate the demand of private customers. Traditionally, insurances develop standard products to achieve demand based on the law of large numbers. With the advent of InsurTech, we identify a variety of intermediaries that exploit digital channels to aggregate insurance needs of potential customers and, then, develop and negotiate policies with specific insurers. For example, on the one hand, Bought by Many aggregates long-tail insurance needs to develop niche insurance products such as pet insurance for rescue dogs and health insurance for cyclists. On the other hand, we identify intermediaries such as Drive like a girl, which aggregate the demand for innovative novel insurance products and collaborate with specific incumbents as risk carriers.

Facilitation

Intermediaries act as information exchange facilitators that reduce operating costs, e.g., the overall processing and coordination costs (Bailey and Bakos, 1997). For a long time, incumbent insurers hesitated to digitize their processes along the customer journey. Therefore, novel digital intermediaries are able to reduce the operating costs of private customers by exploiting transformational capabilities that digitize customer facing processes.

First, all-in-one insurance managers such as Knip, Esurance, WeFox and Clark have entered the market and offer digital and customer-oriented processes by exploiting several of the proposed transformational capabilities (e.g., digital claim submission, digital access to policies). In particular, all-in-one insurance managers take on both roles (aggregator and facilitator) and offer their customers one single point of interaction across insurance companies (e.g., access to policies and claim submissions of all insurances in one portal). Thus, reducing the overall processing and coordination costs for their customers, although our case study suggests that back office processes like policy administration are not yet fully automated. One interviewee stated: "they promote and push the digitalization per se. They offer electronic processes […] but how do they operate? They manually scan the policy they receive from us in the background and provide them digitally to the customer."

Second, considering the insurance-as-a-service providers (e.g., Simplesurance) from an end customer point of view, suggests that they act as facilitators. Namely, by enabling third-parties such as e-commerce providers to sell insurance at the point of sale, they lower the operating costs of the end customers.

Third, facilitation comprises the provisioning of additional services (Bailey and Bakos, 1997). This is reflected by actors that exploit the transformational capability of integrating insurance with related services (i.e., TC6) as well as complementing reimbursement with prevention and recovery services (i.e., TC5). In an increasingly digital economy, such associated services can span across industry borders. Against this background, our research shows that new market entrants integrate employee benefit services, health services and financial services and, thus, take on a facilitating intermediary role. Moreover, in case of employee benefit services, intermediaries such as Bayzat Benefits and Zenefits do not only offer health insurance related services to employees, but also retirement saving and human resource services (in countries that couple health insurance with employers). In fact, such facilitators occur along entire customer journeys, e.g., Abracar (part of Allianz) provides services such as security and trust along the customer journey of private individuals that sell their car.

Matching

Traditionally, insurance intermediaries act as market makers by matching insurance needs of customers with those of insurers (Cummins and Doherty, 2006). By accumulating market supply and market demand knowledge, they filter information for the respective party. As such, we identify two corresponding forms of intermediaries.

First, from a customer perspective, intermediaries take the role of matching customers with offerings by harnessing their knowledge on insurance product and price information. This is reflected in our empirical data by all-in-one insurance managers (e.g., Knip and WeFox) as well as price comparison platforms (e.g., Check24 and Comparis 360). Specifically, they go beyond aggregating product and price information and offer insurance coverage optimization by proposing concrete offerings to customers.

As such, these intermediaries take advantage of the high transaction costs required to compare insurance offerings. However, the influence of the identified transformational capabilities on the need for matching is twofold. On the one hand, as insurers increasingly exploit digital service provisioning (see TC4-6) and digital distribution (see TC11-13) transaction costs decrease and, consequently, the need for matching decreases as well following a general trend in electronic markets (Malone, Yates and Benjamin, 1987; Chircu and Kauffman, 1999). On the other hand, though, the identified transformational capabilities represent potentials to increase product and service differentiation, thus, resulting in increased diversity and complexity of insurance offerings (e.g., by exploiting data for risk assessment and underwriting, offering risk-adjusted pricing, pursuing predictive prevention or providing proactive warnings). This, in turn, leads to increased need for matching (Chircu and Kauffman, 1999), because the value of fulfilling a matching function depends on the frequency and complexity of the transaction (Bailey and Bakos, 1997). Accordingly, intermediaries could theoretically match customers with individualized offerings based on their data (e.g., driving behavior and mobility preferences) by harnessing their knowledge on market supply (e.g., differences in rewards for certain driving behavior or differences in on-demand and annual pricing). Empirically, such intermediaries could not be identified in our data, even though we find many intermediaries that develop insurance products and service with risk-adjusted pricing (e.g., Drive like a girl). They do collaborate with a specific incumbent, which acts as a risk-carrier. Therefore, we consider them to aggregate the demand for risk-adjusted insurance products rather than taking a matching role (see Aggregation).

Second, from an insurer perspective, intermediaries take the role of matching appropriate customers for insurers by harnessing knowledge on market demand based on available data. For example, Amodo exploits, among other data, driving behavior data to enable insurers to create targeted marketing and sales campaigns. In addition, customer-related knowledge is used to build insurance products and services (e.g., FitSense combines various mobile data to derive lifestyle customer profiles that enable health and life insurers to build products and services that fulfill real customer needs). While from a functional point of view, Amodo and FitSense fulfill a matching role, they operate on a white-labeling rather than brokerage model. This means, they provide insurers with white-labeled apps to gain access to their customers and, in turn, provide insurers with the knowledge they gain on the market demand.

Trust

Finally, intermediaries act as trust providers to buyers and sellers (Bailey and Bakos, 1997). Prior research reveals trust that is sourced in familiarity (i.e., through repeated interaction), calculativeness (i.e., through a subjective assessment of the other party's cost and benefit of cheating), and values (i.e., through institutional structures that increase confidence in trustworthy behavior and goodwill) (Ba and Pavlou, 2002). In particular in the personal lines (i.e., where we identify most new intermediaries), incumbents rely to a large extend on insurance-dependent local agents (Mayer, 2008). Thus, familiarity-based trust can be interpreted as initial competitive disadvantage of new intermediaries because the local agents have built relationships for years. However, literature puts the emphasis on calculativeness-based trust for initial online relationships (McKnight, Choudhury and Kacmar, 2002). Accordingly, we identify two ways how the transformational capabilities affect the available information of customers to assess the other party's cost and benefit of cheating.

First, our empirical data reveals various P2P insurance models (e.g., Friendsurance, insPeer, and Lemonade). Accordingly, they charge a fixed percentage of the premium for insurance, while the majority is allocated for claims. The remaining money is used for a predefined purpose (e.g., Lemonade donates the money to a charity selected by the customer and Friendsurance pays the money back). Thus, they reduce conflicts of interest, because they do not benefit from refused claims.

Second, literature suggests that site quality correlates with trusting beliefs, and web experience is positively related to institutional trust (McKnight et al., 2002). This is reflected by intermediaries such as Trov, Brolly, Cuvva and Slice, which gain in attention through the way they exploit the transformational capabilities to optimize digital service provisioning and service development. At last, it has been argued that independence from insurers affects the provided quality of the services positively (Garven, 2002; Maas, 2010). This suggests that, among others, all-in-one insurance managers such as Knip have good prerequisites to take the role of a trust provider.

Discussion on Future Developments in the Insurance Industry

By taking over the first point of contact, novel digital intermediaries have started to gain control over the processes along the customer journey (e.g., product comparison, policy administration, claims handling, advisory). At first glance, intermediaries are not a new phenomenon, because insurers distribute via both intermediaries (e.g., brokers and agents) and directly since years. Nevertheless, in contrast to commercial insurance, brokers are relatively rare for personal insurance lines, which often rely on insurance-dependent captive agents (Mayer, 2008). Based on these findings, we see four areas of future developments.

First, a possible consequence is that the opportunities for incumbents to differentiate by means of products, services, and customer-facing processes, is decreasing. Literature suggests that incumbents should focus on product differentiation and favor electronic markets that emphasize product information, rather than price information (Bakos, 1998). However, intermediaries such as price comparison platforms have the power to design their platforms and affect the differentiating parameters that customers see. In many cases this is the price. An interviewee argued that in the worst case, differentiation would be limited to the price and risk appetite of insurers, which would reduce them to pure risk-carriers. As such, we see a threat for incumbents to lose their direct access to the end customers in the personal insurance market. This in turn can impede differentiation through the development of customer-oriented products and services because it requires understanding the customers' needs. As the founder of Simplesurance stated: "we manage all the processes, all the customer relationships end-to-end, including the claim. We collect a lot of data about customer behavior, consumer behavior, and claim behavior. And so, we can generate a lot of insights about loss ratios, about claim ratios into the verticals, the countries. [...] That puts us in a position to really come up now with our own products and own pricing for insurance products" (von Bonin, 2016). Three options to respond to emerging FinTech start-ups (aside from doing nothing) have been suggested for incumbents, i.e., to acquire them, to adopt legacy IT and strategy to become a FinTech company or to partner with FinTech companies to serve customers (Allayannis and Cartwright, 2017).

Second, innovative service providers have entered the market and enable incumbents to exploit the transformational capabilities (e.g., development of innovative front-end applications for claims submissions). Given the weaknesses of insurers in IT operations and development (Maas and Janesch, 2015), this can further lead to increased specialization following the on-going reduction of in-house production (Puschmann, 2017).

Third, value networks along the different risk domains will emerge (e.g., car, health, household and life). On the one hand, many of the identified transformational capabilities rely on access to risk-related data, which many incumbents until now do not have. On the other hand, many stakeholders with direct access to risk-related data have not yet exploited this data for insurance purposes. Hence, various arrangements become possible. From the perspective of exploiting data for risk assessment (i.e., TC2), multiple scenarios become possible. Stakeholders with access to risk-data may provide insurances with raw data, may process and complement this data, may act as digital broker to offer insurance by themselves (i.e., TC13) or may even act as risk carriers. In between, specialized service providers may enter the market. However, in many cases, risk-related data needs to be aggregated to be useful for insurances as well as customers, which again relates to the transformational capability of integrating related services with insurance (i.e., TC6).

Fourth, we observe moves of novel intermediaries to expand their power. On the one hand, intermediaries start increasing their competitive scope. For example, the FinTech start-up N26 (i.e., a purely mobile bank provider) has recently announced to partner with the InsurTech start-up Clark to expand their services and products by introducing a purely digital insurance service N26 Insurance. On the other hand, our data suggests that intermediaries start shifting from offering pure price comparison towards individualized services. For example, the price comparison provider Check24 has recently launched a portal that offers contract management, expert check, insurance optimization, reminder services, and personal advice. Similar efforts can be observed in other countries (e.g., Optimatis and Comparis 360). This can be interpreted as a move towards combining all the four intermediary roles, i.e., aggregation, facilitation, matching and trust (Bailey and Bakos, 1997). This shift towards individualized advisory services (in the personal insurance market) also bears similarities to findings in the commercial insurance market. That is, a shift from transaction-oriented services to tailor-made solutions, and a tendency towards close customer relationships, customer-orientation, and empathic and competent behavior (Maas, 2010).

To sum up, the short-term impact of InsurTech is represented by a rise of novel digital intermediaries in the personal insurance industry. As such, it will be interesting to explore the long-term impact of InsurTech on the industry structure and see how these intermediaries evolve. Put simply in the exemplary words of the founder of an observed intermediary: “the vision itself for Knip is to reinvent insurance experience. We are not focused on being a broker. I think that's the entry point for us now. It's the easiest entry point that enables us to own the customer, to get the data that we need in terms of customer interaction and experience, but it's not something that we say we need to stick to the next two to three years” (Just, 2016).

Conclusions

Given the lack of empirical research on InsurTech and the novelty of topic, we strived to advance the understanding of InsurTech and its impact on firm-level value creation and insurance industry structure. To do so, we applied grounded theory methodology to develop theory inductively from rich empirical data. Our contribution to theory is twofold: First, our results advance literature on FinTech by contributing a systematic understanding of InsurTech through the presented model comprising 52 characteristics and 14 transformational capabilities. Drawing on value network literature, we demonstrate how the identified transformational capabilities (i.e., sources of competitive advantage) relate to the three interdependent primary activities infrastructure operations, service provisioning, and network promotion. This particularly emphasizes the relevance of aligning these primary activities and their respective transformational capabilities to understand firm-level value creation in the light of InsurTech. Second, by relating our results to the roles of intermediaries (i.e., aggregation, facilitation, matching and trust), we elaborate on the impact of InsurTech on the industry structure. Namely, the rise of novel digital intermediaries in the personal insurance market. For practitioners, the identified characteristics and transformational capabilities serve as building blocks, which can be combined to plan, discuss and compare InsurTech initiatives. Informing strategic positioning and competitive analyses, the model provides a foundation for deciding where to strive for possessing a competitive advantage and where to give up sovereignty.

There are several limitations in the light of which our results have to be interpreted: Contingent on the qualitative and interpretive nature of our research, exhaustiveness cannot be ensured. In spite of the iterative data collection, InsurTech is continuously evolving and might demand future changes of our model. In addition, the results might suffer from sample bias, because not every InsurTech innovation is posted on Twitter. Finally, we have to emphasize that literature on value networks, FinTech and intermediation might not be the only research fields worth to relate our emergent model to in the course of theoretical integration.

In particular, we would like to emphasize two main areas of future research. First, future work should investigate InsurTech from a customer's perspective in terms of trust, perceived value, and motives. For example, Milanova and Maas (2017) studied the motives to participate in peer-to-peer insurance. Second, as the nature of value creation shifts towards integrating and applying resources in networks of actors, it seems fruitful to investigate the emergent network structures in more detail (i.e., analyzing the exchanged operand and operant resources between actors such as reinsurance, primary insurance, service providers, and intermediaries). As such, literature on actor-network theory, value co-creation and service-dominant logic could inform future analyses.

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Article II: Feedback in IS Research: Seven Feedback Domains

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Table 6. Bibliographic Information for Article II

Feedback in Information Systems Research: Seven Feedback Domains

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Abstract

Feedback is essential for learning and progress. However, the concept of feedback is used for a multitude of purposes in an overwhelming diversity of fields such as performance management, education, and information retrieval. Given a fragmented landscape and lack of coherence, it remains unclear how the concept of feedback is used in the existing body of information systems (IS) research. This problem is addressed by conducting a systematic literature review that queries the AISeL database and the Senior Scholar Basket of journals. In total, 144 articles were analyzed to explore different domains in which the concept of feedback is adopted within IS research. The results highlight seven feedback domains: (1) product and service feedback, (2) machine performance feedback, (3) human performance feedback, (4) community contribution feedback, (5) educational feedback, (6) everyday life activity feedback, and (7) system (use) feedback. By providing an overview of seven domains and by discussing the roles which feedback plays in these domains, complexity is reduced. Further, this article provides a foundation for scholars to assess their feedback domain and inspires scholars to transfer knowledge in between these domains.

Keywords

Feedback, systematic literature review, information systems research.

Introduction

Given its multifaceted informational and motivational functions, feedback is key for learning and improvement of human (Hattie & Timperley, 2007; Ilgen, Fisher, & Taylor, 1979; Latham & Locke, 1990) and machine actors (Kaelbling, 1993; Sutton & Barto, 1998). Today, many aspects of our everyday life include exchanging feedback. For example, getting and responding to feedback prompts has become a daily reality whenever visiting restaurants, staying in hotels, driving with Uber and flying with airlines. In turn, seeking and acting on customer feedback is a crucial managerial task for organizations.

However, customer feedback is only one particular variation among many types of feedback examined in the field of information systems (IS) research. In fact, the concept of feedback is used in such diverse ways so that scholars, for instance, refer to feedback in terms of outcome feedback (Balzer, Doherty, & Others, 1989), cognitive feedback of decision support systems (Kayande, De Bruyn, Lilien, Rangaswamy, & van Bruggen, 2009), feedback about the task, processing of the task, self-regulation or feedback about the self as a person (Hattie & Timperley, 2007).

Due to its socio-technical nature, IS research includes, but is not limited to these above-mentioned forms of feedback. In result, prior research on feedback in IS research has to be assessed as fragmented and lacks coherence: "A pat on the back and a hearty 'well done' is 'positive feedback'. A course grade is 'feedback'. A meeting in which a supervisor rates the performance of an employee is called 'feedback'. The sound of a pellet falling into the food tray of a Skinner box and the sight and taste of the pellet are said to provide 'feedback' as well as reinforcement to the rat or pigeon" (Doherty & Balzer, 1988, p. 186).

Given this multitude of feedback conceptualizations and applications, it remains unclear how the concept of feedback is used in the existing body of IS research. Therefore, I pose the following research question: *What are different research streams that adopt the concept of feedback within the field of information systems and what roles does feedback play?*

The IS discipline is characterized by its diverse and interdisciplinary nature (Webster & Watson, 2002). Providing scholars with an overview of the diverse feedback research streams and linking these domains to corresponding authors, reduces complexity and facilitates the identification of similarities and differences between the different domains.

Research Method

The purpose of this research is to identify and analyze domains in which the concept feedback is adopted within the field of information systems and to present an integrated overview. To do so, a systematic literature review is conducted that builds upon the framework of vom Brocke et al. (2009) and follows the guidelines of Webster and Watson (2002).

Review Scope and Topic Conceptualization

The scope of this review is visualized in Table 7 and structured along the well-established taxonomy of literature reviews from Cooper (1988).

Dimension	**Characteristics**			
Focus	Outcomes	Methods	Theories	**Practices or Applications**
Goal	Integration	Criticism	**Central Issues**	
Organization	Historical	**Conceptual**	Methodological	
Perspective	**Neutral Representation**	Espousal of Position		
Audience	**Specialized Scholars**	**General Scholars**	Practitioners	General Public
Coverage	Exhaustive	Exhaustive & Selective	**Representative**	Central / Pivotal

Table 7. Scope of the literature review; Source: Cooper (Cooper, 1988).

The focus of this article lies on research practices with the goal to identify central domains in which the concept of feedback is adopted within the body of IS literature. Thereby, a domain is considered as “a field or sphere of activity, influence or expertise” (Wiktionary, 2019). Specifically, this research seeks to identify a set of domains, whereas in each domain the feedback concepts are used in a similar vein. This is achieved by obtaining a natural representation of literature, which is organized concept-centric (Webster & Watson, 2002). The intended audience is twofold. On the one hand, general feedback scholars from any field are targeted to provide them an overview of how the concept is used in IS research. On the other hand, IS scholars specialized in one of the identified domains are targeted to provide them a structure to delineate their feedback domain from others as well as transfer knowledge in between. Finally, this research strives for a representative coverage of the subject rather than for completeness (vom Brocke et al., 2015). Regarding topic conceptualization, the research at hand focuses on one particular concept, that is, feedback. According to dictionaries, the concept of feedback originates etymologically from the verb “feed“ and the adverb “back” and has often been viewed from the perspective of a system so that feedback refers to "the return of a fraction of an output signal to the input of an earlier stage" (Memidex Dictionary/Thesaurus, 2019). Similarly, feedback may be seen as a process in which a system (e.g., a person) produces an output and receives back some measure that “allows the system to compare its present state with an ideal state, to adjust itself in light of that comparison, and bring itself closer to that ideal state” (Doherty & Balzer, 1988, p. 163). Alternatively, in the context of human performance, feedback is understood as "information about the gap between the actual level and the reference level of a system parameter which is used to alter the gap in some way" (Ramaprasad, 1983, p. 4). Thereby, the information about the gap may relate to any system parameter such as the input (e.g., the effort an employee puts into a task), process (e.g., the way an employee approaches a task), or output (e.g., the outcome from completing a task) (Ramaprasad, 1983). Nevertheless, the “information about the gap must be used to alter the gap; only then is the loop complete” (Ramaprasad, 1983, p. 4). This means, the sole awareness of employee performance is not enough to call it feedback, but actions are required to close the feedback loop (Ramaprasad, 1983). However, to prevent being preconceived, the search and analysis within this structured literature review is not limited to a particular type of feedback and phenomenon (e.g., a particular behavior and action), but relies on the obtained literature to identify different feedback conceptualizations emergent in IS research.

Approach to Literature Search and Analysis

A structured literature search process was conducted on February 05, 2019 by following two different strategies and applying four exclusion criteria, which are described subsequently.

Search Strategy 1: Diversity of feedback in IS research. In a first step, we searched the AIS Electronic Library (AISeL) library on February 05, 2019. By probing all articles that contain “feedback” in their titles to ensure covering a broad variety of information systems research in which feedback plays the principal role. This is in line with the scope of our review (see Table 7), since we do not strive for exhaustiveness.

Search Strategy 2: Feedback in high quality IS research. In a second step, we continued our search with the Senior Scholar Basket of Journals (Association for Information Systems, 2019), since the corresponding journals are known as the most recognized IS journals. Specifically, the journals of the basket were chosen based on three criteria: “(1) the rigorousness of the review process, (2) the composition of the editorial board […], and (3) the existence of an international readership and contribution” (Hirschheim & Klein, 2012, p. 216). Consequently, we searched the following journals for articles with titles that include the keyword “feedback”: European Journal of Information Systems (EJIS), Information Systems Journal (ISJ), Information Systems Research (ISR), Journal of AIS (JAIS), Journal of MIS (JMIS), and MIS Quarterly (MISQ), Journal of Strategic Information Systems (JSIS) and Journal of Information Technology (JIT).

Stage	Description	Change (Total)
Search Strategy 1 - Diversity	*Search in AISeL for articles with titles that include “feedback”*	**+ 151 articles (151)**
Exclusion Criteria 1	Duplicates and unavailable files	- 3 articles (148)
Exclusion Criteria 2	Formal criteria not met	- 9 articles (139)
Exclusion Criteria 3	Focus on investigating feedback	- 9 articles (130)
Exclusion Criteria 4	Lack of definition of type of feedback	- 2 articles (128)
Search Strategy 2 - Quality	*Search in Senior Scholar Basket for articles with titles that include “feedback”*	**+ 23 articles (151)**
Exclusion Criteria 1	Duplicates from AISeL (MISQ, JAIS)	- 6 articles (145)
Exclusion Criteria 3	Focus on investigating feedback	- 1 articles (144)
Total		**144 articles**

Table 8. Structured approach to literature search and analysis.

Exclusion Criteria. Throughout both search strategies, we applied four exclusion criteria. First, publications for which no file was available could not be considered and duplicates were removed. Second, we excluded articles that did not meet formal criteria: (1) articles without results such as research-in-progress and short papers without results, (2) summaries of panel discussions and commentaries as well as (3) articles without proper scientific structure (i.e., without abstract). Third, articles without a clear focus on investigating feedback mechanisms were omitted. For example, research in which the term feedback was associated with the evaluation or with the application of methods (e.g., feedback mapping) were separated out. Fourth, research in which the nature of feedback was ambiguous was not considered.

Literature Analysis. To analyze the collected literature, a coding framework was developed based on theory-driven and data-driven codes (DeCuir-Gunby, Marshall, &

McCulloch, 2011). It is distinguished between the phenomena that are observed, assessed or evaluated (i.e., the feedback subject) and the different types of feedback that are investigated. In regard to the latter, literature further suggests that feedback is either provided by humans or machines, which is referred to as human-generated and computer-generated feedback (Ang et al. 1991). In addition, literature distinguishes between the two delivery modes face-to-face and computer-mediated feedback (Ang et al. 1991).

In the following, the qualitative data analysis software MAXQDA was used to code text passages of the obtained articles by applying the following coding schema:

- Feedback Type *(theory-driven code)*
    - Human-Generated Feedback *(theory-driven code)*
        - Face-to-Face Feedback *(theory-driven code)*
            - Open codes of face-to-face feedback *(data-driven code)*
        - Computer-Mediated Feedback *(theory-driven code)*
            - Open codes of computer-mediated feedback *(data-driven code)*
    - Computer-Generated Feedback *(theory-driven code)*
        - Open codes of computer-generated feedback *(data-driven code)*
- Feedback Subject *(theory-driven code)*
    - Feedback Domains *(data-driven code)*
        - Open codes of feedback subject *(data-driven code)*

Finally, seven feedback domains were identified from analyzing a total of 144 articles (see Table 9).

Feedback Domain	**Number of Articles per Source**		
	AISeL	*Senior Scholar Basket*	*Total (unique)*
D1. Product and Service Feedback	21	3	23
D2. Machine Performance Feedback	11	0	11
D3. Human Performance Feedback	20	6	24
D4. Community Contribution Feedback	12	2	14
D5. Educational Feedback	14	0	14
D6. Everyday Life Activity Feedback	26	0	26
D7. System (Use) Feedback	24	11	32
Total included	128	22	144

Table 9. Identified feedback domains with distribution of literature sources.

Results - Seven Feedback Domains in IS Literature

This research highlights seven distinct feedback domains within the field of information systems research (see Figure 4) and elaborates on the diversity of feedback concepts. Each domain is introduced in the following by describing the roles of feedback in these domains.

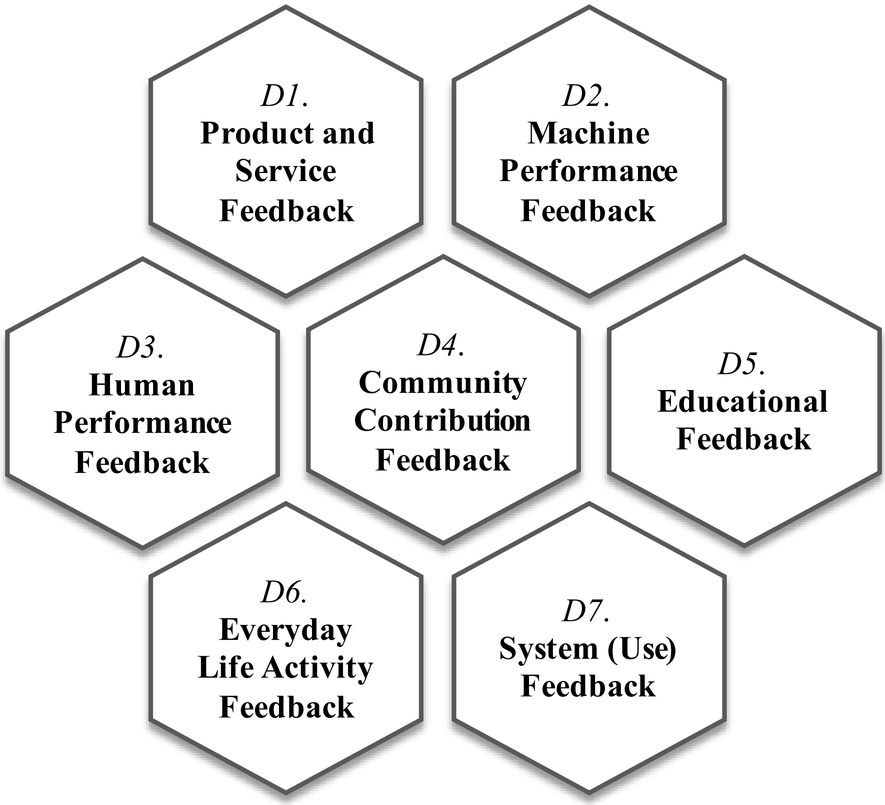

Figure 4. Seven Feedback Domains in IS Literature.

D1 – Product and Service Feedback. The first domain is concerned with user, consumer and customer feedback on products and services such as software systems, physical products, services as well as the reputation of individuals and companies. The first identified article dates back to the 1980s, in which scholars have started to investigate how to elicit user feedback during system development (Salaway, 1981). In the meanwhile, much literature moved towards examining feedback and reputation mechanisms in the context of E-commerce marketplaces, platform-based trading and auctions, and alternate forms of online communities that include feedback on products and services. More specifically, the identified literature examines online reviews of books (e.g., Chen, Wu, & Yoon, 2004), hotels (e.g., Li, Lin, & Zhang, 2015), and movies (e.g., Mukhopadhyay, Conlon, & Simmons, 2011). Thereby, reviews comprise both quantitative numerical ratings as well as qualitative text comments (Pavlou & Dimoka, 2006). Further, not only products, but also individuals and companies are increasingly being rated as they engage in transactions such as selling and buying products and services. In particular, research investigates the role of feedback on trust building, price premiums, and seller differentiation in online marketplaces (Pavlou & Dimoka, 2006). Similarly, scholars study implications of the reputation of service providers such as physicians in online health consultation and how they harness their online popularity to achieve price premiums (Chen, Rai, & Guo, 2015). With the advent of digitalization, phenomena such as datafication and big data allow collecting and gaining access to usage data and sensor data of products and services. On the one hand, such data is harnessed in the form of computer-generated feedback to improve the product design (Holler, Neiditsch, Uebernickel, & Brenner, 2017). On the other hand, and aside from explicit feedback on products and services through reviews and ratings, implicit feedback becomes available through analyzing the actual behavior of users, customers, and consumers, e.g., buying behavior and music listening behavior (Qi et al., 2013).

D2 – Machine Performance Feedback. In the second domain, the concept of feedback is used to evaluate machine performance such as calculating recommendations and predications. Much IS research in this domain is concerned with recommender systems and is tightly linked to related fields in the computer science discipline, therefore, relies on corresponding concepts. Most notably, the concept of relevance feedback is adopted, which originates from literature on information retrieval (IR). In contrast to database and decision support systems, IR systems aim at finding information (and reducing information overload) from a vast amount of unstructured data by means of search queries, whereas the corresponding performance is evaluated as users modify the query or use the results (i.e., relevance feedback) (Belkin & Croft, 1992; Salton & McGill, 1983). While some IS research in this feedback domain is concerned with improving relevance feedback (e.g., Xu, 2001), others investigate recommender systems and domain-specific recommendations such as news articles (Prawesh & Padmanabhan, 2012), task-relevant knowledge (Wu & Liu, 2003), and e-commerce products (Gupta, Kumar, & Bhasker, 2017). Interestingly, not only explicit feedback is used, but also various ways to derive implicit feedback data are examined, since (negative) feedback is often missing or unknown in real-world applications (Li et al., 2018). In contrast to the first domain, the role of feedback here is to help improving the machine recommendations and predictions, rather than reducing information asymmetry and increasing trust. For instance, binary and quantitative implicit feedback data such as the listening count of music, the purchasing count of items, or webpage bookmarking is harnessed (Gupta et al., 2017). Also, implicit feedback data is derived from applying collaborative filtering, e.g., by predicting if a user will rate an item (Li et al., 2018). Finally, one work examines effects of self-feedback on the performance of chaotic neural network models (Xu & Liu, 2012).

D3 – Human Performance Feedback. The third feedback domain comprises feedback on human performance reflecting a field of research that is often associated with performance management, performance appraisals, and human resource management, which is traditionally covered by management and psychological literature. With the advent of the digitalization of work, information systems research investigates three roles of corresponding performance feedback. First, research on traditional work settings increasingly investigates computer-mediated and computer-generated feedback aside from face-to-face (Ang, Cummings, Straub, & Earley, 1993; Ang, Straub, Cummings, & Earley, 1991) and how to design such electronic feedback systems (Niehaves & Ortbach, 2016). Further, it is examined how computer-generated feedback mechanisms facilitate the improvement of employee motivation of train drivers through the continuous provisioning of gamified feedback mechanisms that target the basic human needs of competence, relatedness, autonomy and purpose (Bartnik & Ćwil, 2017). Second, information systems literature includes research that investigates performance feedback in platform-mediated work settings such as crowdsourcing and open innovation. For example, prior research examines the relevance of platform facilitated feedback mechanisms in the form of comments within IT-based innovation contests (Adamczyk, Haller, Bullinger, & Moeslein, 2011). Third, research investigates the role of feedback that is available on projects and team performance. For example, in the area of system deployment, developers increasingly rely on post-release feedback (Lee, Licorish, MacDonell, Patel, & Savarimuthu, 2015). Further, it is investigated how project-related accountability and feedback in terms of direction and optimism affect the willingness of managers to continue with these software projects (Wei, Tan, & Heng, 2003).

D4 – Community Contribution Feedback. Today, various social software platforms provide interaction possibilities to form communities and exchange information (Kaplan & Haenlein, 2010). In this context, the fourth feedback domain relates to feedback on voluntary contributions to platforms such as social networking sites, online communities and open source software. On the one hand, these platforms offer computer-mediated feedback mechanisms that foster community feedback, e.g., commenting and liking (e.g., Cheikh-Ammar & Barki, 2014) as well as up- and down-voting (e.g., Armisen, Majchrzak, & Brunswicker, 2016) of contributions posted by other members. In contrast to formal organizations in which feedback is controlled, feedback in the context of voluntary contributions is itself a voluntary behavior (Moon & Sproull, 2008). Accordingly, feedback mechanism are essential components of community and social software platforms that shape individual perceptions of social presence and enjoyment (Cheikh-Ammar & Barki, 2014). As such, it is examined how receiving feedback influences the quantity and quality of voluntary contributions, and as such, how it facilitates and motivates people to (continue) contributing. In fact, research shows that systematic feedback systems have positive effects on the quality and quantity of contributions over time (Moon & Sproull, 2008). Further, it is examined how receiving feedback upon message posts relates to the number of connections (e.g., friends) and the frequency of postings. For example, research suggests that both having a small number and a plethora of friends goes along with receiving less feedback compared with people that have moderate friend counts (Schoendienst & Dang-Xuan, 2011). Note that community feedback is by no means limited to feedback on social network posts among friends, but include such as recipe contributions (Hong et al., 2016; Huang et al., 2017), knowledge contributions on Wikipedia (Grigore, Rosenkranz, & Sutanto, 2015), answers to academic surveys (Winkler, Sarstedt, Keil, & Rost, 2015), participation in forecasting communities (Teschner, Mazarakis, Riordan, & Weinhardt, 2011), and product configurations (Hildebrand, Häubl, Herrmann, & Landwehr, 2013; Hildebrand, Landwehr, & Herrmann, 2011). For example, studies of the latter suggest that receiving others' feedback on initial product configurations leads to less unique final self-designs and lower satisfaction with self-designed products (Hildebrand et al., 2013). Aside from computer-mediated feedback mechanisms, descriptive and normative feedback on community contributions can be automatically generated by platforms. Prior research suggests that (social) normative feedback is a powerful means to foster community contributions and facilitate behavioral change (Noyen & Wortmann, 2014). Thereby, investigations show positive effects of feedback on the quantity of content contributions when it is framed either pro-socially (e.g., you helped x other users) or pro-self (e.g., you are in the top x%), while competitively framed feedback was found to be less effective (Huang et al., 2017). Such metrics may not only be embedded in the corresponding platform but are provided over various channels such as weekly newsletters that act as reminders that drive participation (Teschner et al., 2011).

D5 – Educational Feedback. In the fifth feedback domain, feedback is viewed from a pedagogical and learning perspective in educational settings. Identified key concepts in this domain are summative and formative feedback, peer assessments, computerized feedback, and self-regulated learning. On the one hand, research in this domain includes investigations of face-to-face classroom settings, for example, to examine how instant online feedback on presentations increases students' interest in, commitment to and quality of presentations (Figl, Bauer, & Kriglstein, 2009) and how audio feedback instead of textual feedback on assignments enhances the process for tutors and learners (Evans & Palacios, 2010). On the other hand, research includes studies that examine the learning behavior of students in online learning (i.e., E-Learning) settings in which feedback is increasingly generated by information systems (i.e., computerized feedback) to reduce the workload of instructors and increase self-regulation of learners. Accordingly, Wu et al. (2017) compare the effects of computerized and instructor feedback and Rietsche et al. (2018) design and evaluate an IT-based formative feedback tool.

D6 – Everyday Life Activity Feedback. The sixth feedback domain comprises feedback on (1) health and lifestyle behavior as well as (2) safety and sustainability behavior of humans in their everyday life. Examples of the former include feedback on the sleeping behavior (Nguyen, Ruiz, Wilson, Strong, & Djamasbi, 2018), on food choices (Ronen & Te'eni, 2011), on diet and exercise decisions (McCreless, Goul, Louis, & Warner, 2017), on taking medications and keeping diets (Ronen & Teeni, 2013) as well as on managing fitness and health data (Kwon, Lee, & Lee, 2014). Examples of the latter are often referred to as eco-feedback and include feedback on the consumed electricity in households (Loock, Landwehr, Staake, Fleisch, & Pentland, 2012), consumed water in the shower (Tasic, Tiefenbeck, Schöb, & Staake, 2015), sustainability of driving behavior (Tulusan, Steggers, Staake, & Fleisch, 2012), commuting behavior with e-bikes (Flüchter & Wortmann, 2014), and on public safety within cities (Gopeni, Wayi, & Flowerday, 2016). Across these various types of feedback on everyday life activities, this research commonly investigates effects of different types of absolute and normative feedback interventions on the subsequent behavior. In this context, Loock et al. (2012) elaborate on the relevance of setting appropriate reference groups when presenting descriptive normative feedback that compares the behavior of individuals to others. Dalén and Krämer (2017) illustrate the relevance of user-centered feedback design by showing feedback of monetary savings instead of consumed energy. Ronen and Teeni (2013) highlight the impact of feedback visualization, personalization, and interactivity. As a final example, Tiefenbeck et al. (2016) find persistent long-term effects from providing people with real-time feedback on their energy consumption (in contrast to aggregated information).

D7 – System (Use) Feedback. The seventh feedback domain relates to information systems use and occurs in four varieties. First, feedback is understood as system-generated information that is presented to a systems' users in response to their actions with the goal to help them improving the accomplishment of tasks and processes (Te'eni, 1992). Drawing on cognitive psychology, the underlying logic is that humans have limited cognitive abilities and need help in information processing as well as judgment and decision making (Doherty & Balzer, 1988; Kahneman, Slovic, & Tversky, 1982). Accordingly, the concept of feedback denotes, for instance, information about decision-making processes and scholars investigate how systems "can be designed to provide feedback at the appropriate time so that the decision maker can use it effectively" (Te'eni, 1991, p. 644). Most notably, the concept of *cognitive feedback* refers to systems that present their users with information of one or more of the following three components of cognitive feedback (Balzer et al., 1989). Task information or feed-forward includes relations of the task environment, e.g., how to do a judgment task (Balzer et al., 1989; Balzer, Sulsky, Hammer, & Sumner, 1992). Cognitive information includes relations of the perceptions of the user, e.g., how a judgment task is done or how it was done previously (Balzer et al., 1989, 1992). Functional validity information includes relations between the environment and the user's perceptions of the environment, e.g., how successful a judgment strategy is (Balzer et al., 1989, 1992). As opponent to outcome feedback that provides knowledge of results, cognitive feedback is understood as process feedback (Balzer et al., 1989). Thus, it can influence and change the behavior of people (e.g., the decisions they make). However, the effectiveness depends on the content and form of the feedback and, therefore, requires sophisticated design considerations (Te'eni, 1992). Due to the diversity of IS research, cognitive feedback and so-called *information feedback* is investigated for varies types of information systems (e.g., decision support systems, auctions, and online retail sites). In the context of auctions, it is examined how the provisioning of information to suppliers influences the economic outcome of auctions (Adomavicius, Gupta, & Sanyal, 2012) and how bidder support systems can be designed so that bidders are guided by exact price feedback (Adomavicius, Curley, Gupta, & Sanyal, 2013). In the context of online retail sites, scholars investigate the influence of information feedback such as the total amount and past expenses on consumer behavior in online payment processes and how this can improve the experience (Dutta, Jarvenpaa,

& Tomak, 2003). However, cognitive feedback goes beyond purely digital settings and includes research that investigates how public feedback on mobile self-checkout systems in physical stores can make users more comfortable making purchases in public when others can be observe if the payment was successful (Vuckovac, Hubert, Fritzen, Fuchs, & Ilic, 2017).

Second, IS research related to human-computer interaction often takes a broader stance by considering feedback as any communication from the system back to the user (Frysak, 2016). Such feedback may provide users with information regarding the actions that have actually been executed by the system (Norman, 1998), a system's state (Sheng & Lockwood, 2011) and the signalization of system responses and outcomes (Vuckovac et al., 2017). For example, it is examined how the provisioning of system status feedback can reduce uncertainty and, thus, increases the perceived acceptability of delays, satisfaction with the site, as well as the intention to return to the site (Sheng & Lockwood, 2011).

Third, literature on computer-mediated communication emphasizes the anticipated personal feedback that is somewhat limited or delayed when information systems are used to communicate as opposed to interpersonal face-to-face communication that comes with plenty and immediate feedback. In this context, feedback is understood as the perception of a message receiver that a reply to this message would be read and answered (Wilson & Djamasbi, 2013). This is tightly coupled to the richness of media, which differs in the immediacy of feedback, that is, to what extent media enable providing rapid feedback on received communication and to what degree they enable the sender to recognize to which extent a receiver has understood the message (Dennis & Kinney, 1998).

Fourth, from a task-technology fit perspective (Goodhue & Thompson, 1995), information systems use is coupled to experience and adaptation feedback (Chiasson, Kelley, & Downey, 2015). *Experience feedback* describes how using an information system allows users to check if their initial expectations (of the task-technology fit) have been met so that they can adjust their expectations and the subsequent use (Chiasson et al., 2015; Goodhue & Thompson, 1995). *Adaptation feedback* describes that using an information system leads to positive or negative effects that allow users to adjust as well as learn to improve the ways they use a system and, thus, to increase their individual-technology fit (Chiasson et al., 2015; Goodhue & Thompson, 1995).

In the following, Table 10 provides a detailed overview of the articles for each feedback domain.

Feedback Domain	**Human-Generated Feedback**	**Computer-Generated Feedback**
D1. Product and Service Feedback <u>Keywords</u>: *Trust, online review, (digital or electronic) word-of-mouth, signaling theory, online trustworthiness, online feedback, social exchange theory, motivation crowding theory, benevolence, creditability, institution-based trust, subjective norm, text mining.*	- Direct user/ consumer/ customer feedback via analog or digital channels such as questionnaires, telephone, letters, and email (Bragge & Merisalo-Rantanen, 2002; Culnan, 1989; Eklund, Toivonen, Vanharanta, & Back, 2011; Jayanth, Jacob, & Radhakrishnan, 2011; Lee et al., 2015; Salaway, 1981; Tabor, 1999). - Platform-based online feedback mechanism (i.e., reputation systems such as reviews and ratings) (Chen et al., 2015; Chen et al., 2004; Cui, Wang, Feng, & Teng, 2014; Li et al., 2015; Loebbecke, Bolton, & Ockenfels, 2007; Mou, Ren, Qin, & Kurcz, 2018; Mukhopadhyay et al., 2011; Pardue, Landry, & Shaw, 2007; Pavlou & Dimoka, 2006; Sänger & Pernul, 2018; Seeger, Neben, & Heinzl, 2017; Shahbaznezhad, 2016; Shen & Liu, 2018; Vannoy, Nath, & Iyer, 2008; Wang, Teo, & Wei, 2005; Zhang, Zheng, & Wang, 2004).	- Usage and sensor data of products and services (Holler et al., 2017). - Implicit feedback through usage behavior (Qi et al., 2013).
D2. Machine Performance Feedback <u>Keywords</u>: *Information retrieval, semantic analysis, concept extraction, document re-ranking, concept fusion, term hierarchy, item ranking, weight learning, non-linear self-feedback, neural network, linguistic approach, collaborative filtering.*		- *Implicit and explicit relevance feedback* (Bot, 2003; Chou, Dai, Liu, & Lin, 2015; Chou, Zeng, & Dai, 2014; Gupta, Kumar, & Bhasker, 2016; Gupta et al., 2017; D. Li et al., 2018; Pathak, 1998; Prawesh & Padmanabhan, 2012; Wu & Liu, 2003; Xu & Liu, 2012; Xu, 2001).
D3. Human Performance Feedback <u>Keywords</u>: *Absorptive capacity, open innovation, feedback seeking, motivation, improvement, continuous feedback, goal setting, self-regulation, social facilitation, feedback intervention, team performance, rank order*	- *Face-to-face performance feedback* (Ang et al., 1993, 1991) including techniques such as pair programming and peer code reviews (Schmidt, Spohrer, Kude, & Heinzl, 2012). - *Computer-mediated electronic performance feedback* (Ang et al., 1993, 1991; Bellini & Lacet Serpa, 2018; Niehaves &	- *Descriptive statistics of performance* (Babar et al., 2018a, 2018b; Bartnik & Ćwil, 2017; Niehaves & Ortbach, 2016). - *Normative feedback on performance* (Jung, Schneider, & Valacich, 2005; Straub, Gimpel, Teschner, & Weinhardt, 2014, 2015).

tournament, incentives, accountability, feedback optimism, feedback direction, feedback specificity, feedback acceptance, dissonance reduction theory, feedback process model, behavioral theory, anchoring effect.	Ortbach, 2016; Wang, Zhao, Qiu, & Zhu, 2014). - *Social feedback from peers* (Babar, Chan, & Choi, 2018b, 2018a). - *Crowd and peer feedback* (Adamczyk et al., 2011; Koh, 2018; Lee et al., 2015; Seeber, Zantedeschi, Bhattacherjee, & Füller, 2017; Thiebes, Scheidt, Schmidt-Kraepelin, & Benlian, 2018; Yang & Hahn, 2016). - *Feedback on group performance such organizational performance as well as project feedback and evaluation* (Baker, 1995; Baker, Song, & Jones, 2017; Koch, 2015; Saraf, Dasgupta, & Assadi, 2012; Wei et al., 2003).	- *Computerized feedback* (Ang et al., 1993, 1991; Garfield, Satzinger, Taylor, & Dennis, 1997).
D4. Community Contribution Feedback Keywords: *Social presence, social loafing, social influence, social value orientation theory, self-determination theory, incentive mechanisms, user-generated content, reputation, social judgment theory.*	- *Online community feedback mechanisms such as likes, gratitude, up-votes and down-votes* (Armisen et al., 2016; Cheikh-Ammar & Barki, 2014; Glogowska, Csáki, Feller, & Gleasure, 2016; Grigore et al., 2015; Hildebrand et al., 2013, 2011; Moon & Sproull, 2008; Schoendienst & Dang-Xuan, 2011). - *Sentiment-driven (affective) feedback* (Grigore et al., 2015).	- *Descriptive statistics* (Winkler et al., 2015). - *Normative feedback such as relative ranking among peers and social ranking feedback* (Hong et al., 2016; Huang et al., 2017; Noyen & Wortmann, 2014; Teschner et al., 2011). - *Summative system feedback* (Armisen et al., 2016).
D5. Educational Feedback Keywords: *Self-regulated learning, self-motives, social influence, value perceptions, instructor feedback, online learning, social support, learning outcome, information processing, student engagement, student participation, personalized feedback, formative assessment; active learning, interactive technology enhanced learning, pedagogy, anonymity, eLearning, Gamification, Mobile Learning, Motivation.*	- *Feedback from teachers and peers in general* (Aoun, Ang, & Vatanasakdakul, 2014). - *Computer-mediated feedback from teacher* (Evans & Palacios, 2010). - *Computer-mediated feedback* from peers (Dreher & Maurer, 2006; Figl et al., 2009; Sager, 2006; Williams, Mondschein, Farmer, & Twyman, 2018; Wu, Wang, Zhao, & Liang, 2015).	- *Computerized feedback for students* (Coakley & Tyran, 1999; Grigoriou, Cheong, & Cheong, 2015; Lederman et al., 2017; Rietsche et al., 2018; Schneider, Janson, & Schöbel, 2018; Wu et al., 2017). - *Computerized feedback for teachers* (Cristea et al., 2018).

D6. Everyday Life Activity Feedback Keywords: Feedback application, task-technology fit, task-performance chain, feed-forward, learning process, social norms, motivation theory, social normative feedback, feedback loop, self-feedback, continued use of IT, social presence, behavior change, decision support systems, conscientiousness, persuasive system design, praise, rewards, reminders, suggestions, eco-feedback, self-efficacy, personalization, interactivity, social cognitive theory, goal setting theory, self-regulation, real-time feedback, effect persistence, data push system, intrinsic motivation, feedback presentation, humanized feedback, computers are social actors (CASA), cognitive load.	- *Self-feedback* (Kwon et al., 2014). - *Computer-mediated feedback concerning public safety issues* (Gopeni et al., 2016).	- *Absolute feedback on behavior regarding health, lifestyle, safety and sustainability* (Ableitner, Tiefenbeck, Fleisch, & Staake, 2018; Albizri & Zahedi, 2012; Dalén & Krämer, 2017; Gottlieb & Böhm, 2018; Gottlieb, Böhm, & Krcmar, 2018; Nguyen et al., 2018; Piccolo, Scharl, & Baranauskas, 2012; Promann & Brunswicker, 2017; Ronen & Teeni, 2013; Ronen & Te'eni, 2011; Strong, Tulu, Agu, & He, 2014; Tasic et al., 2015; Tiefenbeck et al., 2016; Tulusan et al., 2012; Yoganathan & Kajanan, 2014). - *Normative feedback on behavior regarding health, lifestyle, safety and sustainability* (Flüchter & Wortmann, 2014; Flüchter, Wortmann, & Fleisch, 2014; Loock et al., 2012; Loock, Staake, & Landwehr, 2011). - *Cognitive feedback for behavior change* (McCreless et al., 2017). - *Biofeedback* (Lux et al., 2018; Lux, Hawlitschek, Adam, & Pfeiffer, 2015; Maier, Reimer, & Ridinger, 2011; Shih, Kowatsch, Tinschert, Barata, & Nissen, 2016).
D7. System (Use) Feedback Keywords: Auctions, information feedback, bidder behavior, reputation, classification of sellers, groupware, awareness, media richness theory, information cues, equivocality, group support system, feedback utilization, decision making, decision support systems, decisional guidance, recommender system, transparency, computer-mediated communication, feedback immediacy, nonverbal cues, mental models, business intelligence, data warehouse, consumer expertise, flow, intrinsic motivation, information failure, trust violation, trust repair, electronic word-of-mouth, e-commerce, multi-user systems, software	- *Feedback from IS use* (Tennant & Chin, 2015). - *Experience and adaptation feedback* (Chiasson et al., 2015).	- *Feedback on system status* (Sheng & Lockwood, 2011) or *system outcomes* (Vuckovac et al., 2017). - *Cognitive feedback and information feedback* (Adomavicius et al., 2007; 2008; 2009; 2012; 2013; Appan & Lin, 2004; Bordetsky & Mark, 2000; Djamasbi & Loiacono, 2006; Dutta et al., 2003; Frysak, 2016; Hashim, Kannan, & Maximiano, 2017; Hebrado, Lee, & Choi, 2011; Hiltz, Johnson, & Turoff, 1991; Huguenard & Frolick, 2001; Kayande et al., 2009; Kolodner & Even, 2009a, 2009b; Koppius, Heck, & Kumar, 2000; Ottaway, Bruneau, & Evans, 2001; Pikovsky & Bichler, 2005; Schaffer & Feng, 2015; Sen & Bagchi, 2012; Sengupta & Te'eni, 1993; Weber, Presser, & Norrie, 2015; Zhang & Zhang, 2015). - *Feedback related to computer-mediated communication and media richness* (Dennis & Kinney,

agents, delay, attention, satisfaction, intention, eye tracking, change, post-adoption, (continued) use, adoption, public feedback, persuasion, influence, interpersonal communication, feedback strategy.		1998; Kahai & Cooper, 2003; Wilson & Djamasbi, 2013).

Table 10. Details of feedback types by feedback domains

Discussion

The literature review at hand reveals seven different feedback domains and elucidates the diversity of feedback in IS research. Specifically, it provides an overview of how the concept of feedback is applied in different domains of IS research. We now discuss similarities and differences before offering suggestions on how to bridge these, so far, detached feedback domains.

Similarities and Differences Among the Feedback Domains

To discuss similarities and differences, we now reflect the seven feedback domains along the following five aspects: (1) goal setting and control, (2) explicit and implicit feedback, (3) feedback exchange in a digital world, (4) feedback timing and purpose, (5) external and internal feedback.

Goal setting and goal control

Prior research shows that feedback and goal setting are closely interrelated, since (1) feedback only leads to performance improvement given that it leads to higher goal setting and (2) performance only increases over time given the presence of feedback that relates to goal attainment (Latham, 2012; Latham & Locke, 1990). However, the seven feedback domains differ in the way goal setting and control is treated. On the one hand, feedback conceptualizations strongly emphasize the control function of feedback to compare a system's current state against the predetermined goal state, thus, contribute towards goal attainment (Clement & Frandsen, 1976). On the other hand, scholars consider any reaction or signal of communication as feedback. Accordingly, it has been argued that by considering independent messages and sole response cues as feedback, scholars "have largely overlooked or ignored the vital aspects of control and goal-setting that are central to the concept of feedback" (Clement & Frandsen, 1976, p. 21). Within the scope of this literature review, this is particularly reflected in the domain of system use feedback (D7). For example, the provisioning of information about a system's state to its users is considered as feedback (Sheng & Lockwood, 2011). One way to look at this example is that goal setting and goal control is implicitly given, because users control their actions and attain the goal of establishing a successful human-computer interaction. On the other hand, goal setting and goal control can be interpreted as rather trivial with little to no goal conflicts. In many other feedback domains (e.g., performance feedback) multiple actors are involved and mutually influence the goals and goal setting so that goal determination and alignment becomes much more complex and crucial (Clement & Frandsen, 1976). In the context of human performance feedback (i.e., the third feedback domain), goal-setting depends on multiple involved actors and the information about a gap is not necessarily an objective unidimensional measure, since humans are perceptual and adaptive actors (Clement & Frandsen, 1976; Smith, 1973). As such, feedback effects are often negative (Kluger & Denisi, 1996), since they depend on factors such the creditability of the feedback source, the perceived accuracy, desire to respond or the intended response (Kinicki, Prussia, Wu, & McKee-Ryan, 2004). Furthermore, in other situations the goals might also be relatively fixed and given by one actor. For instance, in the educational context goals are usually set by a teacher and feedback is conceptualized accordingly as "information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one’s performance or understanding" (Hattie & Timperley, 2007, p. 102). To sum up, the characteristics of the underlying goal setting and control processes widely differ between the seven feedback domains. In turn, the extent to which feedback is treated as control system is tightly coupled to the way feedback enables corrective behavior, provides direction, reinforcement and persuasion (Clement & Frandsen, 1976).

Explicit and implicit feedback

While prior research comprises explicit feedback across the seven feedback domains, only part of the feedback domains include research that adopts a systematic understanding of feedback which incorporates implicit feedback. For example, implicit relevance feedback on machine performance (e.g., no clicks on a particular search result), implicit feedback through usage behavior (e.g., no one listening to a particular song), or implicit feedback on voluntary contributions (e.g., no likes on a particular social media posting). This distinction between explicit and implicit feedback can be seen in the broader context of cybernetics. Cybernetics examines communication from the perspective of a control systems and introduces the concept of feedback as circularity of response, which provides information whether or not the exerted control was effective (Smith, 1973; Wiener, 1948). In this context, mechanical conceptualizations differ from systemic conceptualizations of feedback so that the former reduces feedback to the direct and materially evident exchange of information, whereas the latter views feedback "as a relationship rather than a material response" (Smith, 1973, p. 26). Specifically, in the more general systemic understanding, feedback is not given and received. Once a feedback relationship exists based on circularity of interaction, a receiver cannot not respond, since no response also comes with informational value (Smith, 1973). Hence, in the context of the ongoing digitalization, datafication and ubiquitous computing, one can argue that a feedback relationship is increasingly being given. Therefore, it seems increasingly valuable to embrace a systemic understanding of feedback.

Feedback exchange in a digital world

Against the backdrop of the ongoing digitalization, datafication and automation (Brynjolfsson & McAfee, 2014; Faraj, Pachidi, & Sayegh, 2018; Markus, 2017), behavior and performance can increasingly be monitored, and, on the other hand, feedback can increasingly be mediated and generated by computers. Though the seven feedback domains vary regarding task characteristics such as regulatory and privacy constraints, computer-generated feedback is investigated across all feedback domains. However, scholars have adopted alternate concepts to refer to computer-generated feedback: computerized feedback, automated feedback, computer-based feedback, computer-aided instructions, and machine-based feedback. While the result is the same, the plurality of concepts reflects the contextual differences. For example, the concept of automation acknowledges the full or partial replacement of human operators (Parasuraman, Sheridan, & Wickens, 2000), while the concept of computer-aided instruction emphasizes the role of the computer as support function of teachers addressing the challenge to provide formative feedback in large-scale lectures given a constant rise of student numbers (Rietsche et al., 2018). However, aside from the different concepts, the discussed advantages and disadvantages of computer-generated feedback are similar. From a feedback receiver perspective, computer-generated feedback directs the attention more to the task and to the task details compared to identical feedback from a supervisor (Earley, 1988). Given that the source of the feedback changes from a person to a computer, critical factors that would otherwise elicit negative feedback effects, such as source credibility, expertise, and power, can be eluded (D. Ilgen & Davis, 2000; D. R. Ilgen et al., 1979). At the same time, computer-generated feedback enables setting up less threatening and anonymous feedback-seeking environments (Anseel, Beatty, Shen, Lievens, & Sackett, 2015; Anseel, Lievens, & Levy, 2007). However, monitoring systems come with the risk of being perceived as invisible supervisors leading to greater stress, psychological reactance and resistance (Ang et al., 1993). Accordingly, it seems crucial to consider how the underlying behavior and tasks are motivated, which may vary across and within the seven domains. Lastly, from a feedback giver perspective, computer-generated feedback reduces the workload to provide timely and personalized feedback (e.g., Wu et al., 2017).

Feedback timing and purpose

Prior research highlights feedback timing as a crucial characteristic with complex effects on the effectiveness of feedback interventions (Kulik & Kulik, 1988; Lechermeier & Fassnacht, 2018; Shute, 2008). This is reflected in the present research by information systems that play an active role in enabling more timely feedback exchange. In fact, it seems to be a common denominator among the seven feedback domains that digitalization increases the opportunities of timely feedback (i.e., instant, immediate or even real-time) rather than delayed feedback. However, only part of the scholars explicitly refer to *real-time feedback*. For example, in the domain of everyday life feedback (i.e., sixth feedback domain) scholars investigate real-time feedback on energy consumption (e.g., Tiefenbeck et al., 2016) or live biofeedback (e.g., Lux et al., 2018). In contrast, many scholars rather put the emphasis on particular types of feedback (i.e., formative feedback, process feedback, progress feedback and cognitive feedback), which are indirectly linked to timely feedback due to their purpose and content. First, timely feedback is often examined from the perspective of *formative feedback*, which aims at fostering improvement, learning and progress opposed to summative feedback that aims at judging ex post on success or failure. According to Armisen et al. (2016) formative feedback "provides ongoing comments on how to improve a solution" (p. 2), while summative feedback "measures the level of success of the solution" (p. 2). It seems not surprising that this perspective is widely taken in educational research where formative feedback is understood as "information communicated to the learner that is intended to modify his or her thinking or behavior for the purpose of improving learning" (Shute, 2008, p. 154). As such, scholars, for example, investigate how information systems can be designed and harnessed to facilitate formative feedback (Rietsche et al., 2018). Second, timely feedback is examined from the view of *process feedback* (i.e., information concerning the manner in which an individual implements a work strategy) opposed to outcome feedback (i.e., information concerning performance outcomes) (Earley, Northcraft, Lee, & Lituchy, 1990). Process feedback is corrective feedback and directs attention on task-learning (Kayande et al., 2009). Though outcome feedback may trigger adjustments and progress, it is associated with less specific information on how to adjust compared to process feedback (Earley et al., 1990). Similarly, specific and directive feedback is distinguished from general and facilitative feedback as well as verification from elaborated feedback, whereas pure verification relates to “knowledge of results” or “knowledge of outcome” (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Shute, 2008). However, especially for unstructured and complex tasks it is relevant to receive feedback that guides appropriate adjustments rather than receiving sole outcome information (Earley et al., 1990). Aside from process feedback, IS scholars also refer to *progress feedback* (Schaffer & Feng, 2015). Third, there is a vast body of IS literature that looks at timely feedback in the form of *cognitive feedback*, which is closely related to process feedback since its purpose is to improve the accomplishment of tasks and processes (Te’eni, 1992). Much knowledge has been accumulated on how to present users with task information, cognitive information and functional validity information (Balzer et al., 1989). For example, scholars investigate how to design combinatorial auctions so that real-time bidder support metrics support bidders and increase their performance (Gediminas Adomavicius et al., 2013).

External and internal feedback

In the reviewed articles, different concepts are adopted that all relate to the fact that humans are not just passively exposed to external feedback, but also can take an active role in generating internal feedback: self-generated feedback, self-feedback, self-evaluation, self-assessment, self-management, self-monitoring and self-regulation. The common denominator is that “self” emphasizes some degree of autonomy of individuals, which are responsible for their own actions (Kwon et al., 2014). A self “does not regulate itself directly, but it may control the behaviors, feelings, and thoughts that comprise it” (Baumeister, Schmeichel, & Vohs, 2007, p. 517) and it can acknowledge the consequences of the corresponding actions (Kwon et al., 2014). Accordingly, feedback is closely related to the self(-concept) and it fulfills a self-evaluative role since it allows its receivers to compare their actual behavior with their targets and goals and, then, to adjust their future actions and targets (Earley et al., 1990). Self-regulation reflects an essential function of the human self that significantly characterizes the self and the raison d’être (Baumeister et al., 2007). In turn, feedback is an inherent catalyst of self-regulation, since it not only occurs in the form of external feedback, but also as internal feedback (Bangert-Drowns et al., 1991; Butler & Winne, 1995; Narciss, 2008). As humans engage in tasks, they self-generate feedback so that the feedback is provided by their internal source of information such as direct perceptions based on self-monitoring

(Narciss, 2008). Note that, in turn, individuals may also receive feedback about their self-regulation (FR), which should not be confused with feedback about the self as a person. The latter is less effective due to the fact that it is directed to the self (e.g., you are a great student) and does not relate to the task (Hattie & Timperley, 2007). In contrast, feedback about self-regulation may include external feedback (e.g., from a teacher) on internal feedback strategies (e.g., a students' skills to generate feedback through self-evaluation) (Hattie & Timperley, 2007). This is important, since humans that develop self-regulation strategies are viewed as more effective learners in the educational feedback domain (D5), because they are less reliant on external factors (e.g., the task, teachers or supervisors) for feedback (Hattie & Timperley, 2007). Further, research in the area of human performance management (D4) highlights the self as the most important feedback source, since employees more heavily rely on the self as feedback source than on feedback from the task, supervisor, co-workers, and the organization (Greller & Herold, 1975; Ilgen et al., 1979). From an external feedback perspective, valuable feedback is rare, since humans are often reluctant to provide feedback (Fisher, 1979; Rosen & Tesser, 1970). At the same time, feedback is often provided as outcome feedback, which provides less guidance about how to self-regulate (Butler & Winne, 1995). Even if feedback is provided, literature shows that feedback interventions are often ineffective and have negative consequences, such as reduced performance (Kluger & Denisi, 1996). Feedback interventions only have positive effects if people react positively, which many process models suggest depends on factors such as the feedback environment, source creditability, and the perceived accuracy (Anseel et al., 2015; D. R. Ilgen et al., 1979; Kinicki et al., 2004). From an internal feedback perspective, self-evaluation grounds in different motives: (1) self-assessment (i.e., to increase accuracy of the self-evaluation), (2) self-improvement (i.e., to improve traits, abilities, and skills), (3) self-enhancement (i.e., to protect the self-concept from negative information and maximize the self-concept), and (4) self-verification (i.e., to maintain consistency between the self-concept and other self-related information) (Anseel et al., 2007). Both individual factors and situational factors influence the prevailing motive, e.g., a context with higher accountability increases self-assessment motives, while a higher publicity context increases the self-enhancement motive (Anseel et al., 2007). It is here where situational factors are increasingly being altered, since digitalization provides novel possibilities to enable feedback seeking privately with information technology that presents feedback such as performance statistics so that the cost of public feedback seeking can be prevented (Anseel, 2017). This applies to multiple of the identified domains, e.g., performance feedback (D3), community feedback (D4), educational feedback (D5), or feedback on everyday life (D6).

Bridging the Feedback Domains – Avenues for Future Research

Striving to bring the different streams of research together, possible intersections between the seven domains are now discussed and two avenues of future research are proposed.

First, our results show that information systems play a crucial role for computer-mediated and computer-generated feedback across all seven feedback domains. Against the backdrop of the ongoing digitalization, datafication and automation (Brynjolfsson & McAfee, 2014; Dremel, Stoeckli, Wulf, & Herrmann, 2018; Faraj et al., 2018; Markus, 2017), two questions become apparent for each feedback domain: (1) How does the underlying phenomenon change (e.g., behavior, task)? and (2) how does the corresponding feedback mechanism change? On the one hand, research is needed to answer these two questions for each of the seven domains. On the other hand, scholars should, in the long term, try to create more generalizable knowledge across the seven feedback domains. For example, prescriptive knowledge on how to design digital feedback systems considering the different task characteristics. So far, it is very rare that feedback researchers acknowledge the theoretical importance of different task characteristics (Kluger & Denisi, 1996).

Second, an avenue for future research is to transfer knowledge in between the feedback domains. More specifically, the underlying goals of the seven feedback domains are as diverse as reducing information asymmetry and increasing trust in products and services (D1), improving performance of machines (D2) and humans (D3), motivating community contributions (D4), increasing learning (D5), changing everyday life behavior (D6) or improving task performance of system interactions (D7). As such, each article was assigned to one feedback domain based on the research purpose and the role feedback plays in the corresponding article. Though the emergent seven feedback domains are coherent and center on particular uses of the feedback concept, feedback at the very core can be seen as information on a particular phenomenon that is fed back to control a system (Narciss, 2008; Wiener, 1948). To bridge the feedback domains, the same information can be "fed back" to another system for which it is relevant. For example, implicit feedback derived from the tracks played by users of digital music platforms such as last.fm (Qi et al., 2013) can be viewed from different angles. Scholars could take a Domain 1 point of view and consider it as consumer and customer feedback on songs (i.e., product and service feedback). Alternatively, in a Domain 2 view the implicit feedback could serve as relevance feedback to improve the algorithmic performance of music recommendations. Adopting a singer's perspective, implicit feedback can serve as performance feedback as represented by Domain 3. Also, imagine a digital music platform allows song contributions from the community so that a Domain 4 view becomes useful, i.e., community feedback on voluntary contributed songs. From a Domain 7 perspective, scholars could regard digital music services as decision support systems that help users to decide on the music they listen to. Accordingly, future research can benefit from transferring knowledge between the feedback domains. In addition, this also applies to related fields of information systems research. For example, Domain 6 includes research that investigates how to design digital feedback systems in health, while Domain 7 includes research that examines how to design cognitive feedback to improve decision making. Both feedback intervention scenarios may facilitate behavior change. This, in turn, bears similarities with adjacent fields of research such as nudging and persuasive systems (Mirsch, Lehrer, & Jung, 2017; Oinas-Kukkonen & Harjumaa, 2009; Weinmann, Schneider, & vom Brocke, 2016). Consequently, future research can benefit from linking knowledge from adjacent fields with knowledge from the individual feedback domains.

Conclusion

Feedback is and remains crucial to both human and machine learning and development. This literature review highlights seven different feedback domains in IS research: (1) product and service feedback, (2) machine performance feedback, (3) human performance feedback, (4) community contribution feedback, (5) educational feedback, (6) everyday life activity feedback, and (7) system (use) feedback.

However, the literature review also has some limitations. Selecting keywords and databases as well as excluding literature when conducting a systematic literature review commonly implies that the review is not completely inclusive. In particular, this research aimed at identifying a broad range of feedback domains in IS research to provide an overview of this fragmented and incoherent field. Given that the underlying concept of feedback is used for hundreds of years, reducing the search to a viable number of articles was indispensable. To do so, the focus was set on articles in which the concept of feedback is so relevant that authors decided to include the keyword "feedback" in their title.

Consequently, the paper offers an overview of seven relevant feedback domains within the field of information systems and elaborates on the roles that feedback plays in these domains. With this contribution, this article reduces complexity and builds a foundation for scholars to assess their feedback domain and inspires scholars to transfer knowledge in between these domains.

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Article III: Capturing Functional Affordances of Enterprise Social Software

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Abstract

Over the last decade, a plethora of Enterprise Social Software (ESS) has emerged in various shapes, yet difficult to compare what they enable or constrain their users to do. Neither the prior frameworks nor the ambiguous concepts shed light on the fine-granular similarities and differences among them. In particular, organizations can consciously design and adjust their ESS artifacts. Hence, it is relevant to assess the possibilities for goal-oriented action they offer and spot the differences among them. Following a structured method, we identify eight distinct dimensions with subordinate characteristics that enable the classification of functional affordances of ESS. This paper presents the resulting taxonomy that has been built and evaluated over six iterations. We contribute to practice by supporting practitioners to assess ESS, inspire the innovation of existing ESS and the development of future ESS. Furthermore, we build a foundation for future research to systematically develop and investigate ESS.

Keywords

Enterprise Social Software, Enterprise Social Media, Enterprise Social Network, Taxonomy, Affordance.

Introduction

Today, billions of people are using numerous forms of social software to interact with friends, co-workers and acquaintances. Connecting with people and sharing content has become relatively easy. Despite this, social software continues to evolve (Kim et al. 2010). Besides the impressive growth of consumer-facing social software, various types of Enterprise Social Software (ESS) have been introduced, e.g., over 90% of Fortune 500 companies implement enterprise social networks (Lee et al. 2013). From that, productivity increases of up to 25% and annual contributions of $1.3 trillion are expected (Chui et al. 2012). ESS is profoundly changing the capabilities of employees in terms of communicating and collaborating (Aral et al. 2013; Herzog et al. 2015). Grounded at the core of digital technologies, ESS facilitates, mediates and enables digital interactions (Sundararajan et al. 2013). In turn, digital networks become ubiquitous (Yoo 2010). While traditional relationships, informal and formal, are often represented in these emerging digital networks, a multitude of new ways to be related emerge, e.g., networks emerge from people sharing or tagging the same resource (Trier and Richter 2015). Thus, expertise can be identified and knowledge can be memorized (Kane 2015). ESS plays an important role in how people form new relationships (e.g., by making connections of connections visible) and influencing how the content is consumed (e.g., by recommending the content of peers) (Aral et al. 2013).

However, the value of ESS is not determined by its design. Instead, it is determined by how it is harnessed for value creation (Majchrzak et al. 2009). Accordingly, appropriating ESS may lead to positive effects, such as the positive influence of connectedness on the performance of employees that has been corroborated empirically (Kügler et al. 2015), and negative effects, such as social overload (Waizenegger et al. 2016). Nevertheless, the conscious (or unconscious) design of ESS allows and constrains certain interactions. More specifically, it builds the causal potential upon which value is created through an eventual actualization by users (Bernhard et al. 2013). In contrast to public social software, organizations have the power to adjust, customize and extend their ESS, namely to shape their ESS artifacts in terms of their features and goal-oriented action potentials they offer to their users (i.e., their functional affordances). Consequently, we pose the following research question

RQ: What are relevant dimensions and characteristics to describe functional affordances of ESS?

Providing scholars and practitioners with a set of relevant dimensions (e.g., the type of action) and the corresponding characteristics (e.g., share), enables them to assess ESS, inspire the innovation of existing ESS and the development of future ESS. We achieve this by building a classification model, namely a representation of how things are (March and Smith 1995). More specifically, classification models are well-known in providing a premier descriptive tool to reveal different types and enable a side-by-side comparison of types (Bailey 1994). They reduce complexity and facilitate the identification of similarities and differences (Nickerson et al. 2009). Thus, it is a valuable tool to compare ESS, in terms of their functional affordances, and to identify the corresponding similarities and differences among them. This prevents researchers and practitioners from being lulled into a false sense of (dis-)similarity. The problem's significance is the ever-increasing diversity of ESS features and the new dynamics of digital platforms. Being able to classify functional affordances of ESS is relevant for practitioners who deal with a set of ESS systems, as it is crucial for them to gain an overview of their ESS systems and their possibly overlapping feature sets.

Prior research is lacking in in three major areas. First, the existing body of research only focuses on coarse-grained means to assess ESS. For instance, Kim et al. (2010) breaks down social websites into eight essential features (e.g., personal profiles, establishing connections, participating in groups, sharing content). Against the backdrop of the variety of ESS, most of the proposed high-level features are omnipresent and do not reveal the similarities and differences among ESS artifacts. This is especially crucial in the organizational context, where multiple systems are often used in parallel and employees constantly and consistently compare affordances and constraints between systems (Glowalla et al. 2014). An alternative way to classify ESS is based on the dimensions of information management, identity and network management and communication (Koch 2008). Kaplan and Haenlein (2010) distinguish between self-disclosure and social presence. From an affordance point-of-view, Treem and Leonardi (2012) propose visibility, persistence, editability, and association. In fact, the available means of classification are coarse-grained, focused on platforms as a whole and do not allow for a comparison of individual functional affordances.

Second, a common shortcoming of prior IS research is the lack of theorizing the underlying information technology (IT) artifact (Benbasat and Zmud 2003; Orlikowski and Iacono 2001). Taking IT artifacts, such as multi-purpose ESS, for granted limits the ability to understand the possible implications of the design of artifacts (Orlikowski and Iacono 2001). Prior research places emphasis on multi-purpose ESS. Today, the functionality of IT artifacts increasingly grows dynamically as a result of their openness (e.g., through application programming interfaces) and extensibility (e.g., through possibilities to develop and leverage add-ons) (Um and Yoo 2016). Given the ever-increasing diversity of ESS unleashed by this generativity, high-level comparisons of feature bundles (e.g., blog, wiki) are losing their significance. Hence, diving deeper and breaking down ESS into individual functional affordances seems fruitful.

Third, prior research has fabricated a significant ambiguity of interchangeable terms, which detract from a structured assessment, e.g., ESS (Kügler et al. 2015), Enterprise Social Media (Leonardi et al. 2013), Enterprise Social Network (Behrendt et al. 2014), Social Business (Kiron et al. 2013) or Enterprise 2.0 (McAfee 2006). Hence, it is a difficult endeavor to describe social technologies without using these buzzwords. And due to the blurring distinctions among them, it is difficult to study the phenomenon as a such.

In the following section, we outline the concept of ESS and the theory of affordances as theoretical foundation. Next, the methodology is described, and then, the results and possible usage scenarios are illustrated. Finally, the article ends with a conclusion, limitations and recommendations for future work.

Research Background

Enterprise Social Software (ESS)

Continuously authoring and sharing content in a participatory and collaborative way is referred to as Web 2.0 (Kaplan and Haenlein 2010). Social Software builds on that notion and amplifies the social capabilities of social entities by affording a set of interaction possibilities, leading to emergent digital networks (Hatzipanagos 2009). Forming communities and sharing user-generated content are said to be the core of social features (Kim et al. 2010). Within the narrowed scope of ESS, we consider the term enterprise as a restriction of possible users to those belonging to a particular organization (e.g., internal employees, external co-workers).

In contrast to traditional enterprise systems (e.g., groupware), social software is: (1) more user-centric than group oriented, (2) takes a bottom-up perspective of voluntary participation, instead of top-down enforcements, (3) is about co-evolving conventions, rather than determined ways of working together, and (4) is available beyond the project limitations (Koch 2008). Furthermore, ESS is often open to various use contexts, which is referred to as malleability (Richter and Riemer 2013).

Functional Affordances as the Theoretical Lens

Originated in ecological psychology, the theory of affordances emphasizes that animals perceive the opportunities that objects in their environment offer to them (Gibson 1977). In IS research, the concept of functional affordances is widely adopted to refer to the "possibilities for goal-oriented action afforded to specified user groups by technical objects" (Markus and Silver 2008, p.622). Although our main focus lies on the ESS artifact, we draw on the relational concept of functional affordances for several reasons.

First, functional affordances are objective, i.e., they exist without being perceived, and valued by a user in terms of meaning and interpretation, and they are subjective, as a specified user group is required "as a frame of reference" (Pozzi et al. 2014, p.2). In line with our goal to enable the structured assessment of ESS, the point of reference is the group of users with access to the investigated ESS. Scholars and practitioners that use our classification model are then able to describe the causal potential of their ESS artifacts, while taking into account the complex relationship between the ESS artifact and the user.

Second, the interplay between the social structure within technology and the social structure within action is a central and controversial issue in IS research, because they are continually intertwined and each shapes the other (DeSanctis and Poole 1994; Markus and Silver 2008). ESS artefacts entail social structures, which enable and constrain certain interactions by manifesting rules (e.g., possibilities to react to the existing content) and resources (e.g. possibilities to store and assessing the information) (DeSanctis and Poole 1994). As technology is used in context, social structure is brought into action, leading to an instantiation in social life (DeSanctis and Poole 1994).

By drawing on affordances, we emphasize both. This is useful when building a classification model, as it underlines the non-deterministic nature of IT effects to the users of the model (Bernhard et al. 2013). In addition, functional affordances prevent the problem of repeating decomposition, which is the case when theorizing the features of IT artifacts (Markus and Silver 2008).

Research Methodology

Grounded in design science research, we aim at creating a taxonomy (Hevner et al. 2004). A taxonomy was chosen, among other types of classification (e.g., typologies, morphological boxes), due to the empirical nature of the entities to classify (Bailey 1994). Namely, action potentials afforded by ESS artifacts to its users. Taxonomies bring order into complex areas and create a research foundation to describe the phenomenon of interest (Nickerson et al. 2013). Therefore, we follow the rigorous and structured IS taxonomy development method of Nickerson et al. (2013). By considering a taxonomy to be a set of mutually exclusive dimensions and collectively exhaustive characteristics, each object of interest (i.e., an action potential offered by an ESS artifact to its users) has exactly one characteristic for each dimension (Nickerson et al. 2013). The iterative nature of the approach leads to a continuous evaluation and respective adjustment of the dimensions and characteristics. First, a clear purpose and ending conditions are defined. Then, Nickerson et al. (2013) suggests conducting inductive empirical-to-conceptual and deductive conceptual-to-empirical iterations. In the case of the former, dimensions and characteristics are derived from empirical data, while the latter identifies significant domain knowledge.

Meta-Characteristics and Ending Conditions

According to Nickerson et al. (2013), the core of taxonomy development lies in defining so-called meta-characteristics based on the purpose, which, in turn, follows the expected use of the taxonomy. The intended users of this taxonomy are people assessing existing or designing novel ESS artifacts for organizations, e.g., community managers or corresponding decision makers.

The taxonomy is intended to be used in two ways. First, as a tool to assess the functional affordances of a given ESS artifact to a specified group of users by classifying the action potential offered to them. Second, as a source of inspiration during the design and development of ESS features. Consequently, the purpose of our taxonomy is to classify the possibilities for goal-oriented action that ESS artifacts afford to their users.

The corresponding meta-characteristics are: (1) the action potential offered by the artifact to its users, (2) the content that is eventually affected by the action, and (3) the context diversity. The objective and subjective ending conditions have been adopted from Nickerson et al. (2013). Objectively, the taxonomy has to consist of dimensions, each with mutually exclusive and collectively exhaustive characteristics that must not have been changed during the last iteration. Subjectively, the taxonomy has to be concise, robust, comprehensive, extendible, and explanatory.

Build and Evaluate Iterations

We followed a structured and iterative approach (Table 12). Continuous cycles of building (i.e., to collect and alter the dimensions and characteristics of the emerging artifact) and evaluating (i.e., to apply the taxonomy to the latest list of functional affordances) were repeated until all ending-conditions were fulfilled.

Iteration	Research Design	Approach
#1	Literature review	conceptual-to-empirical
#2	Classifying 3 existing ESS	empirical-to-conceptual
#3	6 explorative interviews	empirical-to-conceptual
#4	2 expert interviews	empirical-to-conceptual
#5	Focus group with 3 researchers	empirical-to-conceptual
#6	Innovation project with a novel ESS	empirical-to-conceptual

Table 12. Overview of the Taxonomy Development Iterations

To build upon the existing means of classification, we started with a conceptual-to-empirical iteration in March of 2016. This involved a structured literature review (Webster and Watson 2002) using the following scholarly databases: ProQuest, AISEL, Emerald, Science Direct and Web of Science. Specifically, we searched with keywords that represent ESS (i.e., “Enterprise/ Corporate/ Organizational”, “Social/ 2.0”, “Network/ Media/ Software/ System/ Site/ Platform”) together with keywords related to our meta-characteristics (e.g., affordances, activities, action, opportunities, use cases) or means of classification (e.g., framework, typology, taxonomy). We read the titles and abstracts of the initial results and included articles for further investigation if comprising potential dimensions and characteristics or enabling their derivation. In total, we obtained dimensions and characteristics from a set of 33 articles. If possible, we collected concrete dimensions and characteristics (e.g., the action types view, create, update, delete, share from Rosenberger et al. (2015)). In order to build on coarse-grained classifications, we derived dimensions and characteristics for each meta-characteristic (e.g., the action type *to establish* and the content type *connection* from the essential feature *establishing online connections* proposed by Kim et al. (2010)).

In Iteration 2, we cooperated with one of the largest insurance corporations to assess the functional affordances of their existing ESS (i.e., their customized Jive, the social features of GitHub for Enterprise and Atlassian Confluence). Therefore, we utilized the initial version of the taxonomy that resulted from Iteration 1. While classifying the objects of interest, we added novel dimensions and characteristics based on empirical evidence, resulting in an updated version of the taxonomy.

For Iteration 3, an explorative qualitative research design was chosen. A set of open questions were asked to probe what ESS affords to them, to explore relevant dimensions and to identify relevant objects of interest for subsequent classification. Striving to gain insight from different stakeholders, we selected interviewees (users of ESS) such that half of them works in an innovation field (Innovation Architect, Chief Scientific Officer, Software Engineer in a startup) and half of them work for a large insurance company.

Iterations 4 and 5 were aimed at verifying the relevance and clarity of the dimensions and characteristics (e.g., instead of distinguishing the level of self-disclosure in terms of low and high (Kaplan and Haenlein 2010), clear characteristics were elaborated). In addition, we evaluated how well the artefact performs not only in classifying existing ESS artifacts but also brainstorming novel ESS features. At this point, we applied the taxonomy together with the experts and in a focus group (Morgen 1996).

Iteration 6 followed the calls to consider the applications that may be forthcoming (Kaplan and Haenlein 2010) and to build extendible taxonomies (Nickerson et al. 2013). In line with our objective to inspire the design of future ESS features, we decided to include empirical observations from innovation projects as an additional empirical-to-conceptual iteration. Over nine months, four project teams (four graduate students each) cooperated with companies from different industries (pharmaceutical, insurance, telecommunication and software industry). Due to the user-centered approach applied in the projects, we hope to capture potential future characteristics by considering multiple sources of evidence (Yin 2008), i.e., documentations and qualitative interviews. In one of the innovation projects, a novel ESS artifact was designed (i.e., an ESS that enables micro feedback) and served as an additional source to evaluate the taxonomy by classifying the corresponding objects of interest.

Results

We now present the resulting taxonomy, at a glance, in Figure 5, prior to elaborating on how each dimension emerged from the six iterations described in the previous section.

Dimensions Related to the Offered Action Potential

Dimension 1 - Type of action potential: A fundamental factor that constitutes an action potential is its type of action. Iteration 1 revealed the action types view, create, update, share and delete (Rosenberger et al. 2015) and the high-level distinction between consumption, participation and production (Heinonen 2011). We adopted the former fine-granular characteristics, because they reveal concrete action possibilities. In addition, we acknowledge the possibility of the search and request of content. While these characteristics were initially included in Iteration 1 (McAfee 2006), the subsequent iterations underlined their relevance (e.g., to classify features designed to request various types of user-generated content such as micro feedback in Iteration 6). Grounded in the empirical evidence from Iteration 2, we added the characteristic “build on”, which arose from ESS that enables their users to build on others user’s content (e.g., template features and the fork feature on GitHub for Enterprise). In contrast to sharing, the focus lies on starting to work on a copy of someone else's work, while sharing allows for the facilitation of propagation.

Dimensions		Characteristics							
Action Potential	D1. Type of Action	C1.1 View	C1.2 Search	C1.3 Request	C1.4 Create	C1.5 Update	C1.6 Share	C1.7 Delete	C1.8 Build on
Action Potential	D2. Actualization Constraints	C2.1 None	C2.2 Time	C2.3 Space	C2.4 Quantity	C2.5 Mixed			
Action Potential	D3. Actualization Disclosure	C3.1 Undisclosed	C3.2 Anonymous Disclosure	C3.3 Disclosure of User Attributes	C3.4 Disclosure of Identify	C3.5 Configurable			
Action Potential	D4. Interaction Scope	C4.1 Oneself	C4.2 Individual	C4.3 Group	C4.4 Organization				
Content	D5. Type of Content	C5.1 Profile	C5.2 Group / Community	C5.3 First-Order Relationship	C5.4 Second-Order Relationship (Reaction)	C5.5 User-Generated Content	C5.6 Platform Extension		
Content	D6. Granularity	C6.1 Individual	C6.2 Multiple	C6.3 Aggregated					
Context Diversity	D7. Malleability	C7.1 General-Purpose	C7.2 Purpose-Specific						
Context Diversity	D8. Adaptability	C8.1 None	C8.2 To Configuration	C8.3 To Social Data	C8.4 To User Context				

Figure 5. A Taxonomy to Classify the Functional Affordances of ESS.

Dimension 2 - Actualization constraints: Striving to compare ESS features, we found that the differences often manifested themselves in the systematic constraints of the facilitated action potential. Many limitations, bound to time and space, disappeared in digital artifacts (Yoo 2010). In Iterations 3 and 4, it was mentioned that the possibility of constant social connectivity, however, might be limited by design (e.g., by limiting the actualization of an action potential in time or space). While, others have distinguished between the interactions that take place synchronously or asynchronously, we do not dedicate a dimension to this aspect. Instead, we look at it as a potential action constraint, because real-time response is often supported, but not required (Kim et al. 2010). For example, Slack can be used to synchronously and asynchronously, depending on the appropriation. With time constraints, a well-known consumer example is

Snapchat, which limits the time users can view photos. Relating to the enterprise context, Iteration 6 yielded ESS features that are limited to regular working hours to encourage recreation. Besides constraints in time and space, Iteration 1 revealed that the possibilities for action are often limited in quantity, e.g., Facebook constraints users to add 5’000 friends (Kane 2015).

Dimension 3 - Actualization disclosure: Derived from Iteration 1, we started to distinguish people-focused from activity-focused action potentials (Keenan and Shiri 2009). Iteration 5 revealed disagreements and ambiguity in deciding on what to call people-focused. Therefore, we put the stress on the level of self-disclosure (Kaplan and Haenlein 2010), i.e., to what extent an eventual actualization of an action potential is disclosed. Anchored in the descriptive nature of taxonomies, we specified clear characteristics within the focus group of Iteration 5. Undisclosed means that it remains invisible that a certain action was conducted (e.g., that the content was viewed). Anonymous disclosure implies that the actualization is visible, but without association to the identity of the user (e.g., “someone has updated”). Also, in some cases, the attributes instead of the identity are disclosed (e.g., “someone with job title Software Engineer”). Identity connotes that the full name, username, or similar is disclosed (e.g., “Max posted article X”). In the case of configurable disclosure, actualizing users may determine the level of self-disclosure.

Dimension 4 - Interaction scope: As represented in definitions of ESS (e.g., Kügler et al. 2015), Iteration 1 pointed out that ESS may facilitate interactions between individual co-workers or groups of co-workers. It may also enable the broadcast of content within the whole organization. More specifically, interactions may occur one-to-one, one-to-few, one-to-many or many-to-many from a dyadic point of view. In Iteration 5, we renamed these characteristics to fit our individual action possibility perspective (i.e., a user may view content from oneself, from an individual person, from a group of persons or from many persons).

Dimensions Related to the Content

Dimension 5 - Type of content: At the core of ESS, and thus, relatively stable throughout the iterations, is the possibility of exchanging user-generated content (e.g., article, event) and reactions to suchlike (e.g., likes, emoji’s, ratings, votes, comments to these objects) (Behrendt et al. 2014). Enterprise Social Networks are especially known to allow the exchange of profile information and the ability to connect with other users (Behrendt et al. 2014). Derived thereof, and from the building blocks of Kietzmann et al. (2011), the object types of Rosenberger et al. (2015), the affordances proposed by Treem and Leonardi (2012) and the components of McAfee (2006), we included the content types of profile, group, relationships, reactions, user-generated content in Iteration 1. While social ties are labeled as a first-order relationship, digital networks may also emerge from the reactions to the content, which we refer to as a second-order relationship (Yoo 2010). ESS might offer the potential to make these visible. Groups enable users to establish and manage communities. Originating from Iteration 3 and 4, we additionally consider the extensibility of platforms (McAfee 2006). This allows for covering action potentials related to the extension and modification of the ESS artifacts, e.g., the possibility to share Yammer apps and Slack integrations.

Dimension 6 - Granularity of content: While classifying the functional affordances of ESS in Iteration 2, it became evident that the content may be exchanged in various levels of granularity (e.g., an ESS may offer the possibility to view an individual, a list of multiple individuals, or aggregated content postings). In fact, aggregation potentials are key to turn private judgments into collective wisdom (Surowiecki 2005).

Dimensions Related to the Context Diversity

Dimension 7 - Malleability: The existing body of literature differs malleable from purpose-specific software (Richter and Riemer 2013), general-purpose from vertical software (Kim et al. 2010) and infrastructure from tools (Riemer 2012). While ESS, as a whole, are widely considered malleable, our unit of analysis is an individual functional affordance. When classifying suchlike, the question arises as to what extent the offered action potential implies a particular form of usage (e.g., the potential to create a CRM entry directly from ESS, as offered by Jive plugins, is purpose-specific). Therefore, the distinction between possibilities of goal-oriented action that are general-purpose and purpose-specific has proven to be relevant in Iteration 2 and in the subsequent iterations, e.g., to classify the purpose-specific possibilities to react to content.

Dimension 8 - Adaptability: Iterations 3 and 4 underlined the need to differ the extent an ESS feature adapts to the considered user (e.g., is the way a user is enabled to create content fixed or does it adapt to the context of an employee?). Therefore, we differ adaptability in terms of the following characteristics that emerged empirically: adapting statically to configurations (e.g., user preferences), dynamically to social data (e.g., social graph, social text), and dynamically to the user context (e.g., situation of an employee). This is in line with literature that points out ESS data types (e.g., Behrendt et al. 2014; Vatrapu et al. 2015). For example, social data according to Vatrapu et al.

(2015) includes social graph data (e.g., the actors involved, actions they take, activities they undertake, and artifacts they create and interact with) and social text data (e.g., the topics discussed, keywords mentioned, pronouns used and sentiments expressed). Moreover, adapting to the user context reflects possible gradations from segmentation to personalization (Albert et al. 2004) and the context-awareness of ESS features, e.g., by actively adapting to the context automatically or by passively offering appropriate options based on the context (Barkhuus and Dey 2003).

Usage Scenarios

As of the last iteration, the proposed taxonomy satisfies all objective and subjective ending conditions. By continuously applying the taxonomy, it has proven to be robust, but yet still provide scope for future extensions. Specifically, after each iteration, we classified all objects of interest collected up to that point (i.e., a list of functional affordances of the considered ESS). Throughout the iterations, we resolved the trade-offs between the comprehensiveness and conciseness by iteratively adjusting the number of dimensions and characteristics, each being mutually exclusive and collectively exhaustive. The ultimate taxonomy has enough dimensions and characteristics to clearly differentiate between the ESS features, but is still manageable and presentable at a glance (Figure 5). Finally, applying and evaluating the taxonomy with experts and within a focus group further improved and corroborated its distinctiveness, conciseness, robustness, comprehensiveness and extendibility. The proposed taxonomy has proven to describe the possibilities for goal-oriented action that ESS artifacts afford to their users in a rich and explanatory way.

The usefulness of the proposed taxonomy is illustrated with two usage scenarios that emerged from applying the taxonomy together with experts (Iteration 4), within the focus group (Iteration 5) and the innovation project (Iteration 6).

Usage Scenario 1: Classifying an individual possibility for goal-oriented action that an ESS artifact affords to a particular user group. As illustrated with the gray-colored cells in Figure 5, an individual functional affordance can be described by means of assigning exactly one characteristic to each dimension.

Usage Scenario 2: Brainstorming novel ESS features by selecting two dimensions (Figure 6). It has proven to be useful, but not necessary, to cross meta-characteristics when selecting the first two dimensions. In particular, the type of content (Dimension 5) and the malleability (Dimension 7) turned out to be useful dimensions to start a brainstorming process of possible ESS features (e.g., one element might be a general-purpose status posting). The types of action potentials afforded to a specified user group (Dimension 1) can then be brainstormed for each element (e.g., an ESS may afford an employee to create a general-purpose status posting). Finally, the remaining dimensions can be subsequently used for classification purposes.

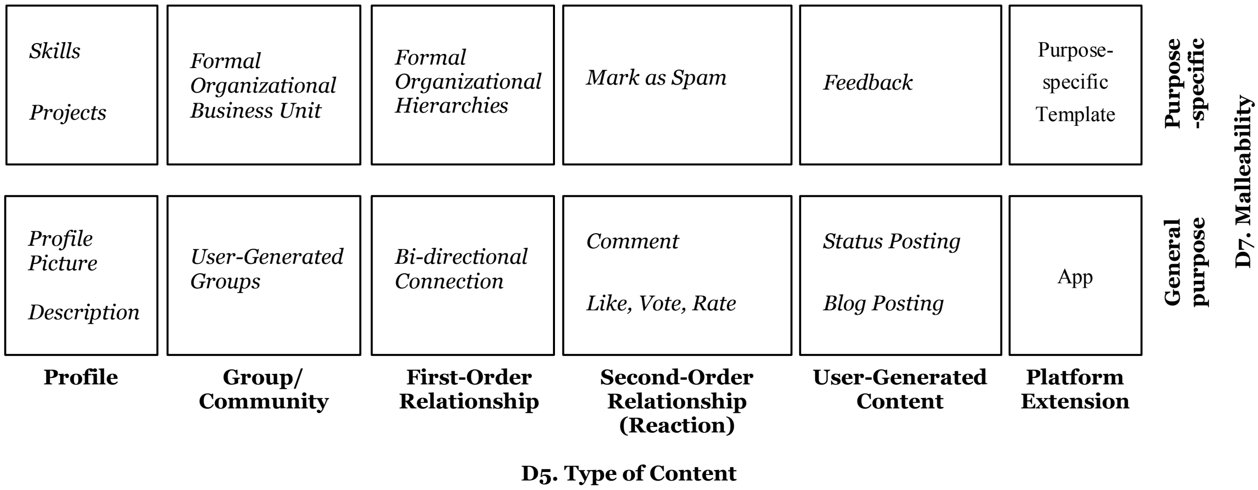

Figure 6. Exemplary Utilization of the Taxonomy to Brainstorm ESS Features

Conclusion, Limitations and Future Work

This paper reports on the iterative development and evaluation of a taxonomy that enables scholars and practitioners to classify functional affordances of ESS, i.e., possibilities for goal-oriented action that ESS artifacts afford to their users. To answer the research question, eight dimensions with subordinate characteristics are proposed to describe the phenomenon of interest. A possibility for goal-oriented action that an ESS artifact affords to their users can be characterized by: (1) the type of action it enables, (2) how the actualization of this action potential is constrained, (3) its level of self-disclosure, (4) its interaction scope, (5-6) the type and the granularity of the content that is exchanged and (7-8) the context specificity and adaptability. Throughout six iterations, different sources of evidence with objects of interest from different industries were collected and classified.

By taking a more fine-grained view of ESS, we hope to provide researchers and practitioners with a better understanding of the diverse action possibilities of ESS and build a foundation for the systematic assessment, maintenance and development of ESS. We make a valuable contribution for practitioners who deal with a broad set of ESS systems. They can use the taxonomy to assess and compare different types of ESS side-by-side and detect the possibly overlapping and missing features. This will assist practitioners in the procurement, implementation and maintenance related to ESS. The taxonomy also serves as a basis and inspires the design of future ESS features.

Contributions to the theoretical body of knowledge occur in several ways. First, the taxonomy will help as a structuring element that contributes to a systematic understanding of what ESS enables their users to do. On the one hand, this can serve as a foundation to derive design principles. On the other hand, the fine-granular means of classification reveals the diversity of available ESS features, which seems to be more and more important with the advent of digital platforms. Second, to the best of our knowledge, this work is the first to include empirical observations from innovation projects concerned with the design of future objects of interest in a separate empirical-to-conceptual iteration. This can be seen as a novel way of applying the taxonomy development method of Nickerson et al. (2013), which may inspire other scholars. Third, scholars may build on the proposed taxonomy when developing similar taxonomies.

Contingent on the qualitative and interpretive nature of the empirical-to-conceptual iterations, exhaustiveness cannot be ensured. In spite of the inclusion of novel objects of interest, ESS is continuously evolving and might demand an extension of the taxonomy in the future. With reference to the conceptual-to-empirical approach, the literature review is characterized as non-exhaustive. This paper strives to classify action-related possibilities that ESS afford to its users. Alternate lenses to assess ESS features were analyzed at a lesser level of detail (e.g., privacy rights).

Future research should identify the differences among ESS artifacts and the various customizations of the same ESS across organizations and industries. It might also be beneficial to investigate how certain action possibilities of one ESS could be adapted to others (e.g., is it useful to map the fork feature from GitHub to other ESS?). Another direction of future research that we recommend is to investigate what and why theoretically possible types do not occur empirically. This may lead to interesting combinations of features.

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Article IV: Affordances and Constraints of a Feedback App

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Abstract

Little is known about how digital work shapes the exchange of performance feedback, even though today's digital and global world demands for more continuous feedback than annual reviews. This research investigates a feedback app in a naturalistic context within a globally leading financial service corporation (InsurCorp). Drawing on malleability and voluntary participation, the app offers possibilities to send and request feedback between employees. Rich contextual insights from a multinational pilot study with 568 users are gained by triangulating qualitative data from 21 semi-structured interviews and 69 feedback app user reviews with usage data. Anchored in the theory of affordances, we provide insights on use practices and find that the app affords operational-level feedback exchange on specific subjects, while general feedback on sensitive topics is preferably exchanged in person. To understand actualization facilitators and barriers, we take a social-technical systems perspective to elaborate contextual factors that influence the individual's actualization decision.

Keywords

Performance Feedback, Digital Work, Affordance Theory.

Introduction

Exchanging performance-related feedback on work is key to ensure individual and organizational progress (Ashford & Tsui, 1991; Baker, Perreault, Reid, & Blanchard, 2013). Scholars and practitioners agree that the ongoing digitalization is changing the nature of work (Richter, Heinrich, Stocker, & Schwabe, 2018; Riemer, Schellhammer, & Meinert, 2018). Accordingly, the question arises how the rise of digital work is shaping the exchange of performance feedback (Durward, Blohm, & Leimeister, 2016; Richter et al., 2018; Riemer et al., 2018).

First, traditional performance management processes such as once-a-year goal settings, performance reviews and 360-degree feedback are losing their appropriateness for the twenty-first century. They are typically long, lack in visible outcomes and are less valuable than conversations that take place in the moment of performance (Buckingham & Goodall, 2015; Levy, Tseng, Rosen, & Lueke, 2017). Accordingly, besides assessing the performance from a retro-perspective, there is a shift towards individualized real-time feedback that guides future action and facilitates improvement, training and development (Levy et al., 2017; Levy & Williams, 2004).

Second, in today's digital and globalized world, virtual, distributed and remote work settings demand for digital work tools (Bailey, Leonardi, & Barley, 2012; Mrass, Li, & Peters, 2017). In fact, the majority of knowledge workers relies on digital technologies (Durward et al., 2016; Richter et al., 2018; Riemer et al., 2018), e.g., 83 percent of employees in Germany use digital technologies at work (Arnold, Butschek, Steffes, & Müller, 2016). Accordingly, novel digital technologies not only offer opportunities for knowledge workers to perform work, but also to exchange feedback (Levy et al., 2017).

Prior research shows how motivation and productivity can be improved through altering the likelihood of receiving feedback (Kuhnen & Tymula, 2012), providing computer-generated feedback (Ang, Cummings, Straub, & Earley, 1993; Chen & Ross, 2005; Kluger & Denisi, 1996), providing real-time feedback on specific behavior (Tiefenbeck et al., 2016), and embedding feedback features into task-specific collaboration environments (Jung, Schneider, & Valacich, 2010). However, there is a lack of research that investigates novel digital work tools dedicated to facilitating performance feedback exchange between employees. Accordingly, calls for research emphasize the need to examine the use of technology for performance management (Levy et al., 2017) and to investigate digital work tools that support knowledge workers in their digital work environments (Mrass et al., 2017; Richter et al., 2018).

Against this backdrop, we adopt a case study research strategy to investigate a digital feedback app and its use in the context of a pilot project in a naturalistic workplace setting at the global financial service provider InsurCorp. While the action possibilities offered by the feedback app may be perceived as enabling as well as inhibiting to employees (i.e., perception of affordances and constraints), employees continuously decide how to realize value from using the app (i.e., actualization).

Therefore, we pose the following research question: *How is the perception and actualization of affordances and constraints from feedback apps affected by employees' individual use practices and organizational context factors?*

Accordingly, we adopt a sociomaterial perspective to acknowledge that "(1) all materiality is social in that it was created through social processes and it is interpreted and used in social contexts and (2) that all social action is possible because of some materiality" (Leonardi, 2012, p.10).

Theoretical Background

Performance Feedback in the Context of Digital Work

Sending and receiving feedback has become a key activity of knowledge workers to exchange information that relates to their performance and understanding (Hattie & Timperley, 2007; Reinhardt, Schmidt, Sloep, & Drachsler, 2011).

Traditional Performance Feedback. In this research, we focus on a particular form of feedback, that is, performance feedback. Drawing on prior research, we consider performance feedback as "dynamic communication process occurring between two individuals that convey information regarding the receiver's performance in the accomplishment of work-related tasks" (Baker et al., 2013, p.260). Thereby, literature distinguishes formal and informal feedback. The former denotes official and top-down enforced events (e.g., yearly goal setting, performance appraisal and 360-degree reviews) (Levy & Williams, 2004), whereas the latter describes feedback events that take place independent of formal mechanisms during day-to-day work (Farr, 1993). Opposed to formal events, informal events often have the advantage of being more timely and contingent on the situation of performance (Baker et al., 2013; Farr, 1993). This is important, because effective feedback is said to be timely (e.g., reducing feedback cycles), specific (e.g., related to a specific event/subject), relevant for the performer (e.g., enabling to request feedback), accurate, and easy to understand (Baker, 2010). Accordingly, work usually involves both formal and informal feedback exchange through feedback seeking and giving (Farr, 1993).

Digital Work Context. Work is increasingly characterized as digital work, i.e., “[an] effort to create digital goods or that makes substantial use of digital tools“ (Durward et al., 2016, p.283). Consequently, possibilities to assess performance and exchange feedback digitally rise. On the one hand, the work of blue-collar as well as white-collar workers can be recorded and analyzed (Chen & Ross, 2005). This enables the provisioning of computer-generated feedback, which is often preferred and more trusted by employees as it directs employees' attention to the task leading to higher performance (Ang et al., 1993; Chen & Ross, 2005; Kluger & Denisi, 1996). Similarly, the availability of performance information enables the provisioning of real-time feedback while engaging in a particular behavior, thus, causing larger shifts in behavior than aggregated feedback and reducing salience bias (Tiefenbeck et al., 2016). In fact, changing the likelihood of receiving feedback improves productivity (Kuhnen & Tymula, 2012). On the other hand, and aside from computer-generated feedback, feedback exchange between employees occurs digitally, i.e., computer-mediated feedback (Ang et al., 1993). Specifically, we focus on digital work tools that offer possibilities for employees to provide and seek feedback (Buckingham & Goodall, 2015; Cappelli & Tavis, 2016; Levy et al., 2017), rather than on platform-based digital work tools with embedded task-specific feedback mechanisms (Jung et al., 2010; Mrass et al., 2017). This is particularly relevant to understand and incorporate others' subjective judgments, e.g., for managers to assess their effectiveness (Ashford & Tsui, 1991). One particular type of instantiation are feedback apps, e.g., used by Amazon, Deloitte, GE, and IBM (Buckingham & Goodall, 2015; Cappelli & Tavis, 2016).

Feedback App. We regard feedback apps as digital work tools dedicated to providing employees with possibilities to exchange feedback in their day-to-day work (Levy et al., 2017). Similarly, social software creates interaction potentials for employees to exchange information (Aral & Walker, 2011). Conceptualizing feedback apps as social software emphasizes two key characteristics that inform our research. First, it is malleable and flexible, and hence, open to various yet unforeseen use contexts (Leonardi, 2011; Richter & Riemer, 2013). In fact, malleability and flexibility are crucial for digital work design, because “human workers have individual, diverging, and continuously changing needs” according which digital solutions need to be adopted (Richter et al., 2018, p.2). Second, it relies on voluntary participation and emphasizes bottom-up engagement instead of top down enforcement (Koch, 2008).

A Sociomaterial Perspective

Digital artifacts entail forms of physical and digital materiality, which is relevant to users and endures across time and place (Leonardi, 2012). However, to obtain meaning and effects from technological structures requires their enrollment in practices embedded in institutional contexts (Orlikowski & Barley, 2001), e.g., shared routines and hierarchies (Leonardi, 2011, 2012). Even though structure may endure across some time and place, neither technological nor social structures are fully stabilized and may change (Leonardi, 2011). In fact, they are interdependent in that "(1) all materiality is social in that it was created through social processes and it is interpreted and used in social contexts and (2) that all social action is possible because of some materiality" (Leonardi, 2012, p.10). A sociomaterial perspective acknowledges this interdependency and adopts "a relational middle ground between technological determinism and social constructivism" (Wang, Wang, & Tang, 2018, p.2).

Theory of Affordances as Theoretical Lens. Grounding this research in the affordance theory puts the emphasis on the perceived possibilities that objects offer to humans in a certain context (Gibson, 1977). Proposed in the domain of ecological psychology, the theory is widely adopted in IS research (Markus & Silver, 2008; Volkoff & Strong, 2017; Wang et al., 2018). Its relational nature proves to be useful as it theorizes both, the human and the technical aspects of IS. This guides our research to mutually investigate the properties of the IT artifact (i.e., a feedback app), and the goals and capabilities of the users (i.e., employees within InsurCorp). Thereby, three conceptual distinctions shape the present research: affordance emergence, perception and actualization (Wang et al., 2018).

First, affordance emergence describes goal-oriented action potentials that arise from the relation between a specified user and a specific IT artifact (Markus & Silver, 2008, p. 622). Affordances are real so that – in our case - the possibility to request feedback with an app exists whether or not a user perceives or exploits it (Gibson, 1977).

Second, affordance perception represents the recognition of action potentials. They may or may not be (mis-)perceived by a user. Both depends on factors such as available information (Bernhard, Recker, & Burton-Jones, 2013). Action possibilities offered by an IT artifact are not always enabling, but may also be constraining depending on the user's goals and capabilities (Leonardi, 2011; Orlikowski, 1992). This may trigger changes in technologies or in routines, which in turn, may lead to changed perceptions of affordances and constraints (Leonardi, 2011). For instance, the same artifact that once was perceived as enabling by a user, may suddenly be perceived as constraining, because the goals have changed or the use of the IT artifact showed that the goals cannot be achieved (Leonardi, 2011).

Third, affordance actualization describes the realization of actions potentials which, in turn, leads to effects. Technology simultaneously liberates and controls human action and is, thus, both constraining and affording to a certain extent; what dominates not only depends on the user, but also on the institutional context in which the user is situated and the technology is embedded (Orlikowski, 1992). Consequently, not only the emergence and perception, but also the decision to actualize affordances varies across contexts and depends on factors such as the expected outcome and the perceived efforts required for actualization (Bernhard et al., 2013). An artifact may provide employees with possibilities to fulfill their goals and they may perceive them, however, still they may decide to not actualize them. Employees compare affordances of novel IT artifacts with similar affordances that other IT artifacts in their context (Glowalla, Rosenkranz, & Sunyaev, 2014). Consequently, the actualization of affordances by individual employees not only depends on their goals and the artifact's materiality, but also on the organizational context in which an employee is situated and performs its daily work (Bernhard et al., 2013; Bygstad, Munkvold, & Volkoff, 2016; Glowalla et al., 2014; Y. Jung & Lyytinen, 2014; Leonardi, 2012; Orlikowski, 1992; Orlikowski & Barley, 2001; Volkoff & Strong, 2017).

Actualization as Socio-Technical Phenomena. Prior research relies on socio-technical systems (STS) theory to elaborate the sociotechnical conditions of affordance emergence and perception (Seidel, Recker, & vom Brocke, 2013) as well as organizational changes required to actualize organizational-level affordances (Dremel, Herterich, Wulf, & Brocke, 2018). Both, the investigated feedback app artifact and employees are embedded in an organizational work context.

Accordingly, we draw on STS theory (Bostrom & Heinen, 1977; Leavitt, 1965) and build on prior research (Dremel et al., 2018; Hester, 2014) to inform our investigation of the actualization process, because the alignment of the four STS components facilitates increased technology use, while gaps in alignment impede technology use (Hester, 2014). STS theory understands organizations as systems of actors, structures, tasks, and technologies (Bostrom & Heinen, 1977; Leavitt, 1965). More specifically, actors comprise people with qualifications (Leavitt, 1965). Structures refer to systems of communication, authority (e.g., roles), and work flow (Leavitt, 1965). Tasks represent the "raison d'être: the production of goods and services, including the large numbers of different but operationally meaningful subtasks that may exist in complex organizations" (Leavitt, 1965, p.1144). At last, technologies describe available means for problem-solving such as computers (Leavitt, 1965). Summarizing the above aspects, studying the actualization of affordances at the individual level requires a broad recognition of the socio-technical context of an organization that may stimulate the actualization of affordances in varies ways (Bygstad et al., 2016).

Research Design

Case Setting

Striving to contribute towards theory development on performance feedback in the context of digital work, we inductively gain rich empirical data (Corbin & Strauss, 1990; Eisenhardt, 1989) from a case study to investigate the phenomenon of interest in its real-world context (Yin, 2017). Namely, a pilot project introducing a feedback app into a global financial services corporation.

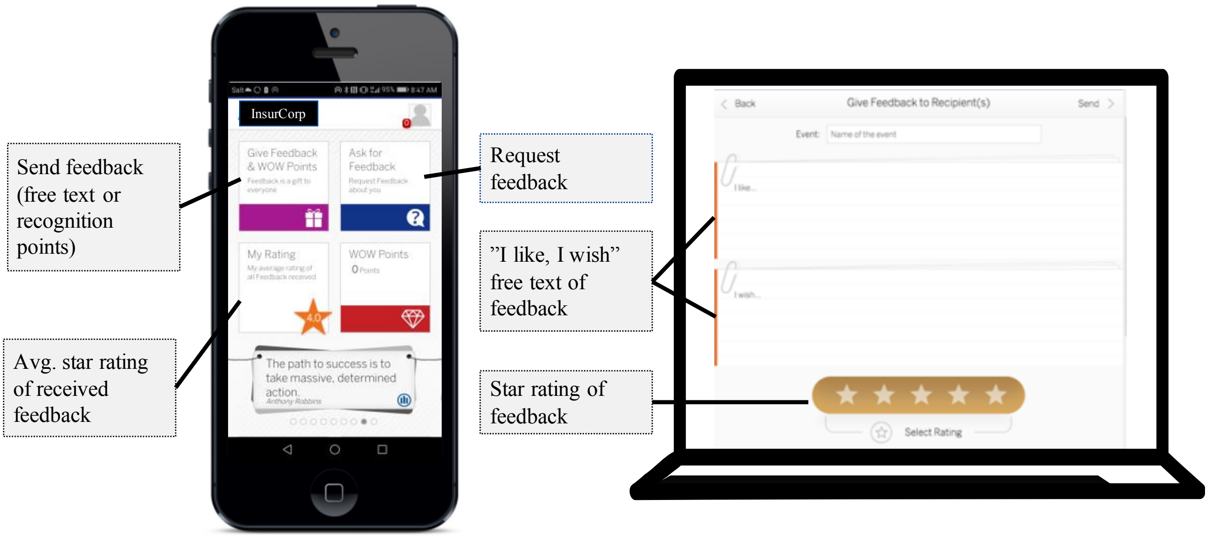

Figure 7. Screenshots of the feedback app on mobile (left) and desktop (right).

Social Setting. The pilot comprises 568 participants situated in a naturalistic work environment at InsurCorp, which employs between 100 and 150 thousand employees and operates globally in the fields of insurance and asset management. There are three key stakeholders. First, InsurCorp's technology provider in Germany runs the pilot and has the vision to transform InsurCorp into a digital group. Second, the global human resources (HR) entity finances the pilot. Accordingly, the project team consists of a project manager, a product owner, and an intern of the first two stakeholders. Third, different operational entities introduce the app. The recruitment process started by consciously selecting entities based on location and specialization. InsurCorp Germany, France and Morocco were selected as national companies running the core business. InsurCorp Technology in Germany and Singapore were selected to include technology-oriented companies. Investment Management, Communication and Corporate Responsibility, and Global HR were selected due to their international orientation. Next, the HR responsible of each entity invited employees to participate on a voluntary basis considering both executives and non-executives as well as males and females from various job roles and departments.

Technological Setting. The introduced artifact is a customized app dedicated to the exchange of feedback (see Figure 7). It has two key features: sending and requesting written feedback or points. Each feedback must follow the structure "I like, I wish" and is non-anonymous. All personal feedbacks are listed in an inbox and the app shows a ranking based on the quantity of exchanged feedbacks. The app is not available in the company app store but is a separate mobile web app accessible via URL. However, it is accessible from everywhere. Due to works council agreements and the limited number of licenses, registration is compulsory and follows a manual workflow.

Data Collection and Analysis

Data Collection. We obtained in-depth qualitative data based on four sources of evidence as well as limited quantitative usage data from an additional source (Table 14) (Yin, 2017). This suits well to address the sociomaterial and contextual research questions and given the various restrictions of the works council.

Data source	List of details and descriptive statistics
1. Qualitative interviews	21 semi-structured interviews with pilot participants (#1 to #21); 62% females / 38% males; 47.7% heavy users / 52.3% light users; 38% executives / 62% non-executives; from Jul. 2017 to Dec. 2017; between 18 and 51 minutes of transcribed recordings.
2. Feedback app user reviews	69 reviews as answers to feedback requests using the feedback app (#FR); Aug. 2017 to Dec. 2017; 48% females / 52% males; avg. of 119 characters "I like" & 145 characters "I wish" statements; avg. of 3.82 of 5 stars.
3. Status meetings	Weekly WebEx calls within the project team; from Jul. 2017 to Mar. 2018; between 30 and 60 minutes.
4. Verification within InsurCorp	Discussion of results with the project team (face-to-face and WebEx), the manager responsible for people sourcing and development (face-to-face), the OE managers (WebEx), and with InsurCorp consulting (WebEx).
5. Usage data	Aggregated transactional usage data restricted by works council.

Table 14. Multiple sources of evidence.

Similar to the recruitment of pilot participants, the interviewee recruitment process started by seeking names of pilot users from the HR responsible person of the individual entities. The goal was to cover executives and non-executives as well as heavy and light users (that used the app at least once) from varies functional and cultural backgrounds (see Table 14 and Table 15). Next, the first author contacted the interviewees directly.

Entities	Locations	Job roles (interview duration and type)
Technology Provider (6)	Germany (2), Singapore (4)	#1 Head of Central Function Platforms (34 min, f2f) #11 Intern (37min, phone) #6 Human Resources Services (18min, phone) #7 Asia Core Systems (46min, phone) #8 Asia Core Systems (39min, phone) #14 Head of Tech. Prov. Singapore (27min, phone)
Investment Management Alpha (4)	Germany (3), Hong Kong (1)	#2 Employee Experience (51min, f2f) #3 HR Systems Consultant (47min, f2f) #4 Head of HR Digital (45min, phone) #5 HR Solutions Specialist (14 min, phone)
Investment Management Beta (3)	Germany (3)	#9 Head of Fixed Income (27min, phone) #19 Chief Investment Officer (37min, f2f) #21 Asset Liability Manager (49min, phone)
Global HR (2)	Germany (2)	#10 Processes - HR Transformation (23min, phone) #20 Head of People Sourcing & Dev. (38min, phone)
Insurance Morocco (3)	Morocco (3)	#12 Head of Dev. & Engagement (36 min, phone), #13 Portfolio Manager (28min, phone) #15 Audit Intern (RB, 25min, phone)
Communication (3)	Germany (3)	#16 Jun. Communication Manager (26min, phone) #17 Internal Communications Officer (35min, f2f) #18 Project Manager (40min, f2f)

Table 15. Characteristics of interview partners per operational entity and location.

To further disclose the interview process, all interviews were conducted either in German or English depending on the native tongue of the interviewee to increase the expressiveness of their statements. The interview guide follows well-established guidelines (Schultze & Avital, 2011) and is grounded in the affordance theory. We started with questions to get to know the interviewees. Next, we focused on daily routines and work practices, since they "often oppose top-down specified production processes, and studying these processes creates a deeper understanding of individual needs" (Richter et al., 2018, p.4). Accordingly, we continued with open-ended questions to prompt how and why the feedback app is used (or not) in everyday work. Further questions ranged from today's action possibilities and benefits as well as constraints and disadvantages. We probed how these perceptions were influenced by their organizational context. Then, we shifted from today's use to changes over time and future use potentials. The interview guide was discussed within the project team and pre-tested in the first two interviews. We analyzed the data and requested feedback on the interview using the feedback app. The interviewees assessed the interview process with 4.5 out of 5 stars and stated: "I liked the questionnaire as it allowed for some deeper evaluation of the use and potential of the tool. I think this is the correct way to collect feedback about the app at this stage. You also managed to create a pleasant trustful atmosphere which makes it easy to speak openly".

Data Analysis. Following guidelines for qualitative research (Corbin & Strauss, 1990; Klein & Myers, 1999; Yin, 2017), data was iteratively collected and analyzed until a coherent picture emerged. We triangulated our sources of evidence in MAXQDA 12 (Yin, 2017) by adopting open, axial and selective coding (Corbin & Strauss, 1990). The unit of analysis are individual employees within their organizational context, thus, analyzing individual affordances and constraints, while applying replication logic across operational entities (Yin, 2017).

During open coding, codes were assigned inductively to condense the transcripts. Axial coding was based on our theoretical underpinning to code (1) properties of the app, (2) properties of pilot users (i.e., goals, capabilities and context), and (3) (mis-)perceived and (non-)actualized affordances as well as constraints.

During selective coding, we sharpened the connections between the affordances and constraints as well as the relations of the organizational context to the emerge-perception-actualization process. Drawing on related research (Dremel et al., 2018; Leonardi, 2012; Seidel et al., 2013), we extended the coding structure with the dimensions of socio-technical systems (Bostrom & Heinen, 1977; Leavitt, 1965) to elaborate factors of the organizational context in which an individual is situated.

In addition, we triangulated our qualitative insights with quantitative data. First, over six months, 6,2% of users engaged in 26 to 50 sessions, while 45,9% of users only had one session. Second, feedback exchange decreased over time. Given the first month is 100%, the number of exchanged feedbacks decreased as follows in the subsequent months 65%, 23%, 22%, 5% and 4%. Third, most feedback is associated with the best rating: 5 stars (57.6%), 4 stars (33.2%), 3 stars (5.9%) 2 stars (2.0%), 1 star (1.4%).

Results

Affordances and Constraints of the Feedback App

Due to its malleability, the feedback app is open for wide variety of feedback. In practice, however, we identify common use practices in the form of four use scenarios and five use trajectories that explain how employees perceive and actualize the feedback app as digital work tool to exchange feedback on concrete and operational activities, i.e. the first-order affordance.

Use Scenarios. First, the feedback app is used for onetime activities. For example, "I saw a presentation that I found particularly good, then I tried the app" (#7). Furthermore, the app was used to request feedback after meetings: "We did a lot of stuff around, we had a team offsite, I asked them [the participants] for their opinion on that." (#2). Aside from group meetings, the app is used for one-on-one meetings: "I simply sent the people a request to give feedback or after giving a presentation to my boss" (#7).

Second, use scenarios include recurring activities. For example, "we have a weekly call for [team name]. So, I asked 'how do you like the weekly call?' [and] 'is it useful at all?'" (#3).

Third, feedback is exchanged upon phase changes such as delivering projects, completing milestones, or finishing the first week at work. For instance, "when we delivered a project, then, of the four or five people working together, I would give some feedback to each of them" (#2).

Fourth, the app is used to acknowledge desired behavior. "When something has been quite amazing, […], you say 'that was good. that's quite nice'. You just want to give a little pat on the back." (#17). Lastly, it was used to say thanks, e.g., "[to my manager for being] very calm and supportive and really helping me to be constructive" (#2).

Use Trajectories. Our results reveal how employees take up five trajectories of use. The first two use scenarios are rather typical (cf., Path 1-2 in Figure 8), while the three additional trajectories show how employees continuously navigate between physical and digital spaces to perform work and exchange feedback (cf., Path 3-5 in Figure 8).

First, employees exchange feedback on digitally performed work (e.g., a WebEx call).

Second, the app is used for offline performed work (e.g., presentations) by either requesting feedback from colleagues or providing unsolicited feedback.

Third, employees refer to the feedback app in conversations: "I don't think I have done it [i.e., requesting feedback] by sending it from the app, but I rather asked them directly. More when we are in the dialogue… like you put in an additional sentence… is there any feedback feel free to use the feedback app" (#2). Accordingly, the app is not used until a colleague decides to actually send feedback.

Fourth, even if feedback is exchanged in person, additional feedback may be exchanged afterwards. For instance, "yesterday we had a meeting with all the team leaders and there were some who had a comment or an idea after the meeting, […], you can do that via the feedback app." (#1). Fifth, employees assess if they make progress on the feedback that they received in person: "I had received feedback in different one-on-one discussions that I was trying to action, […], and so I asked some of them if I was moving the needle at all on that." (#3).

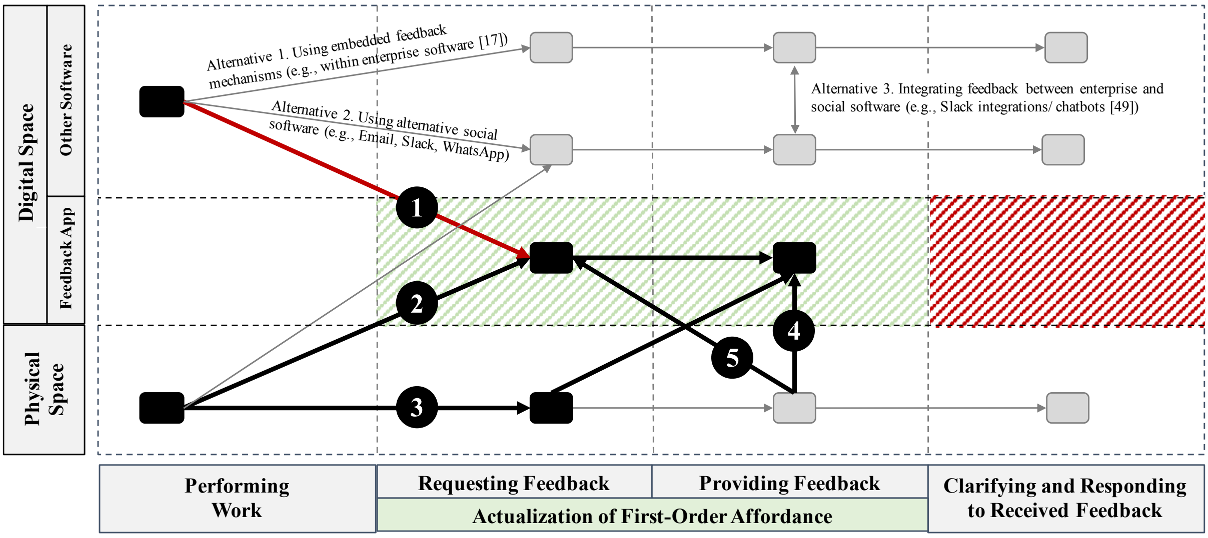

Figure 8. Trajectories (black) of actualization (green), alternatives (gray) and constraints (red).

First-order Constraints. First, constraints emerged from a lack of integration of the feedback app with other enterprise software (e.g., WebEx, Microsoft Outlook). Employees perceived high media change efforts compared to alternative means to exchange feedback (see the red arrow in Figure 8), while the richness of the mediated feedback was limiting. For example, employees expressed additional needs: "Can the app record snippets of a WebEx presentation?" (#FR).

Second, employees perceived constraints from the limited possibilities to see who is registered and the impossibility to send feedback to non-registered co-worker. One employee explained: "I haven't used the app very much so far, since it is not very transparent who of my colleagues has signed up for the pilot phase" (#FR). It was argued that "if we could send feedback to someone that is not registered, it would push him/her to register" (#FR).

Third, some employees expected to send anonymous feedback: "I thought this was anonymous and it doesn't seem like it is and that's a deal breaker." (#17).

Fourth, employees perceived constraints in clarifying and responding to feedback (see the red rectangle in Figure 8): "I would actually like to have more of an interaction on the feedback that I give… like a feedback on the feedback I'm giving… or […] that I'm receiving. […]. And when I receive a feedback where there is something positive and there is something constructive for improvement… then […] I want to answer to that" (#2).

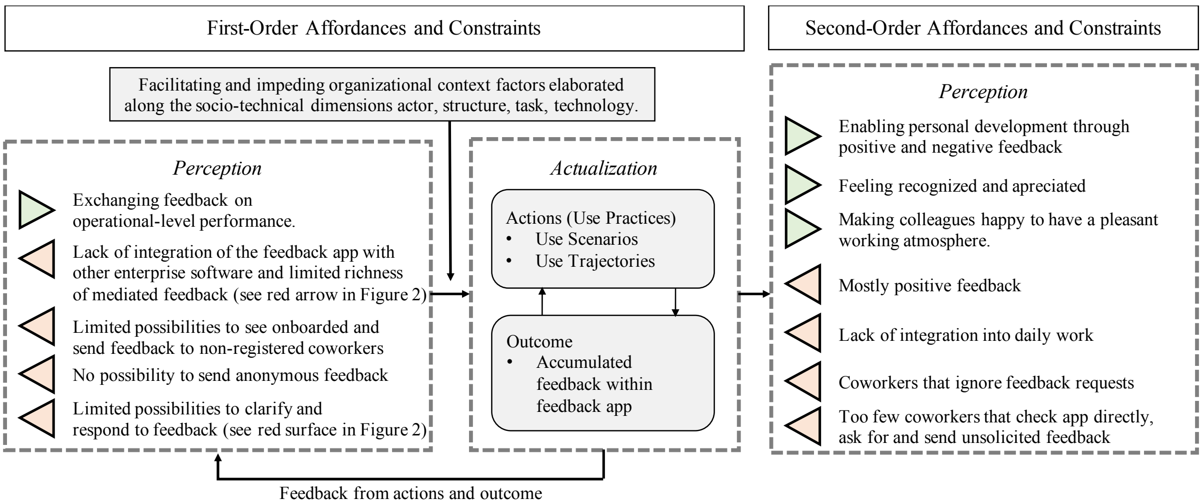

Figure 9. First and second order affordances (green) and constraints (red).

Second-order Affordances and Constraints. Actualizing the first-order affordance to exchange operational-level performance feedback enables the emergence of second-order affordances and constraints (see Figure 9). Given the accumulated operational-level feedback as outcome of the first-order affordance, employees see potentials to for personal development by identifying weaknesses and strengths through positive and negative feedback: "it can actually give me more stuff to work on. To see what are my weaknesses and my strengths and how to improve overall" (#FR). As such, the app serves as "feedback account" to collect feedback in one place.

In turn, constraints emerge from the way coworkers actualize the first-order affordance. Most notably, employees mention an emphasis on positive feedback: "Using the app, I realized most feedback remains personal and the app will be biased to only positive comments" (#FR). This is consistent with the rather high star rankings associated with the feedback. Interestingly, only some employees find this constraining, while others are satisfied and compare it to social media: “I do not write on anyone's Facebook wall ‘I dislike your beach picture’. […] You can tell if your contributions are good in that if you get likes for it, it's probably good […, and otherwise] it was probably only average” (#21).

However, employees consistently reported to feel happy and recognized when they received feedback: “It's a simple thing but receiving points or positive feedback really makes your day even better” (#FR). And sending feedback enables employees to maintain a pleasant working atmosphere that fosters motivation and a feeling of belonging together: “it just makes people feel good when you make them happy, and then it is more pleasant to work together” (#1).

Socio-Technical Context Factors that Facilitate and Impede Actualization

Still, employees may or may not realize the perceived possibilities to exchange feedback. In fact, the number of exchanged feedbacks decreased over time. Our results suggest that understanding individual’s actualization decision requires considering their sociotechnical context, which comprises facilitating (+) and impeding (-) factors (see Figure 10).

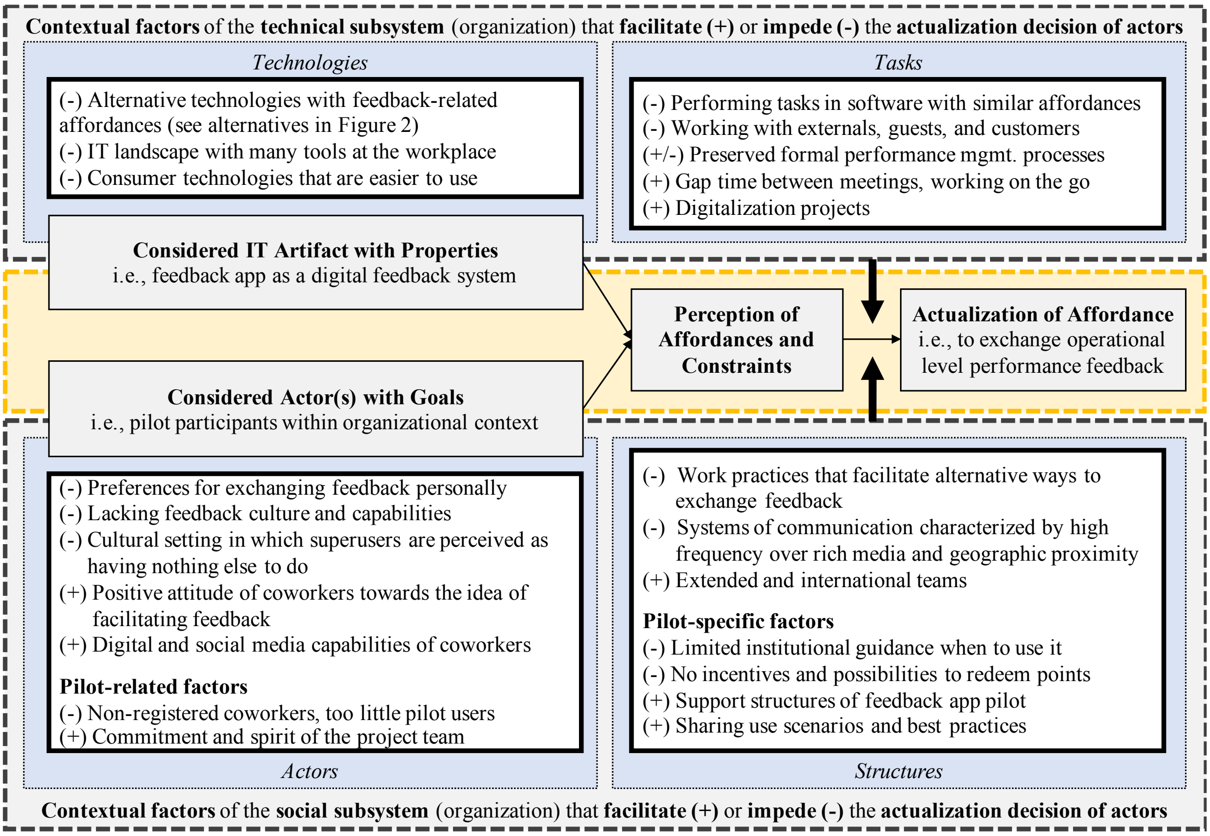

Figure 10. Facilitating and inhibiting context factors.

Technical Subsystem. The feedback app is part of a larger technical subsystem. Employees use it in the context of other technologies at work. A fragmented IT landscape with too many tools impedes actualization: “I wish NOT to work with an additional tool” (#FR). This goes along with alternative technologies that offer similar affordances, e.g., an employee stated that “for me it's actually equivalent to email. But not much better” (#9). Comparisons also include consumer technologies: “when you WhatsApp call people and it appears ‘rate the quality of your call’, you just click a star and then it [the feedback on the call] goes away” (#17). The technological context, in turn, goes along with the task environment. Performing tasks in software that offers feedback-related affordances inhibits employees’ willingness to exchange operational-level performance feedback with the feedback app (see alternatives in Figure 8). Furthermore, working with externals, guests and customers is an inhibiting factor. For example, an auditor points out: “I used it only once, because I wasn't in the company. I am doing inspections, so I go around Morocco” (#15). Consequently, individuals expressed their need to “use it with guests/customers, because this feedback counts the most” (#7). Embedding the pilot in a task environment in which formal performance management processes are preserved was perceived as facilitating and inhibiting. On the one hand, it is additional work: “I would find it ideal if the feedback app is developed so that it replaces the 360-degree feedback. [...]. I cannot have five different processes" (#9). On the other hand, employees argued for keeping it separate from the formal processes to keep it casual, fun and engaging as well as prevent dishonest use. Further observations include facilitating factors, e.g., when working “on-the-go or if you have gap time between meetings” (#1). It was emphasized that the app “should necessarily be seen together with other digitalization topics that we are talking about here at [organizational entity], for example digital e-learning” (#21). In such contexts, people’s efforts need to be recognized and incentivized to bring projects forward.

Social Subsystem. Employees are part of a wider social subsystem. We find that work practices that facilitate alternative ways to exchange feedback inhibit the need to use the feedback app. For example, closing meetings with face-to-face feedback rounds was mentioned as “ending ritual of meetings” (#1). Thus, limiting actualization to situations in which additional feedback is provided afterwards (see Path 4 in Figure 8). Also, daily Scrum stand-up meetings facilitate alternative channels to exchange timely feedback. Furthermore, working frequently with coworkers over rich media is identified as inhibiting, while extended and international team structures as a facilitating factor: “of course I use it a lot more when I'm in [inter-regional meeting]. […]. They come in, present, go out, and fly back to Paris, Milano, and so on […] then you write that together in the evening, on your way home, if you sit on the train" (#19). This is increasingly relevant, because „when we are developing into [the direction of] virtual teams with less rigid hierarchies and work with different teams across projects, we just need it" (#21).

In addition to prevailing structures, the pilot project entails inhibiting and facilitating context factors. For example, collecting feedback and points without incentives and possibilities to redeem these points was mentioned as inhibiting factor together with limited institutional guidance when to use the app: "I wish to have more guidance on when to give feedback. […, and on] how to understand the feedback app vs 360/ multi rater vs other regular feedback" (#FR). Sharing identified use scenarios and best practices was perceived to mitigate this factor. Also, actor-related context factors of the pilot further inhibited the actualization. Many users where surrounded by non-registered coworkers, and hence, felt that there are too little pilot users: "as the group is small, it's hard to not be too repetitive and/or biased towards the group who participates" (#FR).

Further, being surrounded by actors that prefer to exchange feedback personally limits its usefulness. While general feedback on sensitive and controversial topics was preferably exchanged in person, employees' preferences varied for concrete and operational-level feedback. Coworkers with a positive attitude towards the idea of facilitating feedback and digital and social media capabilities foster the actualization.

Discussion and Conclusions

Discussion of Implications

Implications for Theory on Digital Work, Social Software, and Feedback. We address calls for research on digital work (Mrass et al., 2017; Richter et al., 2018) by elaborating how employees in digital work environments still navigate back and forth between various digital and physical spaces to perform work and exchange feedback. Our results reveal that the feedback app, in contrast to traditional feedback systems, is immediately perceived as digital work tool for operational-level performance feedback. As such, there are similarities to alternate systems with similar first-order affordances. Namely operational feedback may be exchanged in general purpose social software (e.g., email, Slack), task-specific systems with embedded feedback mechanisms (Jung et al., 2010), and through integrating enterprise systems in social software that facilitates social interactions and feedback exchange (Stoeckli, Uebernickel, & Brenner, 2018).

While the feedback app is perceived as enabling personal development and growth, this second-order affordance requires employees to use the feedback app as central hub to accumulate feedback in one place. Therefore, future research should investigate how performance feedback can be integrated across systems (e.g., feedback app and enterprise systems) and sources (e.g., computer-mediated and computer-generated).

Also, the feedback app introduces a novel type of enterprise social software aside from general-purpose social software such as social networks. Prior research on social software for specific purposes is scarce, hence, we provide unique contextual insights on social software tailored to the exchange of performance feedback.

These insights are equally relevant for performance management literature, since they respond to calls for research to better investigate informal day-to-day feedback (Ashford & Cummings, 1983) and to examine the use of technology in managing performance (Levy et al., 2017).

Implications for Affordance Theory. Existing research draws on socio-technical systems theory to elaborate affordance emergence and perception (Seidel et al., 2013) as well as the actualization of organizational-level affordances (Dremel et al., 2018). We extend prior research (Dremel et al., 2018; Seidel et al., 2013) by elaborating how socio-technical context factors affect the actualization process of individuals situated in organizational work environments. We contribute to existing actualization models (Bernhard et al., 2013; Glowalla et al., 2014) since the identified factors provide a concrete explanation of how perceptions of expected value and effort are affected by the socio-technical context and why affordances may not be actualized even though they are perceived.

Implications for Practice. Practitioners that introduce feedback apps, should mitigate the identified constraints and inhibiting socio-technical context factors, while enhancing facilitating factors. Designers of feedback apps should consider the use scenarios and trajectories by supporting these practices and preventing the identified constraints as well as inhibiting context factors. For example, feedback apps should integrate well into software in which digital work is performed and should address the need of employees to switch between physical and digital spaces.

Conclusion and Limitations

Investigating the feedback app within a pilot project at InsurCorp enabled us to elaborate affordances and constraints perceived and actualized in a naturalistic case setting as well as to present facilitating and impeding socio-technical context factors.

Nevertheless, our results must be viewed in the light of its limitations. The qualitative and interpretive nature of this research prevents exhaustiveness. The selected pilot participants and interviewees possibly share behavioral and perceptional traits that may not be representative. Even though we minimized selection bias by considering employees from diverse operational entities, locations and job roles, they all belong to the same large financial services group. Future research in other organizational contexts is needed. Finally, note that changes of the technical and social structures as well as data analyses in this domain are restricted by the works council.

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Article V: How Affordances of Chatbots Cross Social and Traditional Enterprise Systems

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How Affordances of Chatbots Cross the Chasm Between Social and Traditional Enterprise Systems

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Abstract

Digital and agile companies widely use chatbots in the form of integrations into enterprise messengers such as Slack and Microsoft Teams. However, there is a lack of empirical evidence about their action possibilities (i.e., affordances), for example, to link social interactions with third-party systems and processes. Therefore, we adopt a three-stage process. Grounded in a preliminary study and a qualitative study with 29 interviews from 17 organizations, we inductively derive rich contextual insights of 14 affordances and constraints, which serve as input for a Q-Methodology study that highlights five perceptional differences. We find that actualizing these affordances leads to higher-level affordances of chatbots that augment social information systems with affordances of traditional enterprise systems. Crossing the chasm between these, so far, detached systems contributes a novel perspective on how to balance novel digital with traditional systems, flexibility and malleability with stability and control, exploration with exploitation, and agility with discipline.

Keywords

Social information systems, Enterprise Systems, Chatbot, Slack, Enterprise Messenger, Affordances.

Introduction

Over the last couple of years, chatbots have gained traction to improve productivity and efficiency among employees in the light of an increasing number of organizations, who adopt enterprise messengers such as Slack and Microsoft Teams (Hubbard & Bailey, 2018; Riemer, Schellhammer, & Meinert, 2018; Schatsky & Gratzke, 2016; Tsai, 2018; vom Brocke et al., 2018). Accordingly, the worldwide chatbot market size is forecasted to increase to 1.25 billion U.S. dollars until 2025 (Grand View Research, 2017). In fact, Gartner predicts that "the average person will have more conversations with bots than with their spouse" by 2020 (Levy, 2016).

This rise of chatbots within enterprise messengers needs to be seen in the light of the broader wave of digitalization. Specifically, a key tenant of digitalization is distributed innovation, which is characterized by balancing flexibility and openness with stability and control (Ciriello, Richter, & Schwabe, 2018a; Tilson, Lyytinen, & Sørensen, 2010; Yoo, Boland, Lyytinen, & Majchrzak, 2012). Further, the growing number of application programming interfaces (APIs) enable standardized digital communication and exchange between different information systems (Eaton, Elaluf-Calderwood, Sorensen, & Yoo, 2015; Ghazawneh & Henfridsson, 2013). In the context of instant messengers (i.e. social information systems), this has led to numerous frameworks and API's that facilitate the development and installation of chatbots in both, the enterprise context (e.g., Slack apps and integrations, HipChat bots, and Microsoft bot framework for Skype/Microsoft Teams) and the consumer context (e.g., Facebook Messenger and Telegram Bot Platform).

The success of these enterprise messengers can be attributed, on the one hand, to their malleability and voluntariness as opposed to traditional enterprise systems which are designed to support dedicated business processes and work tasks (Koch, 2008; Richter & Riemer, 2013; Schmitz, Teng, & Webb, 2016). On the other hand, a key factor for realizing organizational benefits is their integrability (Seddon, Calvert, & Yang, 2010). Taking advantage of the user-centered focus while at the same time increasing the productivity and efficiency of internal workflows are promising potentials that arise from integrating these social information systems into the enterprise landscape (Hubbard & Bailey, 2018; Schatsky & Gratzke, 2016).

For the sake of clarity, we now illustrate a chatbot use scenario in the context of a software developing organization (Lebeuf, Storey, & Zagalsky, 2018; Vehviläinen, 2014). Imagine a company that integrates their software deployment workflows into their enterprise messenger. Bob, a software engineer, deploys software using an isolated command-line tool on his laptop. In contrast, imagine the same scenario, but with Bob initiating the deployment within the enterprise messenger by engaging in a textual conversation with a chatbot in a conversational group thread (accessible by other software engineers). Thus, chatbots extend the functional scope of enterprise messengers and offer new potentials. For example, by shifting from a siloed terminal into a conversational group thread, the workflow described above becomes transparent to team members.

Against this background, prior research pays little attention to two major areas. First, prior research lacks to investigate entanglements of social and traditional enterprise systems (Sedera & Lokuge, 2017; Sedera, Lokuge, Grover, Sarker, & Sarker, 2016). Yet, today's organizational IT landscape is transforming from single and monolithic enterprise systems into portfolios of information systems (Sedera et al., 2016). Given the above noted increasing possibilities to interlink different information systems and the growing relevance of distributed innovation, organizations need to explore ways to combine novel digital technologies such as social information systems with their traditional enterprise systems (Sedera & Lokuge, 2017; Sedera et al., 2016). However, instead of investigating entanglements of social and traditional enterprise systems, existing information systems (IS) research largely emphasizes the contrasts between traditional enterprise systems and social information systems (Koch, 2008; Mettler & Winter, 2016). For instance, the latter are more user-centric than group-oriented, take in a bottom-up perspective of voluntary participation instead of top-down enforcements, enable co-evolvement of conventions and are available across projects and organizational silos rather than determining ways of working together (Koch, 2008). Moreover, prior research illustrates how traditional enterprise systems enable alignment, control, interoperability, efficiency (Mettler & Winter, 2016), while social information systems foster visibility, persistence, editability, and association (Treem & Leonardi, 2012). In consequence, the interrelationship and the entanglement of traditional enterprise systems and social information systems remains, until now, unclear due to their complex dynamics (Limaj, Bernroider, & Choudrie, 2016). Accordingly, research is needed to address this lack and to elaborate on how the existing chasm of traditional information systems and social information systems can be bridged.

Second, the existing body of literature on chatbots has a strong focus on the fields of education, psychology, and linguistics and lacks in academic research on chatbots in business (Io & Lee, 2017). In particular, there is little empirical research that explores the usage of chatbots within enterprises and the possibilities of chatbots to extend the functionality of the existing IT landscape even though the relevance of enterprise messengers is increasing (Lebeuf et al., 2018; Tsai, 2018). Accordingly, we apply affordance theory to take into account the material properties of our technological artifacts (i.e., chatbots within enterprise messengers such as Slack and Microsoft Teams) as well as their recursive effects on social mechanisms in an organizational context (Faraj & Azad, 2012; Orlikowski & Scott, 2008). To date, it remains unclear which action possibilities (i.e., affordances) chatbots offer within organizations and how they provide value. Consequently, we pose the following research question:

RQ: Which affordances emerge for employees from the material properties of chatbots used within enterprises?

The goal of this research is to gain an in-depth understanding of what chatbots enable their employees to do by investigating how chatbots are actually used for everyday work in different organizational contexts. Consequently, we seek to explore novel possibilities for goal-oriented action that emerge for employees, i.e., affordances (Markus & Silver, 2008).

While we take into consideration multiple enterprise messengers, Slack offers a particularly appropriate spawn and focal point for this research, because of their fast-growing ecosystem of Slack apps and integrations (Lebeuf et al., 2018; Tsai, 2018). For example, they have attracted four million daily active users with a user growth of up to three and a half over the course of 2016 (The Economist, 2016). Thereof, over one million users in thirty-three thousand teams operate on paid accounts (The Economist, 2016) and around 90% of these paid teams actively use chatbots in the form of Slack apps and integrations (Slack Platform Blog, 2016). Moreover, due to the fact that Slack apps and integrations are actively used since 2015, work practices of employees may be more established and stable compared to the more recent rise of Microsoft Teams in 2018 driven by the free availability in combination with Office 365 (Tsai, 2018).

The remainder of this article is structured as follows: First, we introduce the theory of affordances as theoretical underpinning. Then, we put the technology under investigation (i.e., chatbots within enterprise messengers) into the broader context of the literature on social information systems. This allows us to discuss the results in a more general theoretical context, while still acknowledging the technological materiality of chatbots and the underlying enterprise messengers. Second, the research methodology is detailed along our three research phases. Third, the results are presented along the four identified categories of affordances. Fourth, we elaborate how chatbots augment social information systems with affordances of traditional enterprise systems and we discuss our results in the light of the affordance theory, before we end with a conclusion.

Theoretical Background

Information technology (IT) artifacts are "man-made cultural objects that have enduring objectified quality through its physical materiality and institutionalized practices" (Yoo, 2012, p. 136). In contrast to the relatively stable structures of physical artifacts (e.g., car), the structure of digital artifacts such as enterprise messengers is pliable, extensible, re-combinable and changes dynamically over time (Faulkner & Runde, 2010; Yoo, 2012). In particular, chatbots are not only designed and created by humans, but at the same time, can be dynamically put into different social contexts by humans (e.g., in different project related shared conversational threads within an enterprise messenger). It is for this reason, why a sociomateriality perspective is especially valuable and acknowledges that "(1) all materiality is social in that is was created through social processes and it is interpreted and used in social contexts and (2) that all social action is possible because of some materiality" (Leonardi, 2012, p. 10). Applied to the context of this research, employees may shape chatbots and, in turn, chatbots may shape employees depending on the goals and capabilities of employees (e.g., programming skills). Furthermore, sociomateriality has to be seen in the context of a global world of technological and organizational networks in which corresponding structures (both technical and social) are increasingly interdependent (Orlikowski & Barley, 2001; Orlikowski & Iacono, 2001). Accordingly, we aim at "simultaneously understanding the role of human agency as embedded in institutional contexts as well as the constraints and affordances of technologies as material systems" (Orlikowski & Barley, 2001, p. 158). To do so, and anchored in the objective to explore what chatbots afford employees to do, we ground this research in the theory of affordances (Gibson, 1977).

Theory of Affordances

Having its origins in the field of ecological psychology, it is guided by the logic that animals perceive what possibilities objects in their environment offer to them (Gibson, 1977). This theoretical lens suits particularly well to pursue our explorative research for two reasons. First, taking up an affordance perspective guides us to mutually investigate: (1) the causal potentials of chatbots in the form of Slack apps and integrations, and (2) the goals, motivations, characteristics and capabilities of the considered employees in their contexts. Second, the relational nature of affordances is fruitful for shedding light on the conditions under which affordance emergence, perception and actualization takes place for different user groups. In doing so, the distinction between IT artifacts and actors (e.g., users) follows the call to bring back the IT artifact and its material properties to information systems (IS) research (Benbasat & Zmud, 2003; Orlikowski & Iacono, 2001).

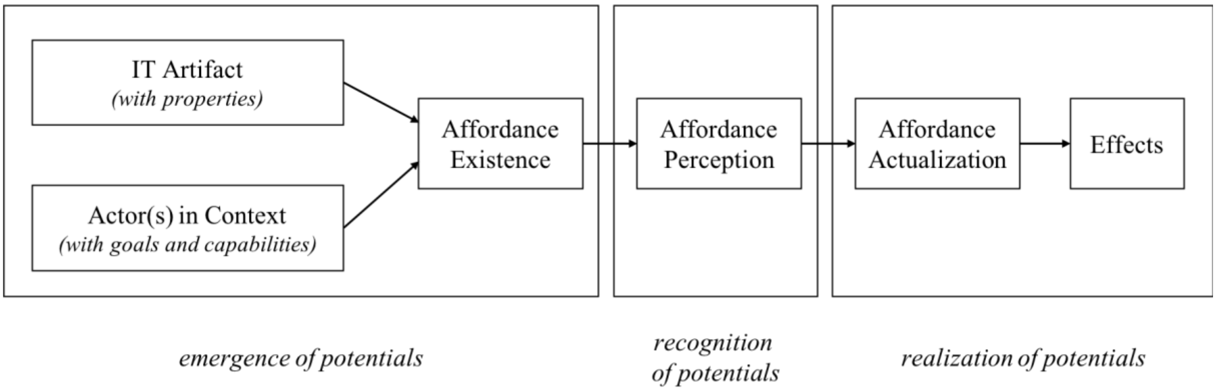

Figure 11. Affordance Concepts (Bernhard et al., 2013; Pozzi et al., 2014).

As widely adopted in IS research (Markus & Silver, 2008; Pozzi et al., 2014; Savoli & Barki, 2013), we conceptualize affordances as "possibilities for goal-oriented action afforded to specified user groups by technical objects" (Markus & Silver, 2008, p. 622). Hence, the concept of affordances is relational as visualized in Figure 11 and considers both (1) a user with its abilities and goals as well as (2) the material properties (e.g., features) of the IT artifact (Bernhard et al., 2013; Strong et al., 2014).

Affordances are real, that is, they exist independently of the user's perception (Gibson, 1977). Figure 11 illustrates the conceptual distinction between the emergence of action potentials (i.e., the existence of an affordance for a specified user), their recognition (i.e., the perception by the user) and their realization (i.e., the actualization by the user that may lead to certain effects) (Bernhard et al., 2013; Glowalla, Rosenkranz, & Sunyaev, 2014; Pozzi et al., 2014). Thereby, the existing possibilities for action that an IT artefact offers to specific users are neither infinite, nor always enabling (Strong et al., 2014). In fact, the offered possibilities may also be constraining to particular users depending on their abilities and goals (Strong et al., 2014).

Affordance perception is influenced by many factors (e.g., available information) and includes the perception of non-existent affordances (Bernhard et al., 2013). Accordingly, the material properties of an IT artifact and the respective material agency, i.e., "ways in which a technology's materiality acts" (Leonardi, 2012, p. 22) and the relation to an actor trying to engage with the IT artifact may result in the perception of affordances. Perceived affordances might be actualized, depending on a user's agency, and influenced by factors such as the expected outcome or the perceived efforts to take (Bernhard et al., 2013).

Both, IT artifacts as well as actors can be considered on various levels of granularity, thus, leading to the emergence of affordances at various levels (Bygstad, Munkvold, & Volkoff, 2015). Extant literature on affordance theory in IS research acknowledges these different levels of granularity by introducing distinct affordance concepts. Strong et al. (2014) elaborate on individual and organizational level affordances. At any given moment, an individual that engages with technology "is part of various organizational structures, from local work groups engaged in collective tasks, to the far-flung multi-level hierarchy that is the modern organization" (Volkoff & Strong, 2017, p. 4). Accordingly, for a given user, multiple affordances may emerge from a given IT artefact. Further, the actualization of these emerging affordances is influences by the socio-technical context in which individual users are situated (Stoeckli, Uebernickel, Brenner, Weierich, & Hess, 2019) and, from an organizational perspective, the actualization might require adaptations of the socio-technical work system (Dremel, Herterich, Wulf, & Brocke, 2018). Furthermore, Leonardi (2013) distinguishes between individualized, collective and shared affordances. In contrast to individualized affordances, collective affordances are "collectively created by members of a group, in the aggregate, which allows the group to do something that it could not otherwise accomplish" (Leonardi, 2013, p. 752). Shared affordances are shared within a group in the way that it represents similar use of a technology (Leonardi, 2013). Finally, Savoli and Barki (2013) acknowledge that IT artifacts can be seen as assemblage of individual parts, hence, leading to feature-level and system-level affordances. Among these affordances on different levels of granularity, dependencies and interactions may occur, e.g., the potential of analyzing data requires having realized the potential of collecting data (Bygstad et al., 2015; Glowalla et al., 2014; Strong et al., 2014). Such dependencies and interactions allow this research to abstract affordances from a concrete to a higher and more generalized level (Bygstad et al., 2015).

Social Information Systems

From a technical materiality perspective, the research at hand investigates chatbots embedded in enterprise messengers such as Slack and Microsoft Teams. However, following the theoretical lens of affordances guides to give "equal play to the material as well as the social" (Faraj & Azad, 2012, p. 238). Consequently, this research has to be seen in a broader context of literature, since the considered social technologies and their surrounding organizational social structures constitute social information systems (Schlagwein & Hu, 2016; Schlagwein, Schoder, & Fischbach, 2011). Specifically, social information systems are information systems (IS) that amplify the social capabilities of actors by creating interaction possibilities to form communities and exchange information based on open collaboration (Kaplan & Haenlein, 2010; W. Kim, Jeong, & Lee, 2010; Schlagwein & Hu, 2016; Schlagwein et al., 2011; Shirky, 2003; von Krogh, 2012).

Prior research has shown that social information systems follow the principles of egalitarianism, social production and weak ties (Schmidt & Nurcan, 2009), which we now illustrate in the light of the enterprise messenger Slack (see Figure 12).

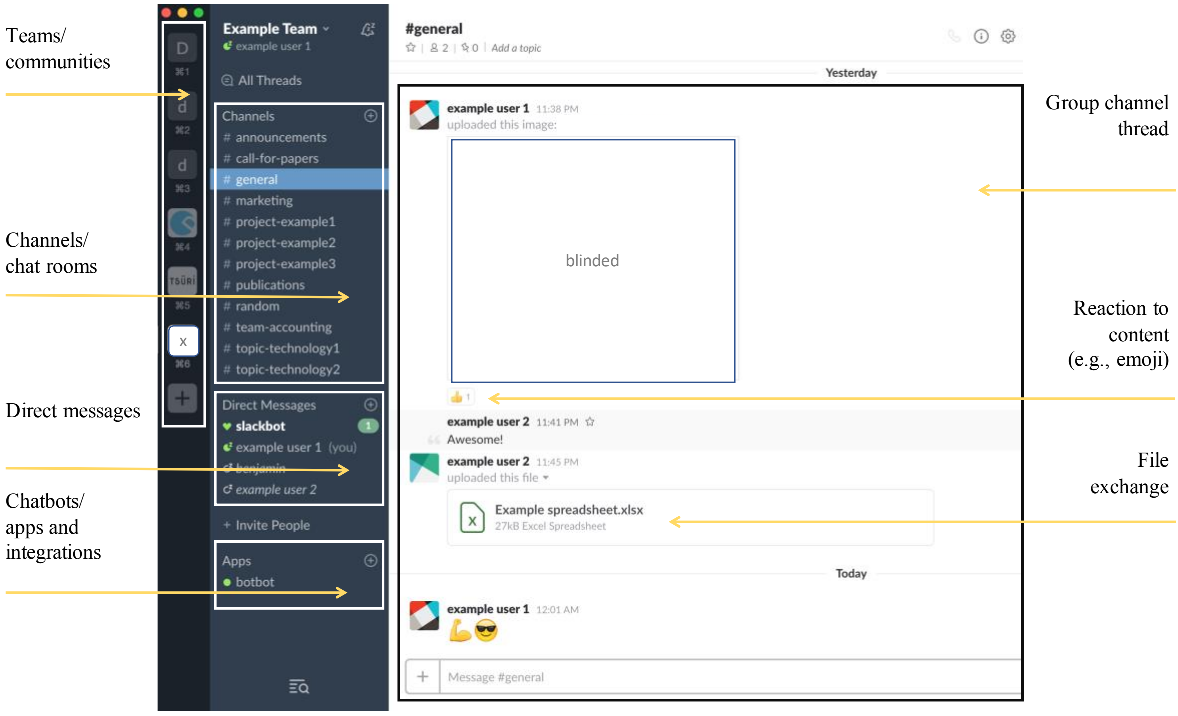

Figure 12. Thread of a group channel within the Slack desktop app.

The principle of egalitarianism is understood as providing "equal rights to all members of a society and [is] tightly connected to democratic principles" (Schmidt & Nurcan, 2009, p. 202). In the context of this research, egalitarianism is manifested by allowing each user to create and join channels as well as contribute to and consume content. Within Slack, chat rooms called channels visualized as a conversational thread of messages, including textual messages, images and files (see Figure 12). The channel can be set as open for users to join, or privately shared per invitation only. As such, the creation of channels and content is a result of social production by the users of a corresponding Slack team.

The principle of social production emphasizes that the production of information and knowledge is organized collaboratively based on free flow rather than process-driven and top-down enforced ways of working together (Benkler, 2006; Schmidt & Nurcan, 2009; Tapscott & Williams, 2008). Due to malleability (Richter & Riemer, 2013; Schmitz et al., 2016), channels can be harnessed for various purposes (e.g., to organize conversations on specific topics of interest, technologies, projects and dedicated team channels). In turn, the visibility of open channels enables the creation of weak ties.

The principle of weak ties acknowledges the characteristic of social information systems to facilitate the spontaneous creation of links (i.e., ties) between non-predetermined individuals (Granovetter, 1973; Schmidt & Nurcan, 2009). Furthermore, users can react to any kind of message that is posted with smileys (emojis), add answers directly in the main thread or create replies in a corresponding sub-thread. They can send direct messages to one or multiple people and can engage in video calls. Further emphasis is put on the search functionality offered across any type of message and the drag and drop of files (Slack, 2017b).

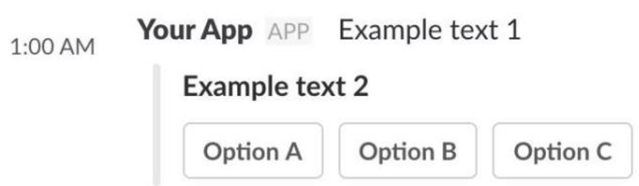

Figure 13. Interactive buttons posted by a Slack chatbot app (Slack, 2017a).

Looking through a sociomaterial lens guided by the theory of affordance, we argue that contemporary enterprise messengers such as Slack and Microsoft Teams differ from previous forms of enterprise messengers in regard to the technical as well social structures. They offer powerful application programming interfaces (API) that allow developers to build conversational driven apps and integrations into these channels, that is, what we refer to as chatbots (see subsequent section on chatbots). More specifically, by registering bot identities, developers can post messages into channels as chatbots. They can register commands to call third-party systems and establish bidirectional connections to send and receive messages of channels. The base functionality such as reacting with emojis is also applicable to messages posted by chatbots. In addition to textual messages, more and more visual elements are provided for chatbots, e.g., buttons (see Figure 13) and menus with selectable options. Finally, today's enterprise messengers allow to share apps and integrations in their publicly available marketplaces, e.g., Slack's App Directory (Slack, 2016a) and Microsoft's AppSource (Microsoft, 2018). This has led to a growing ecosystem in terms of the number of users and the number of apps and integrations. For example, Slack's App Directory listed 150 apps in December 2015 and over 385 apps in April 2016 (Slack, 2016b). With this ecosystem, contemporary enterprise messengers differ from previous enterprise messengers by offering chatbots to a broader audience of users, which may add apps and integrations from the public directory to their channels (i.e., putting chatbots into their working environment).

Chatbots

At the very core, bots can be understood as automated programs which "do not require a human operator", while chatbots in particular are automated programs that interact with chat services (Gianvecchio, Xie, Wu, & Wang, 2011, p. 1558). Consequently, the focus lies on nonhuman actors that engage in *conversations* with human actors, whereas an actor is "any entity that acts" (Seymour, Riemer, & Kay, 2018, p. 956). In turn, a "fully computer-based entity that exhibits, at least to some degree, autonomous behavior" is widely known as an *agent* (Seymour et al., 2018, p. 955).

Accordingly, several authors adopt the concept of *conversational agents* (Gnewuch, Morana, & Maedche, 2017; Nunamaker, Derrick, Elkins, Burgoon, & Patton, 2011; Schuetzler, Grimes, Giboney, & Buckman, 2014) and investigate, for instance, the use of conversational agents in the finance industry in the form of robo-advisory (Jung, Dorner, Glaser, & Morana, 2018; Jung, Dorner, Weinhardt, & Pusmaz, 2017; Jung, Erdfelder, & Glaser, 2018). Against this backdrop, a chatbot can be seen as a type of conversational agent that is text-based (Gnewuch et al., 2017). This conceptual distinction is relevant, because conversational agents are not limited to text, but include voice-driven systems such as Apple Siri, Microsoft Cortana, Amazon Alexa and Google Assistant (Dale, 2016). Commonly, such conversational agents provide assistance to users ranging from basic user assistance to anticipating user assistance with varying degrees of interaction and intelligence (Maedche, Morana, Schacht, Werth, & Krumeich, 2016). Similarly, prior research distinguishes simple agents (i.e., agents that solely act according to pre-scripted behavior) from cognitive agents with sophisticated capabilities to understand the natural language from human actors and to respond accordingly (Seymour et al., 2018).

Furthermore, agents differ in their degree of realistic visual presence. Specifically, human actors may be visually (re-)presented at varying degrees of realism through avatars, while nonhuman actors may be visually presented as visual cognitive agents, i.e., “an interactive, real-time rendered human-like entity, on a screen or in a virtual environment” (Seymour et al., 2018, p. 956). Consequently, visual cognitive agents as well as avatar-represented human actors increasingly become visually believable artificial humans with high degree of presence, thus, create realistic visual presence (Seymour et al., 2018). Similarly, social presence describes the degree to which an actor is perceived as a real and present (Short, Williams, & Christie, 1976). Prior research even suggests that humans perceive nonhuman actors with sufficient social cues as social actors; a paradigm referred to as computers-are-social-actors (Nass & Moon, 2000; Nass, Moon, Fogg, Reeves, & Dryer, D Christopher, 1995; Nass, Steuer, & Tauber, 1994). In fact, team performance of human robot teamwork increases with a higher emotional attachment of humans to their robots (Robert, 2018; You & Robert, 2018). In this regard, studies also show various effects of avatars on the human perception of conversational agents. For example, facial expressions affect the perceived credibility (Cowell & Stanney, 2005) and likability of avatars (Nunamaker et al., 2011). When using conversational agents for e-commerce, literature shows that avatars of sales agents not only influence satisfaction with retailers, but also the positive attitude towards products as well as greater purchase intentions (Holzwarth, Janiszewski, & Neumann, 2006).

With the advent of automation, work is increasingly shaped by the interplay of humans and machines (Lehrer, Wieneke, vom Brocke, Jung, & Seidel, 2018; vom Brocke et al., 2018). At the same time, conversational agents may not only be designed to assist humans, but with the goal to change human attitudes and behavior (Fogg, 2002; Mirsch, Lehrer, & Jung, 2017; Oinas-Kukkonen & Harjumaa, 2009; Weinmann, Schneider, & vom Brocke, 2016). Against this backdrop, machines increasingly take in dominant roles, which is why scholars argue that human agency may be reduced so that it becomes, in an extreme view, subordinate to automated executions: “it is humans that must react to technological stimuli rather than technology that must react to human stimuli” (Demetis & Lee, 2018, p. 930). In this rather extreme perspective, humans are considered “artifacts shaped and used by the (system of) technology rather than vice versa” (Demetis & Lee, 2018, p. 929). Consequently, aside from the varying degrees of (1) interaction, (2) intelligence and (3) realistic visual presence, conversational agents may differ in their dominance and persuasion, which influences (4) the degree of human agency.

To sum up, agents that engage in and assist in conversations with humans are not a novel phenomenon, per se. It is already fifty years ago, since the well-known program ELIZA replied to human input based on keyword recognition (Weizenbaum, 1966). Aside from the introduced concepts, a plethora of related concepts have emerged over time, e.g., conversational interface (Knight, 2016), chat agent (Crutzen, Peters, Portugal, Fisser, & Grolleman, 2011), chatterbot (Mauldin, 1994), and dialogue system (Litman & Pan, 2002). However, "whether you call these things digital assistants, conversational interfaces or just chatbots, the basic concept is the same: achieve some result by conversing with a machine in a dialogic fashion, using natural language" (Dale, 2016, p. 811). Nevertheless, over the years, the background of research on chatbots has changed in three major areas:

First, the technologies to build chatbots have progressed. In particular, the capabilities of information technology, precisely artificial intelligence and machine learning, have advanced. Natural language processing capabilities can now be used to extract meaning from textual input and to form reasonable responses. Thus, social interactions between humans and machines are no longer limited to chatbots operating on fixed rule-based pattern matching and simple decision trees (Schuetzler et al., 2014). Chatbots become artificially intelligent agents (Crutzen et al., 2011).

Second, the social information systems in which chatbots are embedded have changed. Originally, text-driven instant messengers provided mainly desktop computer users with virtual spaces (i.e., chat rooms or channels), e.g., based on IRC, XMPP/ Jabber, MSN and AOL (Gianvecchio et al., 2011). In the meanwhile, contemporary technologies on mobile devices are increasingly pervasive and integrated into the everyday life at home and at work (Lyytinen & Yoo, 2002; Yoo, 2010).

Third, the use of chatbots has evolved against the backdrop of the changing technologies to build chatbots as well as the changing technologies in which chatbots are integrated. In the 1950's, the well-known Turing test has initiated the use of chatbots in experimental settings, in which an examiner decides if a subject in a conversation is a human or a machine (Turing, 1950). Accordingly, a vast body of research is concerned with passing the yet not solved imitation game (Floridi, Taddeo, & Turilli, 2009). Since the rising adoption of messengers in the everyday life of people, research is not limited anymore to experimental settings. In fact, WhatsApp and Facebook Messenger are the most popular mobile messaging apps worldwide with more than 1300 millions monthly active users (Statista, 2018). Accordingly, research reveals chatbots in various settings, e.g., customer support (Lasek & Jessa, 2013), health (Crutzen et al., 2011), education (Kerly, Hall, & Bull, 2007) and psychology (Pilato, Vassallo, Augello, Vasile, & Gaglio, 2005). In the enterprise context, prior research on chatbots has mostly focused on cost reductions and computer-based support for decision making (Watson, 2017).

Against this backdrop, the research at hand differs from prior research in the following two ways. First, the focus of this research is on investigating chatbots within enterprises. In contrast, academic research on chatbots primarily focuses on the fields of education, psychology, and linguistics, while there is a lack of research on chatbots in business (Io & Lee, 2017). As such, we empirically investigate the use of chatbots in practice in contrast to prior research that aims at designing and evaluating chatbots (André, 2008; Gnewuch et al., 2017; Kerly et al., 2007; H. Kim, Ruiz, & Peterson, 2007; Serban et al., 2017). Second, much research strives to optimize the human-like behavior (Floridi et al., 2009; Turing, 1950), e.g., increasing the perceived humanness and engagement of conversational agents through adaptive responses (Schuetzler et al., 2014) and advancing the knowledge on human-like chatbot conversations (Crutzen et al., 2011). In practice, many of today's real world examples highlight the relevance of chatbots that are far away from being intelligent and offer simple linear flows (Budiu, 2018). Even though humanness of chatbots may influence its effects, emerging enterprise messengers such as Slack, Microsoft Teams, and HipChat indicate that chatbots are by no means limited to, but do include, chatbots that strive to act as human-like as possible (Slack, 2016a). Consider the illustrative case from the introduction section, where a chatbot initiates the deployment workflow triggered by commands within a textual conversation. This means that the intention behind chatbots may, but do not necessarily need to lie in increasing the humanness of their conversations. In addition, it has to be acknowledged that "there are three main approaches for conversations: unilateral, bilateral, or multilateral. Unilateral conversation is used for messages, which do not require responses" (Krempels, Spaniol, Scholz, Timm, & Herzog, 2006, p. 395).

In summary, we draw on prior research (Dale, 2016; Gnewuch et al., 2017; Krempels et al., 2006; Seymour et al., 2018) to conceptualize chatbots as *nonhuman actors that act as conversational agents by engaging in unilateral, bilateral or multilateral text-based conversations with human actors*.

Research Methodology

Our research adopts an explorative approach, because prior research on chatbots, in general, and enterprise messengers such as Slack apps and integrations, in particular, is scarce. Accordingly, a qualitative empirical research design is applied with the objective to enlighten this so far unexplored phenomenon inductively with rich contextual insights (Paré, 2004; Yin, 2008). Grounding our research in the interpretative paradigm allows us to gain a deeper understanding of the meaning that individuals assign to the phenomenon of interest (Klein & Myers, 1999; Walsham, 1995).

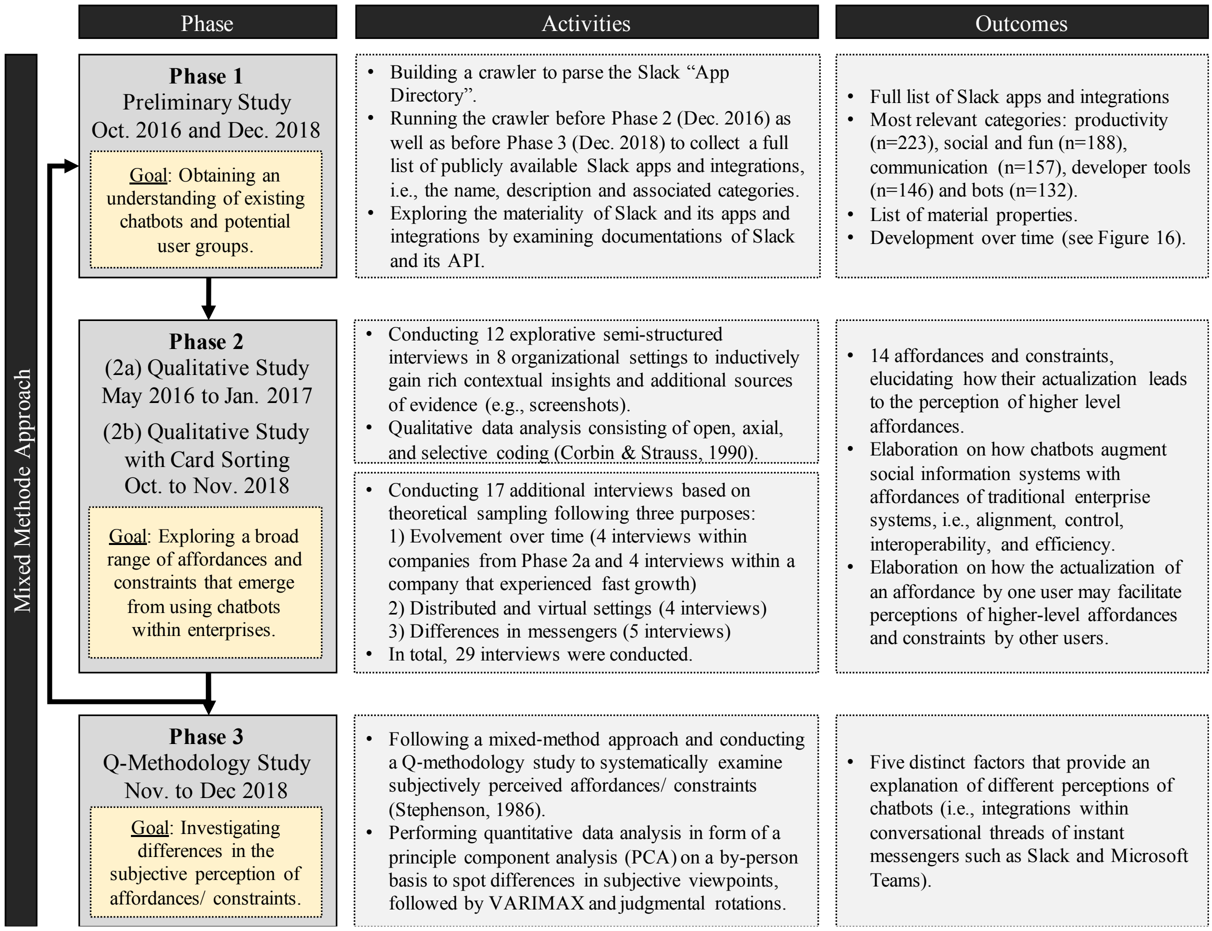

Figure 14. Research approach with three phases at a glance.

Phase 1: Preliminary Study

Following the call to take the IT artefact as serious as its potential effects (Orlikowski & Iacono, 2001), we started with a preliminary study to explore Slack and its apps and integrations in regard to its materiality. This involved examining the documentation of Slack and its API to gain an understanding of the material features. We then built a crawler, which we used to parse the Slack App Directory (Slack, 2016a) on October 11,

2016. From that, we collected the names, descriptions and the associated categories (one or more from 17 categories) for each of the available apps and integrations. After an initial exploration of each category, we calculated the number of chatbots per category as well as association rules to determine how the categories relate to each other. Later in the research process, we run the crawler again before Phase 3 (Dec. 2018).

Our findings, which include the full list of publicly available Slack apps and integrations from two points in time (i.e., 2016 and 2018), allowed us to visualize the corresponding development over time (see Figure 26). We find that a large share of available integrations is targeted at software developers. In the first run, we collected 722 Slack apps and integrations, whereas most of them were assigned to the categories of productivity (n=223), social and fun (n=188), communication (n=157), developer tools (n=146) and bots (n=130).

Overall, the preliminary study adds to the research at hand in two ways. First, we obtained an understanding of the potential user groups relevant for the recruitment of interviewees and participants of the Q-Methodology study as well as it served as initial overview of potential use scenarios of apps and integrations within Slack. Second, the preliminary study helps in the interpretation of our results and enriches the discussion.

Phase 2: Qualitative Study

Data Collection

We conducted 29 semi-structured interviews with employees from 17 companies to investigate their usage of chatbots within their work context (see Table 17). The interviews were conducted in two phases from May 2016 to January 2017 and from October 2018 to November 2018 (see Phase 2a and 2b in Figure 14).

The interviewee selection process was as follows. The overarching goal was to collect empirical data from multiple social and organizational contexts, because our objective is to explore a broad range of affordances, which are, per se, contextual. Consequently, we selected interviewees form different organizational contexts so that a variety of industries and company sizes is included. All interviewees were recruited using Snowball sampling to obtain a sufficient set of interviewees (Myers & Newman, 2007). In doing so, we only included interviewees that have used the corresponding enterprise messenger (i.e., Slack, Microsoft Teams or Telegram) as well as the corresponding chatbots (e.g., Slack apps and integrations).

In Phase 2a, we searched for employees in organizations that use Slack together with Slack apps and integrations. Thereby, the interviewee selection process was based on the findings from the preliminary study. Specifically, crawling the Slack App Directory showed that a large share of available integrations is targeted at software developers (e.g., 146 apps and integrations are assigned to the category developer tools). To prevent an overemphasis on affordances for software developers, we selected about the same number of interviewees with and without programming skills (see Table 17).

Id	Job position of interviewee (Programming skills)	Organizational context	Assimilation (Messenger)
#1, #2	Lead Software Engineer (Yes)	Alpha (Internet of Things software provider for facility management, 10-50 employees, Switzerland)	Routinisation (Slack)
#3	Chief Executive Officer (No)		
#4	R&D Team Lead, Vice President (Yes)	Beta (Innovation team of a financial service provider, 1000-5000 employees, United States)	Infusion (Slack)
#5	Innovation Architect (Yes)		
#6	Senior Consultant (No)	Gamma (Innovation consultancy, 10-50 employees, Germany and Switzerland)	Acceptance (Slack)
#7, #8	Senior Consultant (No)		
#9	Consulting Manager (No)		
#10	Senior Consultant (No)		
#11	Head of Development and Interaction Design (Yes)	Delta (Technical consultancy and software company, 50-100 employees, Switzerland)	Routinisation (Slack)
#12	Deputy Chief Technology Officer (Yes)		
#13	Product Manager (No)	Epsilon (Telecommunication, 50-100 employees within the Slack team/10k-100k in total, Switzerland)	Routinisation (Slack)
#14	Chief Executive Officer (No)	Zeta (Human resources & recruiting, 5-10 employees, Germany)	Acceptance (Slack)
#15	Head of Software and Infrastructure (Yes)	Eta (Software company, 10-50 employees, Switzerland)	Infusion (Slack)

#16	Innovation Manager (No)	Theta (Energy sector, 100-200 employees, Switzerland)	Routinisation (Slack)
#17	Product Owner (Yes)	Iota (FinTech company in the real estate sector, strong growth from <50 to 100-200 employees within one year, Switzerland)	Routinisation (Slack)
#18	Squad Lead (No)		
#19	Front-End Developer (Yes)		
#20	Agile Coach (No)		
#21	Senior Software Engineer (Yes)	Kappa (Cyber security service provider, 100-200 employees, Switzerland)	Routinisation (Slack, extended team use)
#22	Software Engineer & Technical Program Manager (Yes)	Lambda (Software provider for travel agencies, 10-50 employees, Switzerland)	Infusion (Slack, extended team use)
#23	Founder and Software Developer (Yes)	Mu (Software development company, 10-50 employees, Switzerland)	Routinisation (Slack, inter-organizational use)
#24	Manager in Finance and Operations (No)	Nu (Software provider in the cryptocurrency industry, 50-100 employees, Switzerland)	Routinisation (Slack, distributed/ virtual team use)
#25	Chief Executive Officer (No)	Xi (Game development company, 50-100 employees, Germany)	Routinisation (Telegram)
#26	Testmanager / IT Teamlead (Yes)	Omicron (Manufacturing, 10k-100k employees, global presence with headquarter in Switzerland)	Acceptance (Microsoft Teams)
#27	Head of Software Development (Yes)		
#28	Senior Consultant (No)	Pi (IT service management, 1000-5000 employees, 100-200 in Germany)	Adoption (Microsoft Teams)
#29	Chief Executive Officer (No)	Rho (Technology service provider, 10-50 employees, Switzerland).	Routinisation (Microsoft Teams)

Table 17. Multiple sources of evidence.

In Phase 2b, the interviewee selection process followed a theoretical sampling approach that is grounded in three purposes. First, roughly two years after conducting the first interviews we aimed at exploring how the usage of chatbots within enterprise messengers evolved over time. This is why we conducted 4 additional interviews with interviewees from companies that participated already in Phase 2a (see Alpha and Gamma in Table 17) as well as 4 interviews with employees working in a fast-growing company (see Iota in Table 17). More specifically, we selected Alpha and Gamma, since both organizations experienced changes such as growth and office relocation. In both companies (i.e., Alpha and Gamma), we interviewed at least one interviewee twice to compare the perceptional changes of the same person over time. Second, we aimed at exploring distributed, virtual and extended team settings, which is why we conducted 4 additional interviews (i.e., Interview #21 to #24). Third, we strived to understand differences in tooling. To do so, we conducted 5 additional interviews with employees of organizations that rely on Microsoft Teams and Telegram (i.e., Interview #25 to #29). In total, we conducted 17 additional interviews in Phase 2b (leading to an overall number of 29 interviews).

The interview process was as follows. The interviews lasted between 30 and 100 minutes (with an average of 48 minutes) and were recorded as well as transcribed right after conduction. To prevent misunderstandings and to increase the expressiveness of the statements, we either conducted the interviews in German or English depending on the native tongue of the interviewee. Grounded in open-ended questions, the interviewees were initially asked to describe how their enterprise messenger and chatbots are embedded in their everyday work. Accordingly, we characterize the studied enterprises in Table 17 in regard to the assimilation of their enterprise messenger in terms of adoption (i.e., decision to use), acceptance (i.e., committed to use), routinisation (i.e., frequent use), and infusion (i.e., comprehensive and sophisticated use) (Wang, Conboy, & Pikkarainen, 2012).

Due to the semi-structured nature, we were able to dig deeper when the interviewees mentioned interesting and unexpected ways to harness chatbots for their routines (Pare, 2004). In the beginning, we asked general questions to get to know the interviewees, e.g., their job position and tasks. Then, we asked what role the corresponding enterprise messenger in general plays in their daily work, e.g., by probing work practices and typical workday journeys. Questions relating to chatbots ranged from today’s perceived action possibilities, benefits as well as disadvantages and constraints. Finally, we moved from questions that referred to today’s use towards questions that addressed changes in usage over time as well as planned and expected future use potentials of chatbots to accomplish individual and organizational goals. From about a quarter of the organizations, at least one interviewee additionally showed us on a tablet or computer how their team uses chatbots.

In Phase 2b, we additionally employed card sorting of the emergent list of identified affordances (Fincher & Tenenberg, 2005). Specifically, each identified affordance (i.e., 14 affordances across 4 categories) was printed on card and together with two concrete examples from Phase 2a. Category by category the interviewees had to comment on their perceptions of each affordance, while sorting the cards by perceived relevance for their organizational context. Finally, the interviewees sorted the four categories of affordances by relevance.

Qualitative Data Analysis

To proceed in a rigorous way, we have collected and analyzed data iteratively until a coherent picture emerged (Corbin & Strauss, 1990; Klein & Myers, 1999). During the data analysis we performed an interwoven three-step approach for our qualitative data analysis consisting of open, axial and selective coding resulting in a total of 1613 codes (Corbin & Strauss, 1990). In the open coding procedure, we inductively coded concepts to condense the transcripts and obtain an overview (Yin, 2008). During the axial coding procedure, the coding structure was based on our theoretical underpinning: properties of the IT artifacts, properties of the actors (related to their goals, capabilities and contexts), and perceived and actualized affordances as well as constraints. In this process, the identified axial codes were grouped in categories (e.g., Category 1 to Category 4 presented in the results section). Through iteratively making connections between the fractured codes, a core theme emerged (Strauss & Corbin, 1990). That is, different higher-level affordances and constraints emerge for members of a group channel as a consequence of the actualization of a lower-level affordance in this channel by a (potentially other) user. Consequently, we sharpened the relations between the identified affordances and constraints in the selective coding procedure. Following the principle of theoretical sensitivity (Corbin & Strauss, 1990; Strauss & Corbin, 1990), we built on Bygstad et al. (2015) to analyze how the actualization of lower-level affordances and constraints results in higher-level mechanisms. Specifically, our coding structure was extended with higher-level affordances, while continuing to strengthen the codes relating to relevant properties of IT artifacts and actors.

During the entire coding procedure, we triangulated multiple sources of evidence with the software MAXQDA 12 (Yin, 2008). This included the transcribed interview recordings, notes and observations, with supplementary data provided by the companies:

(1) screenshots of chatbots in use, (2) lists of chatbots in use, (3) documentations, (4) blog articles referred by one of the interviewees (which is also the author of the blog article), and (5) a video recording of a practice-oriented conference presentation (team of Company Beta) on how they harness chatbots for software development and operations. This allowed us to examine chatbots in use from different sides and in different embedded contexts (Klein & Myers, 1999; Orlikowski & Iacono, 2001).

Sensitivity, that is, the authors ability “to identify what data is significant and to assign it a meaning” (Halaweh, 2012, p. 36) is crucial for interpretative research that relies on human interpretations and meanings (Walsham, 1995). Sensitivity can come "from experience, especially if the researcher is familiar with the subject under investigation” (Halaweh, 2012, p. 36). From this point of view, it was an advantage that the first and third author of this article use Slack apps and integrations in their daily lives, because it helped them to understand the statements made by the study participants. On the other hand, to minimize salience bias as well as to maintain a critical distance between the personal use of Slack apps and integrations of the researchers and the views of interviewees, we cross-checked the transcriptions with the second author (not an active user of enterprise messengers) and generated a shared meaning through multiple interactions in which we engaged back and forth with the empirical data, theory and our emergent coding schema (Walsham, 1995, 2006).

Phase 3: Q-Methodology Study

To further explore in more detail the mental models that employees have developed when using chatbots (i.e., integrations into conversational threads), we have chosen to apply a mixed-method approach called Q-methodology, as it offers a rigorous and systematic way for capturing human subjectivity (Mettler & Wulf, 2018; Stephenson, 1935, 1986).

Though Q-methodology is particularly used in other research fields as IS research, for instance health services research (Baker, Wildman, Mason, & Donaldson, 2014; Stenner, Cooper, & Skevington, 2003), a small number of articles have proven its usefulness for IS research. Specifically, adopting a Q-methodology in IS research has proven to be valuable to investigate differences in the decision-making of project managers (Tractinsky & Jarvenpaa, 1995), to segment the ecommerce industry based on the subjective assessment of e-commerce providers (Storey, Straub, Stewart, & Welke, 2000), and to explore user resistance in enterprise implementation (Klaus, Wingreen, & Blanton, 2010). In particular, when exploring affordances which technological artifacts provide, it proved a useful tool to systematically analyze the subjective perception of these artifacts (cf. Mettler, Sprenger, & Winter, 2017; Mettler & Wulf, 2018). Both of the latter studies draw on the affordance theory to study the attitudes towards adopting service robots (Mettler et al., 2017) and to explore the mental models of employees who are faced with the introduction of physiolytics (Mettler & Wulf, 2018).

Q-methodology is deemed as suitable for in-depth study of situations where the subjective perception of a study's participants is of special interest – in our cases the perception and actualization of affordances (McKeown & Thomas, 2013; Tractinsky & Jarvenpaa, 1995). Thus, Q-methodology attaches particular importance to the sampling of subjective statements. Yet, it allows to construe generalization while at the same time maintaining a high level of phenomenology as well as acknowledging and considering the subjectivity of respondents (Dziopa & Ahern, 2011; Wingreen, LeRouge, & Blanton, 2009). As such, Q-methodology can be seen at the interception of quantitative and qualitative research (Klaus et al., 2010). Finally, it often uncovers unusual or counterintuitive patterns which are not related to a study participant's characteristics and may thus be neglected by typical survey-based studies (Zabala & Pascual, 2016).

Concepts	Description of Activities	Application of Activities to this Research Context
Q-Set (i.e., selection of statements)	Drawing on a range of sources that include interviews, focus groups, public documents, or the popular press to develop a set of statements (Baker et al. 2006).	A Q-Set of 28 statements is developed based on the identified affordances and constraints from Phase 2 (i.e., the statements are based on rich qualitative data from 29 interviews).
P-Set (i.e., selection of participants/ respondents)	Adopting a purposive sampling approach to select information rich individuals as participants/ respondents who are expected to cover a range of different viewpoints (Baker et al. 2006).	A P-Set of 28 participants were purposeful selected based on the insights from Phase 2 so that employees that use Slack as their main tool as well as complementary to Email were covered.
Q-Sort (i.e., data is collected as participants sort the Q-Set statements using the open source software Easy-HTMLQ)	Participants of the P-Set receive and follow a hyperlink to a Q-Sort online survey to perform a sorting exercise of the Q-Set statements into a given forced-choice quasi-normal distribution (Baker et al. 2006).	A five step process is followed: (1) introduction of background and process, (2) individual sort of cards into agree, neutral, and disagree, (3) review and detailed sort into forced-choice distribution from agree (+2) to disagree (-2), (4) commenting on extreme values (+2 and -2), and (5) descriptive question survey.
Q-Method (i.e., data is analyzed by using Ken-Q Analysis Desktop Edition to conduct factor analysis)	Transforming the gathered Q-Sort records so that the statements are in rows and the ranking of for each participant is in the columns (Mettler & Wulf, 2018). Then, a factor analysis is performed to reduce the columns.	Five distinct factors with eigenvalues greater than 1.00 are extracted by performing a principle component analysis (PCA) on a by-person basis. Overall, these factors cumulatively explain 67% of the variance.

Figure 15. Overview of Q-Methodology concepts and procedure of this study.

Figure 15 highlights four main parts of Q-methodology studies (Brown, 1993; Van Exel & De Graaf, 2005): (1) collecting a wide range of perspectives on a topic and selecting a set of statements referred to as the Q-sample or Q-set, (2) purposefully selecting a set of participants referred to as the P-set, (3) asking the participants to conduct a comparison and ranking of the statements referred to as the Q-sort, and, finally, (4) analyzing and interpreting the results by performing statistical factor analysis. We will now describe how we conducted these steps.

Q-Set Development Procedure

The foundation of each Q-Methodology study lies in collecting subjective statements (i.e., opinions, tastes, preferences, sentiments, motives, but not facts) that represent the perceptions of a certain topic of interest, which is referred to as the concourse (Brown, 1993). According Q-Methodology, these statements can come from various sources (e.g., derived from interviews, participant observations, literature, media reports, or created from scratch) and can be presented in various formats (e.g., text, pictures, paintings, music, videos) (Brown, 1993; Donner, 2001; Van Exel & De Graaf, 2005). Then, a subset of the statements is drawn from the concourse to develop the Q-Set.

In our research, we ground the development of the Q-Set in the rich qualitative insights gathered in Phase 2 of this research that comprises interviews 24 hours of interviews with users of chatbots within enterprise messengers (e.g., apps and integrations within Slack) across 17 organizations (see previous section). From that, a set of 28 statements was derived that covers employees' views on affordances (14 statements) and constraints (14 statements). By considering both affordances as well as constraints, our Q-Set covers a heterogeneous set of statements that broadly represent perceptions that proved to be relevant (Watts & Stenner, 2005). Furthermore, we relied on guidelines to ensure that the formulation of the statements is similar in style (Donner, 2001). Specifically, we choose a framing of the statements so that each makes an assertion about an action/ value potential or constraint/ limitation of chatbots/integrations within enterprise messengers (Watts & Stenner, 2005). For example, the statement that corresponds to affordance AFF-01 was formulated as follows: "I perceive integrations into Slack, HipChat or similar as valuable for receiving status notifications and updates from third-party systems within channels". On the other hand, constraint CON04 was formulated as follows: "I perceive Slack, HipChat or similar messenger integrations as constraining, since they lead to information overload".

P-Set Recruitment Procedure

Q-Methodology studies are conducted with a relatively small number of participants (Stephenson, 1935; Van Exel & De Graaf, 2005) that is usually smaller than the Q-set of statements (Brouwer, 1999) and that enables the comparison of the resulting factors with each another (Brown, 1980). Following this methodological backdrop, and similar to Phase 2, a purposeful sample of 28 information-rich participants was recruited to take part in the Q-sort survey. Note that the key consequence of non-random sampling is that inferences are only made about the viewpoints of the participating groups on the given subject (i.e., the factors that influence the perception of chatbots within enterprise messengers), but not about the wider population and the distribution of the viewpoints among the respondents (Baker, Thompson, & Mannion, 2006; Davies & Hodge, 2007; Watts & Stenner, 2012).

Next, we selected employees who are expected to have a clear and distinct view on chatbots within enterprises messengers. Namely, we focused on knowledge workers that perform mainly digital work, that is, "[an] effort to create digital goods or that makes substantial use of digital tools" (Durward, Blohm, & Leimeister, 2016, p.283) and that use chatbots within enterprise messengers as part of their daily work. Accordingly, the descriptive statistics of our list of respondents shows that 96% of the participating knowledge workers engage in work with digital input and output, while 4% of them engage in physical work (i.e., consultants that conduct face-to-face workshops). 75% of the respondents use their enterprise messenger for work in a dispersed, distributed, or extended team setting, whereas 25% use it locally. Furthermore, 39% of the participants work in micro enterprises (fewer than 10 employees), 36% in small enterprises (10 to 49 employees), 18% in medium-sized enterprise (50 to 249 employees), and 7% in large enterprise (250 or more employees). Within these work contexts, 57% of the study participants use their enterprise messenger as their main collaboration tool at work (i.e., replaces internal email), while 43% use it as a complementary tool. Moreover, most of them were somewhat familiar with programming integrations (71%). Lastly, 21% were females and 79% males.

Q-Sort Study Procedure

All participants received links to a Q-Sort survey tool (see Figure 16), which was setup using a fork[4] of the open source software Easy-HtmlQ[5] that allows working with the database system Firebase. Aside from configurational changes (e.g., introduction text, guidance through the individual steps, statements), we additionally adjusted the source

[4] https://github.com/shawnbanasick/easy-htmlq

[5] https://github.com/aproxima/htmlq

code of the tool so that color priming is minimized (i.e., we removed the red and green color to ensure that participants are not primed to agree on the provided statements) and usability is increased (i.e., we implemented a hover feature for statements that were already sorted).

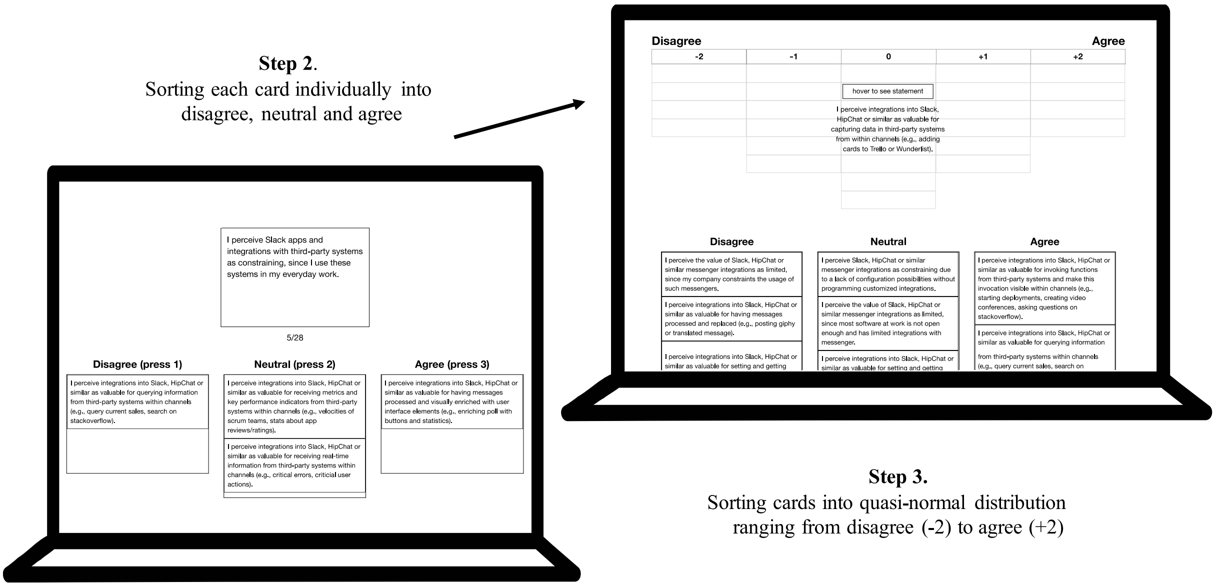

Figure 16. Q-sort survey tool used to conduct the Q-Methodology study.

Each participant was guided through five steps. Step 1 introduced the background, the goal and the expected duration of the study as well as author-related contact information. In Step 2 each statement was shown individually to the participants (in random order), which then had to select “agree”, “neutral” or “disagree” by either using drag and drop or by pressing the corresponding keyboard shortcuts. Following the widely established procedure of using forced-choice quasi-normal distributions in Q-methodology studies (McKeown & Thomas, 2013), Step 3 comprised sorting the statements into the five levels of agreement ranging from +2 (agree) to -2 (disagree). The instructions guided the participants to start with the agree pile, read the statements again, select the four statements that participants mostly agree with and place them on the right side of the score sheet below the +2 (see Figure 16). This process was continued with sorting statements into the piles for statements that are perceived as most disagreed (-2), partly agreed (+1), disagreed (-1) as well as neutral (0). Step 4 involved commenting on the four most agreed and disagreed statements. Finally, in Step 5, the participants were asked to answer a set of descriptive questions (e.g., age, sex, job role, industry, company size) as well as indicate the relevance of chatbots for different types of channels on a scale from 1 to 5 (e.g., project team channels, inter-organizational channels).

Quantitative Data Analysis

We used the software Ken-Q Analysis Desktop Edition (KADE) (Banasick, 2019) which offers dedicated calculation functionalities for the analysis of Q-Methodology studies (Version 1.0.0). We started by exporting all Q-Sort survey records from the Firebase database and calculated the correlations between the respondents, which resulted in a by-person correlation matrix (Watts & Stenner, 2005). At the core of Q-Methodology, the correlation matrix lies the foundation to apply factor analysis to determine a set of basically different Q-sorts that are evident in the data (Brown, 1993). Note that the way factor analysis is applied is on a by-Q sort (i.e., by-person) level, which means that each record is transposed so that the statements are in rows and the sort values (i.e., from -2 to +2) are in columns (i.e., one column for each participant) (Mettler & Wulf, 2018).

To perform the factor analysis, we used principle components analysis (PCA) with Varimax rotation of seven factors to maximize statistical differences (McKeown & Thomas, 2013). To do so, on the one hand, we calculated eigenvalues, the explained variance (in percent) as well as the cumulative explained variance (in percent) for each factor so that we were able to extract seven factors with eigenvalues greater than 1.00. This is a widely applied criteria for initially selecting factors (Coogan & Herrington, 2011; Donner, 2001), however, scholars commonly agree to critically reflect the number of factors to include in the final selection (McKeown & Thomas, 2013).

Therefore, we proceeded with calculating the idealized Q-sorts for each factor and read carefully through the corresponding statements. Basic statistics on normal distributions suggests performing calculations with a standard error of 2.58 for the 99.5 percentile point. To decide on the Q-Sorts to include for each factor, we calculated the value for significant factors loadings as follows: $2.58 * 1/\sqrt{}$ (number of statements) = $2.58 * 0.189 = 0.488$. Accordingly, a Q-sort was included if greater than 0.488 for a given factor. For each factor we calculated the distinguishing statements with $p < 0.05$ and $p < 0.01$ and checked for which statement the z-Score is higher or lower compared to all of the other factors. With this foundation, we applied theoretical or so-called judgmental rotation, which is recommended to harness domain knowledge to consider the factors from different angles before choosing a factor solution (e.g., Baker et al., 2006; Brown, 1980, 1993).

Finally, we extracted five factors with eigenvalues greater than 1.00 and a cumulative explanation of 67% of the variance. With this decision we are in line with the eigenvalue criteria (Coogan & Herrington, 2011; Donner, 2001) and we ensure that at least two Q-sorts loadings are significant per factor (Watts & Stenner, 2012). As such, these five factors represent five distinct interpretations of the relationship between employees and chatbots, since each factor can be understood as a viewpoint that is commonly shared between groups of similarly minded employees (i.e., they have similarly sorted the affordances and constraints statements into the forced-choice quasi-normal distribution). Going carefully through the idealized Q-sorts and comparing the distinguishing statements with the respondents (given their descriptive statistics and comments) allowed us to assign appropriate names to the factors.

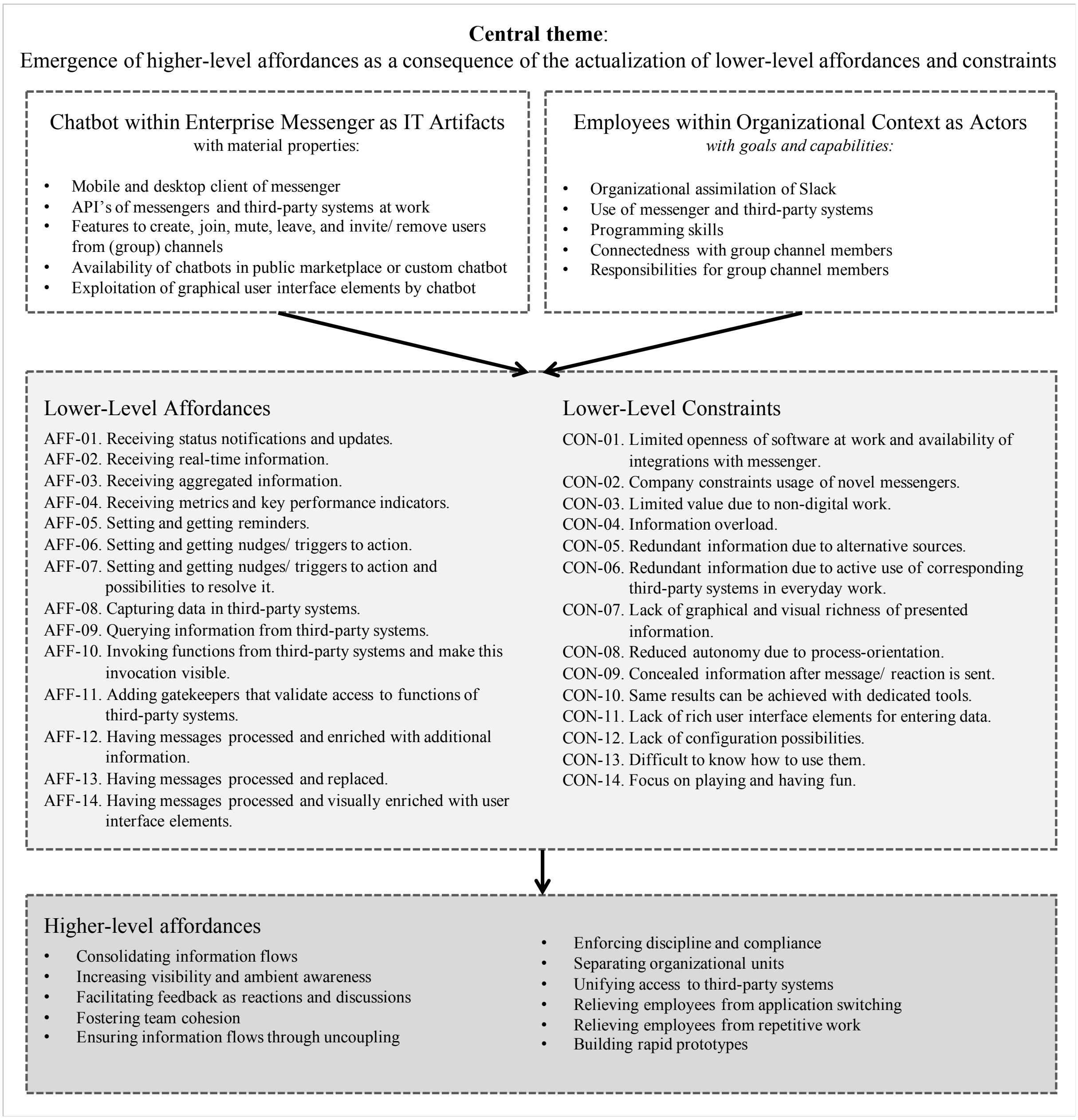

Figure 17. Emergence of lower-level and higher-level affordances and constraints.

Results

Our research reveals 14 lower-level affordances and 14 constraints of chatbots within enterprises. In the following these affordances and constraints are illustrated along four categories by providing empirical evidence from exemplary actualization contexts (see Table 18 to Table 21). We find that the actualization of these lower-level affordances as well as constraints in group channels offer higher-level affordances that emerge for the members of this channel (see Figure 17).

It is in the very nature of affordance theory that technologies provide different possibilities to different people. Accordingly, the second part of the results section reveals how employees weigh the identified affordances and constraints against each other by pointing out similarities and differences in perception along five factors identified in the Q-Methodology study.

Affordances and Constraints of Chatbots within Enterprises

Category 1. Receiving Messages

First, four affordances (see AFF-01 to AFF-04 in Table 18) emerge from chatbots that post messages into conversational channels with information from third-party systems and outcomes of automated workflows.

Affordance	Context and Outcome of Affordance Actualization	Card Sorting Phase 2b & 3
Receiving status notifications and updates (AFF-01)	*Context (Alpha, Beta, Delta, Epsilon, Eta)*. In software developing teams, chatbots were used to post status updates from version control systems (e.g., Git), issue tracking systems (e.g., Jira), build and continuous integration systems (e.g., TeamCity). *Outcome*. Status update (e.g., source code was committed, issue was resolved, new version was deployed) is automatically posted to a team or dedicated separate channel.	**1.94** avg. sort position (1 as most relevant of 4 cards) in Phase 2b. **1.04** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
	Context (Alpha). Outgoing social media posts are officially posted by the responsible employees but relevant for all. *Outcome*. Outgoing social media communication is posted to a general channel.	

Receiving real-time information (AFF-02)	*Context (Eta)*. Error messages of different systems are often spread across various log files, which hinders debugging. *Outcome*. Major error messages are passed to a channel to debug in chronological order.	**2.82** avg. sort position (1 as most relevant of 4 cards) in Phase 2b. **1.32** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
	Context (Theta). To better understand individual test users, chatbots were used to trace a customer along a buying process. *Outcome*. Each step of a customers' journey is posted to a Slack channel.	
Receiving aggregated information (AFF-03)	*Context (Beta)*. Fetching information from various sources (e.g., Kanban board) and preparing a structured meeting agenda for status meetings is a repetitive task that is done by a chatbot. *Outcome*. Automatically generated meeting agenda is posted to project channel.	**2.53** avg. sort position (1 as most relevant of 4 cards) in Phase 2b. **0.89** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
	Context (Alpha). Gathering lunch menus of nearby cafeterias is done by a chatbot. *Outcome*. Automatically fetched meals are posted to channel.	
Receiving metrics and key performance indicators (AFF-04)	*Context (Beta)*. Velocity measure as amount of functionality scrum teams deliver is repeatedly calculated by a chatbot. *Outcome*. An overview of the relative movement of each project is posted to a channel.	**2.65** avg. sort position (1 as most relevant of 4 cards) in Phase 2b. **0.5** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
	Context (Epsilon, Eta, Theta). Analytics data and reviews/ratings from app stores are fetched by chatbots. *Outcome*. This feedback to the own product or service is posted to Slack (either immediately or aggregated).	

Table 18. Affordances related to receiving messages.

Higher level affordances. Being able to integrate messages from multiple chatbots and humans in one place affords to consolidate and unify communication flows. "I know that all the important things that I have to be aware of end up [in the corresponding Slack channel]" (Interview #15). This yield "a tremendous saving of time. Instead of gathering information up from emails and hundreds of third-party systems, I have everything at a glance" (Interview #15). "I see everything that happened over night, this is cool because conversations are sorted by project [channel] and I can go through by priority" (Interview #5). Furthermore, it relieves employees from "switching between monitors and programs all the time" (Interview #16) and "it redeems from informing someone that you have pushed [source code], because it happens automatically" (Interview #1). Thus, affording to automate information flows and, consequently, to uncouple information flows from individual employees.

In addition, our interviewees expect that actualizing Affordances 1.1 to 1.4 can collectively lead to increased ambient awareness. Chatbots "help team members to be more aware of the load they are putting on others" (Interview #4). An interviewee perceived that receiving build and continuous integration updates brings business and technology closer together. "I see where we stand, [...], what the current version contains, and new features that we have developed [relevant] for sales – so, it certainly creates proximity to the software development team" (Interview #3). Also, within teams, "I notice what is going on in other repositories [from my team] where I'm not directly involved" (Interview #1).

Moreover, teams created dedicated channels, e.g., a channel for major errors, where "I know exactly, if something goes wrong, then, we really have a major problem which absolutely has to be resolved" (Interview #15). As described by the interviewees, this nicely coalesces with the possibility to react to any posted content (e.g., with emojis, replies). For the interviewees, this is how it affords them facilitating discussions, as well as faster and shorter feedback cycles, which "is key in today's world. When a developer gets aware of what user x thinks about our product at the same time as I do, then, the communication simply flows much faster. And this is something we cannot achieve differently, even if I would tell it in every daily [Scrum meeting], which would be completely inefficient" (Interview #13). Here, the affordance to uncouple such information flows from individual employees was described with positive side effects, namely, "it also feels better [when the information of bad product reviews comes from the bot instead of the boss]" (Interview #13).

Finally, posting metrics and key performance indicators makes undisciplined behavior and violations against reference values visible (see Figure 18). This enables to enforce discipline and compliance, because "they could see the problems" (Interview #4). Accordingly, possibilities to shape the organizational culture emerge.

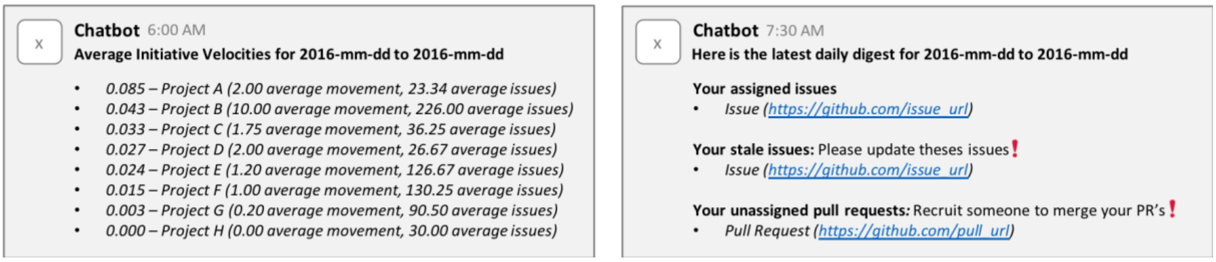

Figure 18. Chatbot from Case Beta related to AFF-04 and AFF-06.

Constraints. By having machines post messages to channels, a risk of producing information overload exists. It "is basically a question of [applying the] push or pull principle... do I really have to know when someone builds, or do I look it up when I need it?" (Interview #12). Therefore, integrating chatbots that post messages has to be well thought out, to prevent the messages from becoming constraining. In fact, "messages regarding the build processes were only interesting in 20% of the time" (Interview #12). Our results indicate that the way incoming chatbot messages are perceived (e.g., as an affordance or a constraint) strongly depends on the individual workflow and current context, which is not necessarily aligned with the other subscribers of a channel. Project status meeting agendas generated from metadata are perceived as "semi-interesting because I spend at least some hours on that project every day, but for people that are less involved it is very useful to run a meeting" (Interview #5). "These are my daily working tools, I don't need an integration that tells me hey your project has reached 50% of the billable hours, because [as a manager] I'm using this software every day" (Interview #12). This plays well together with the possibility of Slack to mute individual channels. Therefore, "we have thought about creating a separate channel for our chatbot and if it annoys you, then you can simply leave or mute the channel" (Interview #1). However, "if a separate channel is used, then, you risk not being able to reach all team members anymore. It has to be balanced how important it is that everyone sees it" (Interview #1). "If the channel is relatively important, [...], then you cannot mute it" (Interview #5). Oftentimes, "it depends on your job role, personally I have muted many of the channels in which chatbots regularly post messages except for the project [channels] where I'm responsible for. I have two projects where I as the architect have the technical responsibility and do have to know what my software developers commit and what bug reports are created" (Interview #5).

Interviewees expect to be able to "create some sort of digest, which means that I would be able to choose getting information [i.e., chatbot messages for a certain channel] only once per day, week, only during nights or just if it matches certain filter criteria" (Interview #15). Some interviewees perceived incoming information to be redundant, and thus, distracting. "At a certain point I had to say okay if I get this notification also here [within Slack] and I have already seen it before [notifications of the third-party system on mobile and desktop], then it distracts more than it is useful" (Interview #3). Furthermore, the textual representation of information was perceived as a constraint. "I like having information graphically prepared" (Interview #15).

Category 2. Affordances and Constraints Related to Getting Triggers

Next, three affordances (AFF-05 to AFF-07 in Table 19) ground in the potential of chatbots to allow setting and getting triggers.

Affordance	Context and Outcome of Affordance Actualization	Card Sorting Phase 2b & 3
Setting and getting reminders (AFF-05)	*Context (Beta, Theta)*. The default Slack Bot was used to prevent from forgetting to answer an incoming message. *Outcome*. Reminders to answer are posted to Slack channel at a chosen time.	**2.29** avg. sort position (with 1 being the most relevant of 3 cards) in Phase 2b. **0.93** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
	Context (Alpha, Delta). Chatbots were used to avoid that community tasks such as cleaning the office or periodic tasks such as daily scrum meetings are forgotten. *Outcome*. Reminders of expectable events are posted to Slack channel.	
Setting and getting nudges/ triggers to action (AFF-06)	*Context (Beta)*. Monitoring potential problems areas (e.g., unassigned pull requests, unresolved issues) is often annoying for managers and is therefore done by a chatbot. *Outcome*. Nudging employees to improve by creating and posting a daily digest with commitments and problem areas until they are fixed.	**2.00** avg. sort position (with 1 being the most relevant of 3 cards) in Phase 2b. **0.93** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
Setting and getting nudges/ triggers to action with possibilities to resolve it (AFF-07)	*Context (Gamma)*. Time tracking is a common task of employees. However, it often gets forgotten and is difficult to do later. To prevent this, a chatbot is used. *Outcome*. Reminders to capture working hours are posted and can be resolved by responding to the chatbot.	**1.71** avg. sort position (with 1 being the most relevant of 3 cards) in Phase 2b. **0.96** avg. Q-Sort ranking (from +2 to -2) in Phase 3.

Table 19. Affordances related to getting and setting triggers and reminders.

Higher level affordances. Setting reminders was perceived as affording automation of repetitive message flows and, thus, to relieves employees from repetitive work. "So that not every day someone has to write [to remind of the daily scrum meeting]" (Interview #3). Also, getting reminded to perform some task together with the potential to resolve it, was perceived as a chance to increase efficiency. "If I get reminded every evening [to capture the hours I worked], then everything is done in 3 seconds" (Interview #7). "I see a lot of potential for activities which are made regularly, but not every day" (Interview #6).

Furthermore, it was perceived as enforcing team discipline and compliance. As such, it provides "advice in accordance with our development culture" (Interview #4). For example, it includes problem areas and undisciplined behavior, such as unassigned pull requests or unassigned issues. Thus, it affords to shape the organizational culture. An interviewee stated that "sometimes something goes forgotten and then you get daily a reminder" and has compared it to previous situations in which "a project manager had this [...] job to run after all to say why are there no labels and why is this like that" (Interview #5).

On the one hand, such chatbots are perceived as tools to relieve managers from repetitive micromanagement tasks, which are then executed automatically in a consistent and exact way. "It is mainly a tool that helps our managers to enforce discipline. For me as a developer it is much less useful than for him" (Interview #5). On the other hand, the technology is perceived as an actor that "keeps its eyes on us and barks when it saw a slip in discipline" (Interview #4). However, "as soon as it becomes quantitative, employees begin to play out the whole thing. If you tell me one gets points for each movement on the [Kanban] board, then, I can create micro issues and move them through" (Interview #5).

Constraints. On the one hand, certain teams "want to keep up the degree of freedom so that we do not really want to squeeze ourselves into processes" (Interview #16). On the other hand, many bot-specific constraints were perceived, such as a lack of usability. The chatbot "only asks, I give the input and then it disappears. It should also be visually recognizable what I have entered. [...] But basically I think it is good when you are able to directly resolve things" (Interview #6). As a consequence, other technical artifacts often afford similar goal-oriented actions, e.g., "my calendar reminds me as well with a popup" (Interview #6).

Furthermore, interviewees expected "an official communication to everyone or for a certain group that informs what we want to achieve, and then that applies to all. [...] And that did not exist in this case, there was no communication. Suddenly, there was a bot who has asked me now and then what I do" (Interview #6).

Category 3. Affordances and Constraints Related to Queries and Invocations

Additional four affordances (AFF-08 to AFF-11 in Table 20) are reveal potentials to query and invoke functionality of third-party systems.

Affordance	**Context and Outcome of Affordance Actualization**	**Card Sorting Phase 2b & 3**
Capturing data (AFF-08)	*Context (Epsilon, Theta)*. When using Kanban boards for project management (e.g., Trello), chatbots help to capture data. *Outcome*. Command adds cards to Trello boards from within Slack channel.	**2.82** avg. sort position (with 1 being the most relevant of 4 cards) in Phase 2b. **0.39** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
Querying information (AFF-09)	*Context (Eta)*. Querying databases requires corresponding skills. To rapidly enable employees from sales to execute predefined queries, chatbots were used. *Outcome*. Available commands for everyone within the actualized channel to query the latest data.	**2.41** avg. sort position (with 1 being the most relevant of 4 cards) in Phase 2b. **0.10** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
Invoking functionality and making this invocation visible (AFF-10)	*Context (Beta)*. Status reports with repetitive elements can be partially generated by a chatbot to limit the required human input to writing a summary. *Outcome*. Available commands to partially generate status reports.	**2.06** avg. sort position (with 1 being the most relevant of 4 cards) in Phase 2b. **0.43** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
	Context (Alpha, Delta). Instead of creating video conference (e.g., join.me, appear.in) followed by sharing access details, bots are used to achieve both in one step. *Outcome*. Available commands to create and share access to a video conference within the corresponding channel.	

	Context (Beta). Instead of initiating software deployments from the isolated console, chatbots are harnessed to initiate deployments within Slack channels (e.g., the corresponding project channel). *Outcome*. Available commands to initiate deployment within Slack channels, which makes it is visible and traceable.	
Adding gatekeepers (AFF-11)	*Context (Beta).* Due to separation of duties, developers were separated from production environments with sensitive data and glued back together using chatbots. *Outcome*. Authorized legal responsible uses chatbot to confirm and trigger the provisioning of software to customer environments.	**2.71** avg. sort position (with 1 being the most relevant of 4 cards) in Phase 2b. **0.10** avg. Q-Sort ranking (from +2 to -2) in Phase 3.

Table 20. Affordances related to queries and invocations within Slack channels.

Higher level affordances. Being able to capture data into third-party systems directly from Slack was perceived as valuable to achieve everything in one place, but not necessarily act as a substitute for the third-party systems. "We do not want to replace it, we still open Trello but we have the possibility to capture tasks [directly within Slack]. This makes it much easier, because you can mark something, copy, and quickly pass it over [to Trello]" (Interview #16). Accordingly, it relieves employees from application switching.

Moreover, being able to query and invoke functionality from third-party systems was perceived as a possibility for rapidly building prototypes without having to develop and introduce yet another employee-facing user interface. It is useful "for new features that we develop and try out. So, you can prototype faster" (Interview #5). It was also used to provide a broader audience with access to third-party systems so "that they have an interface to pull information easily [from the database]" (Interview #15).

Using commands (or natural language) to invoke functionality within Slack does not only afford the accomplishment of the invocation itself, it also simultaneously affords visibility to all members of the team channel. For example, when directly deploying from the project channel within Slack, then, the information about who is deploying when is disclosed. "It saves to say I now have pushed a new version, because it happens automatically" (Interview #1). Hence, it affords automation and consequently ensures certain information flows. At the same time, invocations become traceable and searchable in real-time, thus, facilitating ambient awareness within the teams. "Usually just before 7, I open Slack and see what my colleagues in India have already done" (Interview #5). In turn, reactions and discussions enable fast feedback cycles.

Furthermore, possibilities to introduce gatekeepers arise, e.g., the default Slack bot tracks the status of people and intervenes when someone sends a message to ask if Slack should really push a notification, even though the user status is set on "do not disturb". This is helpful "in general to reduce noise, like a personal assistant as a gatekeeper" (Interview #5). In addition, invocations might be verified, delayed or prevented. In fact, chatbots afford to separate different organizational units (e.g., developers from the production environments of customers) and glue them back together.

Constraints. In the long run, querying information within Slack was found to be constraining, as compared to dedicated tools. "The company has grown now. For the beginning it was relatively simple and also easily possible [for the sales team to query data within Slack], but the more customers and the bigger the customers, you need proper tools for data processing, aggregation, and evaluation" (Interview #15).

Passing parameters with commands to invoke functionality was also perceived as constraining. "We then started to build our own tools, because it is annoying to pass numerous parameters with commands and they [i.e., existing Slack apps and integrations] are often not really configurable" (Interview #15).

Non-technical interviewees often expressed difficulties to obtain an idea about how certain Slack apps and integrations may create value. "What is missing are cases that point out how teams work with this and that and thus showing how it [i.e., the Slack app and integration] creates added value" (Interview #3).

Category 4. Affordances and Constraints Related to Enriching Messages

Finally, three affordances (AFF-12 to AFF-14 in Table 21) relate to enriching outgoing messages of human actors.

Affordance	**Context and Outcome of Affordance Actualization**	**Card Sorting Phase 2b & 3**
Having messages processed and enriched with content (AFF-12)	*Context (Alpha, Delta, Theta)*. Teams working with file management services (e.g., Dropbox, Google Drive) use apps and integrations to extend the functional scope.	**1.18** avg. sort position (with 1 being the most relevant of 2 cards) in Phase 2b.

	Outcome. Posted messages with links to files are processed (e.g., imported) and enriched (e.g., meta-information).	**0.29** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
Having messages processed and replaced (AFF-13)	*Context (Beta, Delta, Eta)*. As a response to the limiting interpersonal communication with textual messages, chatbots such as Giphy provide potentials to increase the expressive power of textual messages. *Outcome*. Using the available commands together with a keyword replaces the message with a topic-related gif image.	**1.82** avg. sort position (with 1 being the most relevant of 4 cards) in Phase 2b. **0.29** avg. Q-Sort ranking (from +2 to -2) in Phase 3.
Having messages processed and visually enriched with user interface elements (AFF-14)	*Context (Iota, Kappa, Lambda, Mu, Nu)*. Gathering feedback within teams by creating short polls and surveys is a frequent task of employees. However, when doing so by asking a simple question it is difficult to keep an overview of replies. *Outcome*. Polls are created within a channel of choice by employees can vote/ participate by using buttons, while the votes are visually aggregated.	Added after Phase 2b. **0.86** avg. Q-Sort ranking (from +2 to -2) in Phase 3.

Table 21. Affordances related to the enrichment of messages.

Higher level affordances. In the majority of the considered organizational contexts, variations of chatbots enrich messages with appropriate gif images to increase the expressive power of textual communication. Using them affords to foster team cohesion, spirit and fun, because "especially in a distributed team, it is relatively difficult to promote interpersonal communication" (Interview #5). Assuming that "you have forgotten something, then, a gif is shown from Barack Obama where he drops his microphone. This is just to promote interpersonal communication and to not having quite such a dry business context" (Interview #5). It is "just for fun, but I think to a relatively large extent, it helps to keep the people together" (Interview #15).

Having messages processed and enriched with additional information, was found to play well together with the basic functionality of Slack, e.g., by automatically importing files posted as links within a message to enable searches on it. Access to files can be simplified by automatically sharing it with channel members. Overall, it affords linking and consolidating third-party systems within Slack, e.g., traditional enterprise systems such as customer relationship management systems.

Constraints. It was stated that "much is about playing a bit and a bit of fun, but what is the real value added?" (Interview #3). Accordingly, the use has decreased over time. "When we introduced Slack, it almost exploded for three days, because for every word, you found [someone posting] a gif, which has led to whole conversations composed of GIFs, but this is not useful, just funny, what in turn is fine as well" (Interview #11).

Perceptional Similarities and Differences Among Employees

Conducting physical card sorting as part of the interviews of Phase 2b and the subsequent Q-Methodology study in Phase 3 reveals patterns of how employees weigh the perception of affordances against the perception of constraints that emerge from chatbots within enterprises. Specifically, our empirical data highlights both similarities as well as differences among employees in the perception of chatbots within enterprises. Perceptional similarities can be summarized along two dimensions.

First, we find that on average employees perceive affordances related to receiving messages from third-party systems (i.e., Category 1) as higher compared to all other affordances. This finding is true for both conducted card sorting studies (see the heatmap of values from Phase 2 and Phase 3 in Attachment 1). Though we explored the use of alternative messengers aside from Slack (i.e., Microsoft Teams and Telegram), the identified affordances and constraints within the enterprise context remained rather constant. However, aside from chatbots, Microsoft Teams provides tabs as an alternate form of messenger integrations with third-party systems, which offer similar affordances, e.g., both tabs as well as chatbots may be used to receive metrics and key performance indicators within Microsoft Teams (Interviews #26 and #27).

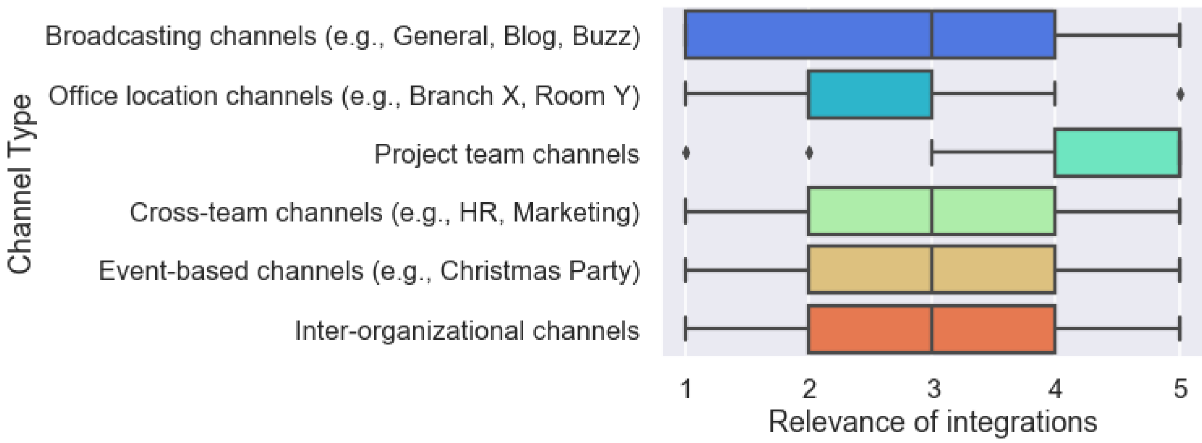

Figure 19. Relevance of chatbot integrations per channel type.

Second, throughout the participants of the Q-Study, the relevance of chatbots is assessed as highest in group channels that relate to projects at work (see Figure 19). In contrast, the variance in the assessed relevance of chatbots was much higher for all other types of group channels. In fact, this variance in the relevance of certain channels is also reflected in the qualitative interviews. For example, an interviewee explained that inter-organizational channels became relevant when they moved to a new co-working space that promoted such a channel (Interview #2). We find that changes of the socio-technical context over time (e.g., hiring new co-workers, changing the office location, introducing new third-party systems) alter the coordination needs and, thus, the perception of chatbots by employees. In turn, this leads over to the perceptional differences studied in our Q-Methodology study.

Our results highlight five factors that represent perceptional differences among employees in the form of five distinct viewpoints on chatbots. Specifically, we find that chatbots within enterprise messengers are viewed (1) as operational assistants, (2) as central information hubs, (3) as difficult to use black boxes and worse alternatives to dedicated tools, (4) as shadow IT in restrictive and closed legacy environments, and (5) as spammy and process-enforcing burden. In the following we elaborate each of the five viewpoints and present the idealized Q-Sort in Figure 20 to Figure 24.

Viewpoint 1 - As an Operational Assistant at a Central Point of Team Coordination

The first viewpoint reveals a group of employees that perceive chatbots within enterprise messengers as operational assistants that help them invoking functionality from third-parties, setting and getting reminders within channels, receiving real-time information and having messages processed as well as visually enriched (e.g., in the form of polls): "Sometimes we need to create a poll to decide about some things as a team. That's why it's very useful that we can do it in here where all team members have access to and can come back to see the result" (Participant 19). In line with the identified higher-level affordance of relieving employees from application switching, one participant commented on the Q-Sort as follows: "It is particularly helpful, because I do not need to open a new program and, hence, I can save a lot of time" (Participant 8).

-2	-1	0	1	2
CON-03 Most of my work is not digital.	CON-13 It is difficult to know how to use them.	AFF-09 Querying information from third-party systems within channels.	AFF-07 Setting and getting nudges/ triggers to action and possibilities to resolve it within the channel.	AFF-14 Having messages processed and visually enriched with user interface elements.
∗∗◄ CON-05 Repetitive information since I often already know the information from alternative sources such as notifications.	CON-09 Information is concealed after I sent the message.	AFF-12 Having messages processed and enriched with additional information.	AFF-06 Setting and getting nudges/ triggers to action within channels.	AFF-02 Receiving real-time information from third-party systems within channels.
CON-02 My company constraints the usage of such messengers.	CON-04 They lead to information overload.	AFF-03 Receiving aggregated information from third-party systems within channels.	AFF-04 Receiving metrics and key performance indicators from third-party systems within channels.	∗► AFF-10 Invoking functions from third-party systems and make this invocation visible within channels.
CON-14 It is more about playing and having fun than real value added.	CON-06 Repetitive information since I use these systems in my everyday work.	CON-11 Lack of rich user interface elements for entering data.	AFF-01 Receiving status notifications and updates from third-party systems within channels.	AFF-05 Setting and getting reminders within channels.
	CON-08 They introduce process-orientation and reduce my autonomy.	AFF-08 Capturing data in third-party systems from within channels.	CON-01 Most software at work is not open enough and has limited integrations with messenger.	
	CON-10 I can achieve the same results with dedicated tools.	AFF-11 Adding gatekeepers that validate access to functions of third-party systems.	AFF-13 Having messages processed and replaced.	
		CON-07 The presented information lacks graphical and visual richness.		
		CON-12 Lack of configuration possibilities without programming customized integrations.		

Legend

∗ Distinguishing statement at P< 0.05
∗∗ Distinguishing statement at P< 0.01
► z-Score for the statement is higher than in all other factors
◄ z-Score for the statement is lower than in all other factors

Figure 20. Q-Sort Viewpoint 1: Operational Assistant.

A second thought pattern that is shared among this group of employees is the value that arises from the central point of team coordination: "If one starts a deployment to production, another needs to confirm in Slack. Once it's done, a quality assurance engineer needs to confirm that everything is ok. All information of a deployment is easily visible in the Slack channel and one can comment on it" (Participant 15). Accordingly, the Q-Sort shows that employees of this group strongly disagree with the assertion that information is repetitive due to alternate systems such as email. Comments reveal that organizations of this group of employees have mostly replaced emails: "I'm often using Slack instead of Email" (Participant 5).

Viewpoint 2 - As a Central Information Hub for the Coordination of Human and Machine Work

The second viewpoint highlights the value of chatbots in contemporary enterprise messengers to keep pace with what is going on at work by automating status notifications and updates. "When I log on, I quickly see what I've missed" (Participant 21). "It is super convenient to have all notifications in one place. I don't like to check all tools every day to see if something has come up" (Participant 16). In line with the very nature of “instant” messengers to facilitate real-time information between humans, chatbots extend this possibility with real-time information from third-party systems: "Issues and GitHub commits are reported live and give an overview of what is currently going on" (Participant 28). Similar to employees that perceive chatbots as operational assistants, members of this group heavily rely on chatbots in their work practices: "When I know that Slack will send me a message when my build fails, then I don't check the other tools. Thus, the confidence in the integration must be so good that you no longer have to check the other tool" (Participant 2).

-2	-1	0	1	2
CON-06 Repetitive information since I use these systems in my everyday work.	** CON-05 Repetitive information since I often already know the information from alternative sources such as notifications.	AFF-12 Having messages processed and enriched with additional information.	AFF-07 Setting and getting nudges/ triggers to action and possibilities to resolve it within the channel.	**► AFF-01 Receiving status notifications and updates from third-party systems within channels.
CON-08 They introduce process-orientation and reduce my autonomy.	CON-01 Most software at work is not open enough and has limited integrations with messenger.	AFF-11 Adding gatekeepers that validate access to functions of third-party systems.	AFF-03 Receiving aggregated information from third-party systems within channels.	AFF-02 Receiving real-time information from third-party systems within channels.
CON-13 It is difficult to know how to use them.	CON-10 I can achieve the same results with dedicated tools.	AFF-09 Querying information from third-party systems within channels.	AFF-08 Capturing data in third-party systems from within channels.	AFF-05 Setting and getting reminders within channels.
CON-03 Most of my work is not digital.	CON-02 My company constraints the usage of such messengers.	CON-04 They lead to information overload.	AFF-04 Receiving metrics and key performance indicators from third-party systems within channels.	AFF-06 Setting and getting nudges/ triggers to action within channels.
	CON-07 The presented information lacks graphical and visual richness.	**◄ AFF-13 Having messages processed and replaced.	AFF-10 Invoking functions from third-party systems and make this invocation visible within channels.	
	CON-14 It is more about playing and having fun than real value added.	CON-11 Lack of rich user interface elements for entering data.	AFF-14 Having messages processed and visually enriched with user interface elements.	
		CON-12 Lack of configuration possibilities without programming customized integrations.		
		CON-09 Information is concealed after I sent the message.		

Figure 21. Q-Sort Viewpoint 2: Central Information Hub.

A further perspective that is taken is the that information from humans and machines come together in one place: "So far I found no other tool that allows me to integrate information from all other systems and, at the same time, can be used as a communication channel" (Participant 16). Following this line of thought suggests that employees like switching back and forth between passively following work activities and actively coordinate work: "With HipChat it is possible to collect all information about a topic and to discuss problems (e.g., build errors) immediately. That's why I notice HipChat notifications more than mail notifications." (Participant 24). Consequently, this viewpoint goes along with task dependencies: "It raises awareness when someone contributed or finished a part of work that is relevant for one’s own task" (Participant 5).

Viewpoint 3 - As a Difficult to Use Black Box and a Worse Alternative to Dedicated Tools

The third viewpoint reflects the opinion of a critical group of users that shares concerns regarding usability and that is skeptical that chatbots provide an added value in comparison to dedicated tools with richer user interfaces. On the one hand, the Q-Sort highlights agreement with constraints in the ease of use of chatbots that are integrated into the conversational thread: “most of the integrations I don't use, because it's not worth the effort, I prefer to use the original application" (Participant 20).

-2	-1	0	1	2
CON-14 It is more about playing and having fun than real value added.	AFF-06 Setting and getting nudges/ triggers to action within channels.	AFF-12 Having messages processed and enriched with additional information.	CON-10 I can achieve the same results with dedicated tools.	AFF-02 Receiving real-time information from third-party systems within channels.
CON-03 Most of my work is not digital.	CON-12 Lack of configuration possibilities without programming customized integrations.	AFF-05 Setting and getting reminders within channels.	CON-05 Repetitive information since I often already know the information from alternative sources such as notifications.	AFF-13 Having messages processed and replaced.
AFF-10 Invoking functions from third-party systems and make this invocation visible within channels.	CON-08 They introduce process-orientation and reduce my autonomy.	AFF-08 Capturing data in third-party systems from within channels.	AFF-03 Receiving aggregated information from third-party systems within channels.	CON-09 Information is concealed after I sent the message.
CON-02 My company constraints the usage of such messengers.	CON-04 They lead to information overload.	AFF-01 Receiving status notifications and updates from third-party systems within channels.	CON-06 Repetitive information since I use these systems in my everyday work.	CON-13 It is difficult to know how to use them.
	CON-01 Most software at work is not open enough and has limited integrations with messenger.	AFF-07 Setting and getting nudges/ triggers to action and possibilities to resolve it within the channel.	AFF-14 Having messages processed and visually enriched with user interface elements.	
	AFF-11 Adding gatekeepers that validate access to functions of third-party systems.	AFF-09 Querying information from third-party systems within channels.	CON-11 Lack of rich user interface elements for entering data.	
		AFF-04 Receiving metrics and key performance indicators from third-party systems within channels.		
		CON-07 The presented information lacks graphical and visual richness.		

Figure 22. Q-Sort Viewpoint 3: Difficult to Use Black Box and Worse Than Dedicated Tools.

On the other hand, information is concealed after messages are exchanged: "It's very hard to keep track of information, there is no system, only the chronology of the messages" (Participant 20)”. As such, the perspective of this group is in contrast to the previous two viewpoints, even though all three groups compare chatbots with alternate tools: "probably I could achieve the same result with other tools, but not in the same time, e.g., if I would have to check one system for my alerts, talk to my colleagues in another tool and, then, analyze it further in a third tool, I would need much more time" (Participant 11). Nevertheless, this rather skeptical group shares the perception that chatbots are valuable for receiving real-time information and as a means for having messages processed and replaced (e.g., through a Giphy integration): "Most things are easier in a dedicated tool, but the most important thing for integrations are notifications and message enhancements" (Participant 1).

Viewpoint 4 - As Shadow IT in a Restrictive and Closed Legacy Environment

The fourth viewpoint can be symbolically described as “driving with the handbrake on”. Namely, it represents the perceptions of employees, which use enterprise messengers in (large) companies that constraint the usage of such enterprise messengers. In addition, the perceptions are shaped by barriers that result from the available IT infrastructure with a portfolio of enterprise software that is not open enough and lacks integrations into these enterprise messengers.

-2	-1	0	1	2
CON-03 Most of my work is not digital.	AFF-04 Receiving metrics and key performance indicators from third-party systems within channels.	AFF-06 Setting and getting nudges/ triggers to action within channels.	AFF-07 Setting and getting nudges/ triggers to action and possibilities to resolve it within the channel.	**▶ CON-02 My company constraints the usage of such messengers.
AFF-01 Receiving status notifications and updates from third-party systems within channels.	AFF-05 Setting and getting reminders within channels.	CON-12 Lack of configuration possibilities without programming customized integrations.	AFF-14 Having messages processed and visually enriched with user interface elements.	AFF-13 Having messages processed and replaced.
CON-13 It is difficult to know how to use them.	CON-11 Lack of rich user interface elements for entering data.	CON-09 Information is concealed after I sent the message.	AFF-09 Querying information from third-party systems within channels.	*▶ AFF-12 Having messages processed and enriched with additional information.
CON-14 It is more about playing and having fun than real value added.	CON-08 They introduce process-orientation and reduce my autonomy.	AFF-10 Invoking functions from third-party systems and make this invocation visible within channels.	AFF-08 Capturing data in third-party systems from within channels.	CON-01 Most software at work is not open enough and has limited integrations with messenger.
	CON-04 They lead to information overload.	AFF-03 Receiving aggregated information from third-party systems within channels.	CON-05 Repetitive information since I often already know the information from alternative sources such as notifications.	
	CON-07 The presented information lacks graphical and visual richness.	AFF-11 Adding gatekeepers that validate access to functions of third-party systems.	AFF-02 Receiving real-time information from third-party systems within channels.	
		CON-06 Repetitive information since I use these systems in my everyday work.		
		CON-10 I can achieve the same results with dedicated tools.		

Figure 23. Q-Sort Viewpoint 4: Shadow IT in a Restrictive and Closed Legacy Environment.

Participants that agree to CON-01 and CON-02 in their Q-Sort comment this viewpoint as follows: "The current legacy systems are not made for such cloud-based tools. Currently I'm working at a big insurance company where most of their systems do not work with Slack or a similar tools" (Participant 7). "Unfortunately, I cannot even connect our ticketing or CRM system to Slack or other messenger systems due to data security reasons. I can of course understand the reasoning behind this decision, but it would be possible to properly handle such integrations (with some more effort) to be compliant with obligations we have towards our customers" (Participant 4). Accordingly, the value of chatbots in such work environments is limited. "We use some closed software that would be neat to integrate to Slack, but which cannot be done. If it would be possible, the value of integrations would be higher" (Participant 26).

Viewpoint 5 - As Spammy and Process-Enforcing Burden

The fifth viewpoint represents a drawback from using chatbots to receive messages from third-party systems. This group of employees shares the feeling that such integrations lead to information overload: "I can't work when I'm bombarded by everything that is happening around me. Important messages are already conveyed through phone or in person. If there is a real issue, people will notice" (Participant 14).

-2	-1	0	1	2
CON-13 It is difficult to know how to use them.	CON-10 I can achieve the same results with dedicated tools.	**► CON-14 It is more about playing and having fun than real value added.	AFF-07 Setting and getting nudges/ triggers to action and possibilities to resolve it within the channel.	AFF-14 Having messages processed and visually enriched with user interface elements.
**◄ AFF-02 Receiving real-time information from third-party systems within channels.	CON-01 Most software at work is not open enough and has limited integrations with messenger.	CON-12 Lack of configuration possibilities without programming customized integrations.	AFF-05 Setting and getting reminders within channels.	AFF-03 Receiving aggregated information from third-party systems within channels.
**◄ AFF-08 Capturing data in third-party systems from within channels.	AFF-10 Invoking functions from third-party systems and make this invocation visible within channels.	CON-11 Lack of rich user interface elements for entering data.	AFF-13 Having messages processed and replaced.	**► CON-04 They lead to information overload.
AFF-01 Receiving status notifications and updates from third-party systems within channels.	CON-03 Most of my work is not digital.	AFF-04 Receiving metrics and key performance indicators from third-party systems within channels.	**► CON-08 They introduce process-orientation and reduce my autonomy.	AFF-06 Setting and getting nudges/ triggers to action within channels.
	AFF-09 Querying information from third-party systems within channels.	CON-06 Repetitive information since I use these systems in my everyday work.	CON-05 Repetitive information since I often already know the information from alternative sources such as notifications.	
	CON-02 My company constraints the usage of such messengers.	CON-07 The presented information lacks graphical and visual richness.	AFF-11 Adding gatekeepers that validate access to functions of third-party systems.	
		AFF-12 Having messages processed and enriched with additional information.		
		CON-09 Information is concealed after I sent the message.		

Figure 24. Q-Sort Viewpoint 5: Spammy and Process-Enforcing Burden.

At the same time, employees point out the importance of a proper configuration of chatbots to keep employees engaged in team channels: "I hate getting automated messages as they end up in spamming the whole channels and no one reacts to updates anymore" (Participant 27). Further differences in viewpoints become apparent in how employees perceive the introduction of process-orientation within social information systems. One standpoint is shaped by perceptions of employees that suffer from a reduced degree of autonomy, since chatbots are "another way for people to leave a paper trail which you have to follow" (Participant 14). This is heavily in contrast to other participants from other organizational settings: "At least in our company, all the integrations are complementary, and employees are not enforced to use it. The ones that see a benefit in it are using it, the other ones can do the same stuff with proprietary dedicated applications" (Participant 3). Lastly, participants explain that the perception of information overload depends on the job profile and employment type: "One issue is that part-time employees are not interested in getting the information about a certain project on the days they don't work for this project" (Participant 25).

Discussion and Implications

Our results show higher-level affordances that emerge for members of group channels in which the 14 lower-level affordances are actualized. Grounded in the emergence of higher-level affordances, we now discuss broader implications of our insights.

Crossing the Chasm: Chatbots Augment Social Information Systems with Affordances of Traditional Enterprise Systems

Figure 25 illustrates how the identified higher-level affordances of chatbots within enterprise messengers enable organizations (1) to facilitate alignment by integrating information (e.g., by receiving messages that consolidate information flows), (2) to provide control mechanisms (e.g., by getting and setting triggers that enforce discipline), (3) to enable interoperability (e.g., by querying and invoking functionality in order to unify access to third-party systems), and (4) to increase efficiency (e.g., by enriching messages to relieving employees from repetitive work).

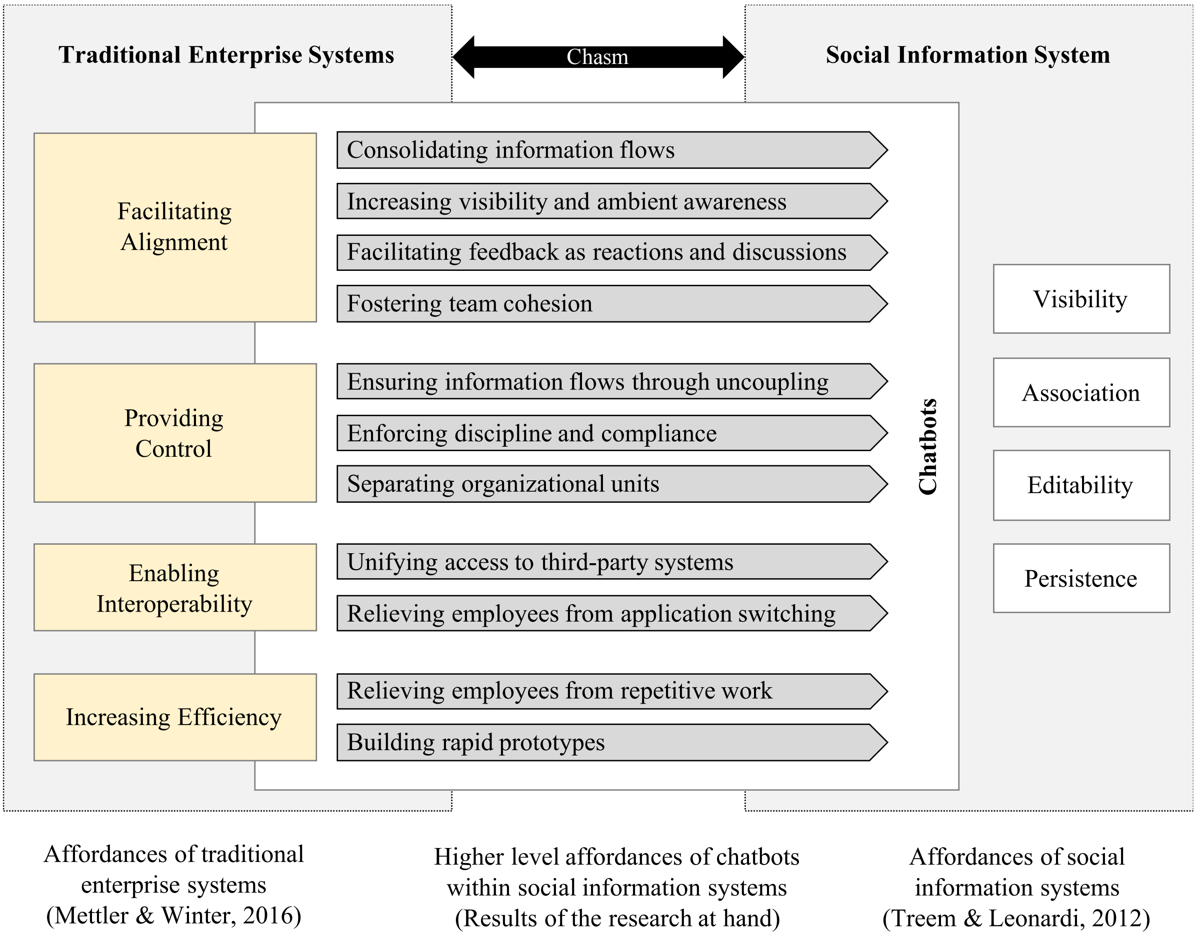

Figure 25. Chatbots augment social information systems with affordances of traditional enterprise systems.

In turn, these four dimensions (i.e., alignment, control, interoperability, efficiency) are well-known affordances of traditional enterprise systems (Mettler & Winter, 2016). We therefore argue that chatbots augment social information systems of organizations (e.g., enterprise messengers such as Slack and Microsoft Teams) with affordances of traditional enterprise systems. This is achieved by enabling the linkage of social interactions within enterprise messengers with third-party systems and business processes. Hence, chatbots can be seen as valuable to cross the chasm between traditional enterprise systems and social information systems.

Triangulating this insight with our results from the preliminary study in which we crawled the full list of publicly available Slack Apps and Integrations enables a discussion of broader implications. Figure 26 shows the number of Slack Apps and Integrations (and their absolute growth) per category. In particular, the categories related to communication and coordination, human resources (HR), and project management have grown tremendously over the past two years, which may not only affect the corresponding enterprise systems, but also the corresponding research streams. However, this also applies to categories such as marketing, distribution and customer support, which doubled in the number of integrations with third-party enterprise systems.

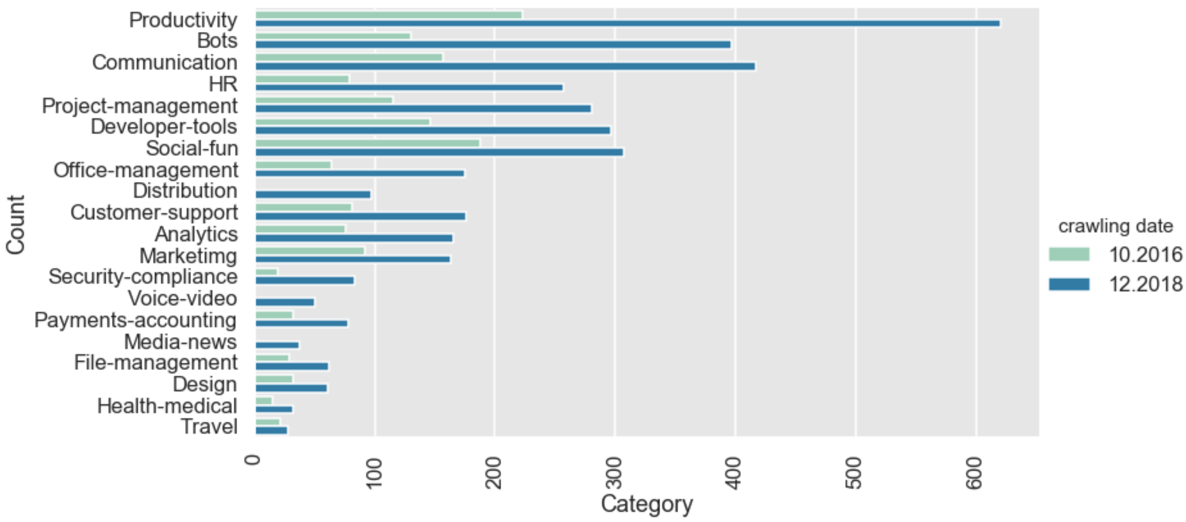

Figure 26. Development of Slack Apps and Integrations from 2016 to 2018 (sorted by absolute growth).

Implications for Theory

Augmenting social information systems with affordances of enterprise systems contrasts prior research that highlights traditional enterprise systems that are enhanced with social features. For example, social features are added to business process management (BPM) systems (Bruno et al., 2011; Schmidt & Nurcan, 2009), business intelligence (BI) software (Alpar, Engler, & Schulz, 2015), enterprise resource planning (ERP) systems (Shankararaman & Kit Lum, 2013), and inter-organizational systems such as supply chain management (SCM) software (Gonzalez, 2013; Steinhueser, Richter, & Smolnik, 2015). In contrast, our research puts social information systems at the focal point (e.g., Slack and Microsoft Teams) and explains how chatbots augment these social information systems with affordances of traditional enterprise systems. Therewith, we contribute a novel perspective on the integration and entanglement of social and enterprise systems that has four essential implications for theory.

First, crossing the chasm between social and traditional enterprise systems has broader implications that extend the discourse on paradoxical tensions (Ciriello, Richter, & Schwabe, 2018b; Smith, Erez, Jarvenpaa, Lewis, & Tracey, 2017). Namely, we offer a novel perspective on how organizations may balance novel digital with traditional systems, flexibility and malleability with stability and control, exploration with exploitation, and agility with discipline approaches. More specifically, our results show how novel digital technologies can be combined with traditional enterprise systems (Seddon et al., 2010; Sedera & Lokuge, 2017; Sedera et al., 2016). This is particularly relevant, since organizations are moving away from monolithic enterprise systems into portfolios of interlinked information systems and digital platforms, which provide them with an "ecosystem of providers and suppliers of tools, techniques, and practices, beyond the conventional boundaries of traditional corporate IT" (Harris, Ives, & Junglas, 2012; Sedera et al., 2016, p. 367; Yoo et al., 2012). Further, our results point out that enterprise messengers as social information systems are not limited to their well-known characteristics of flexibility and malleability (Richter & Riemer, 2013; Schmitz et al., 2016). In fact, chatbots can help organizations in their digital and distributed innovation endeavors which demand for carefully balancing flexibility and malleability with stability and control (Ciriello et al., 2018a; Tilson et al., 2010; Yoo et al., 2012). In a broader perspective, this may enable organizations to balance their exploration (innovation) and exploitation (efficiency) activities, thus, to improve their organizational ambidexterity (Andriopoulos & Lewis, 2009; March, 1991; Tushman & O Reilly, 1996). Finally, agile software development approaches are characterized by self-organizing and cross-functional teams that rely on rapid feedback and change to continuously design, improvement, and test software (Conboy, 2009; McHugh, Conboy, & Lang, 2011; Tripp, Riemenschneider, & Thatcher, 2016; Wang et al., 2012).

However, a central challenge of agile teams is to find the right degree of formalization and coordination within project teams (Strode, Huff, Hope, & Link, 2012) and between self-managed teams (Ingvaldsen & Rolfsen, 2012). In particular, research is needed on how to scale agility and balance agility with discipline and plan-driven approaches (Boehm & Turner, 2003; Dingsøyr, Moe, Fægri, & Seim, 2018; Gerster, Dremel, & Kelker, 2018). Our results show how agile teams adopt enterprise messengers in practice and reveal that for some employees chatbots act as a central hub to coordinate human and machine work (Viewpoint 2), while for others they become a process-enforcing burden (Viewpoint 5).

Second, our results have implications for research on distributed and virtual work. Namely, prior research on distributed (Cummings, Espinosa, & Pickering, 2009; Srikanth & Puranam, 2011; Vlaar, van Fenema, & Tiwari, 2008) and virtual work (Bailey, Leonardi, & Barley, 2012; Griffith, Sawyer, & Neale, 2003; Jarvenpaa & Leidner, 1999; Maznevski & Chudoba, 2000) emphasizes the growing relevance of digital technologies to overcome the challenge of spatial and temporal distances. Our results illustrate novel work practices that go beyond human-to-human collaboration and include machine-to-human as well as human-to-machine collaboration. The identified affordances may contribute to impede the problems faced in distributed and virtual work. Namely, prior research suggests the separation of work in distributed teams impedes the ability of employees to communicate effectively (Meyer et al., 2015). Cramton (2001) distinguishes five types of mutual knowledge problem that distributed teams face: failure to communicate and retain contextual information, unevenly distributed information, difficulty communicating and understanding the salience of information, differences in speed of access to information, and difficulty interpreting the meaning of silence. Identified higher-level affordances such as 'consolidating information flows', 'increasing visibility and ambient awareness', 'facilitating feedback as reactions and discussions', 'ensuring information flows through uncoupling', and 'unifying access to third-party systems' suggest that chatbots may contribute to impede these problems. Furthermore, distributed teams are known to face trust issues (Jarvenpaa & Leidner, 1999; Newell, David, & Chand, 2007). The identified higher-level affordances such as 'increasing visibility and ambient awareness', 'facilitating feedback as reactions and discussions', and 'fostering team cohesion' suggest that chatbots may also contribute to impede trust issues in distributed teams.

Third, our results contribute to ongoing discourse on automation of work and the interplay between humans and machines (vom Brocke et al., 2018). We do this by pointing out higher-level affordances of chatbots that are characterized by their potentials for task automation (e.g., consolidating information flows, ensuring information flows through uncoupling, and relieving employees from repetitive work). Anchored in the principle of egalitarianism within social information systems, each member can add and use chatbots in the context of their conversational threads. As such, the principle of social production in social information systems goes beyond traditional user-generated content and includes the co-creation of automated information and workflows within shared conversational threads. Hence, we demonstrate how chatbots are a powerful instrument to enable organizational automation from bottom-up (rather than top-down). This is relevant, because automation is a key pillar of the current discourse on future work, which is increasingly performed by machines (vom Brocke et al., 2018). In this context, prior research has discussed how big data analytics technologies become generative digital technologies that enable service innovation (Lehrer et al., 2018), how hybrid intelligent decision support systems should be designed (Dellermann, Lipusch, Ebel, & Leimeister, 2018), and how the underlying logic of work is changing (Tumbas, Berente, & vom Brocke, 2018). In addition, we contribute a novel perspective on the interplay of people and machines that extends the ongoing discourse on hybrid arrangements of work. We do this by highlighting how social information systems (e.g., Slack and Microsoft Teams) are key organizational resources to enable bottom-up driven automation of communication, coordination and collaboration.

Fourth, our results have implications for performance feedback literature. Both academic literature (Levy, Tseng, Rosen, & Lueke, 2017; Schleicher et al., 2018) and practice-oriented literature (Armitage & Parrey, 2013; Buckingham & Goodall, 2015; Cappelli & Tavis, 2016) emphasizes that traditional performance management lacks to be in line with current business cycles in providing timely feedback. The identified affordances reveal how chatbots (1) enable computer-generated feedback through automated information flows, and (2) facilitate computer-mediated feedback between employees through reactions and discussions. Given this use of chatbots to facilitate timely feedback, they can be seen as a complementary alternative to computer-mediated digital feedback systems such as dedicated feedback apps (Stoeckli et al., 2019). Therewith, our findings respond to calls for research to increase our understanding of informal day-to-day feedback and to investigate technology usage for performance management (Ashford & Cummings, 1983; Levy et al., 2017; Schleicher et al., 2018). For example, the chatbot in organization Beta calculates velocity measures and posts the relative movement of each project to conversational threads (see Figure 18). Also, the companies Epsilon, Eta and Theta harness chatbots to post analytics data, reviews and ratings from app stores to the corresponding project channels. These automated feedback flows described in the present research can be interpreted as computer-generated feedback that comes from the job (Hackman & Oldham, 1976) rather than from other co-workers (Hackman & Lawler, 1971). These findings are in line with literature that investigates chatbots dedicated to feedback exchange (Lechler, Stoeckli, Rietsche, & Uebernickel, 2019). However, the implications of this research are much broader. Figure 26 highlights the diversity of integrations with numerous enterprise systems (e.g., software for distribution, customer support, marketing, accounting, and design), which may be used to assess the performance and generate feedback. As such, chatbots can be seen as feedback facilitating digital technologies that facilitate self-monitoring of teams (Hermsen, Frost, Renes, & Kerkhof, 2016). This, in turn, is particularly interesting in the light of agile practices that institutionalize feedback (McHugh et al., 2011; Tripp et al., 2016).

Implications for Practice

Chatbots provide value potentials for organizations to improve internal workflows and collaboration through facilitating and enabling to harness enterprise systems affordances (i.e., facilitating alignment, providing control, enabling interoperability, and increasing efficiency) in the context of social information systems (e.g., Slack).

This has three key implications for practitioners in the light of an increasingly digital world that demands for distributed innovation. First of all, firms should leverage the social features of their (existing) social information systems to integrate their enterprise systems through chatbots rather than enrich each traditional enterprise system with social features. Second, our findings underline the relevance of opening up traditional enterprise systems through the conscious design of corresponding interfaces (e.g., API's) to allow bridging the world of traditional enterprise systems and social information systems. This in turn, allows to harness our identified affordances. Third, organizations should be aware that while traditional enterprise systems were usually top-down driven, social information systems are bottom-up driven. While chatbots do bridge this chasm, this may have positive and negative consequences. On the one hand, employees can harness chatbots for bottom-up driven automation. On the other hand, employees may integrate traditional enterprise without awareness of its consequences (e.g., introducing a chatbot that posts feedback in the form of metrics in group channels should be well thought-out, since it has severe consequences on job satisfaction and motivation).

Affordance-Theoretical Peculiarities of Chatbots

Interpreting the results through the affordance theory reveals further characteristics of chatbots in general.

Affordance-related dependencies between individual actors. The perception of affordances depends on the available information (Bernhard et al., 2013). Markus and Silver (2008), for example, emphasize the symbolic expressions that are communicated by IT artifacts to a potential user to reveal meaning and potential uses. In this regard, chatbots have a major disadvantage, because their symbolic expressions are rare (especially for chatbots of Category 3 and Category 4). First, the information on available chatbots is hidden and has to be polled by the user through interaction with the chatbot. Second, for a given chatbot, our interviewees indicated struggles with recognizing the available possibilities for action. Interestingly, our results reveal affordances of chatbots with the characteristics that their actualization within a shared conversational thread leads to effects that are disclosed to other members of the channel. This either occurs 1) when the outcome of the actualization is posted into the shared conversational thread (e.g., creating video conference by invoking functionality and making invocation visible as described in Affordance 3.4), and 2) when the text entered by the actualizing user is disclosed in the conversational thread (e.g., "/poll 'Do you like this article so far?' 'Yes' 'No'). Therewith, the information about the availability of the actualized action potential becomes visible to others. From an affordance point of view, this indicates that the actualization of lower-level affordances by User 1 may lead to its perception by User 2 (see Figure 27).

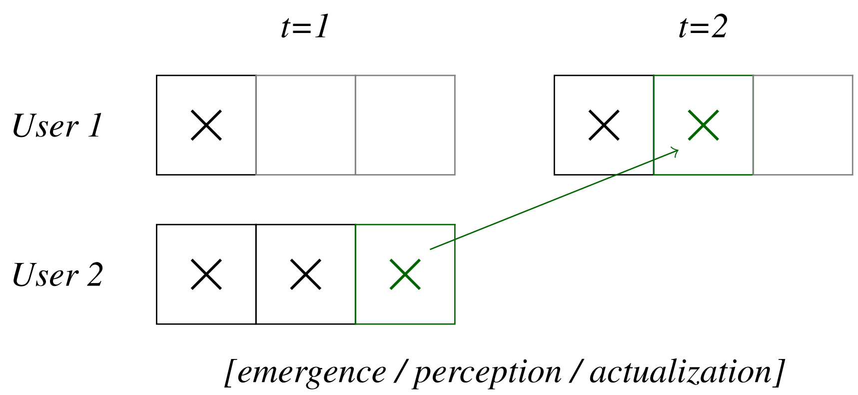

Figure 27. The actualization of an affordance by one user may facilitate its perception by another user

Emergence of individualized, collective, and shared affordances. While technical users may develop and install custom chatbots, most users may simply install publicly available chatbots (e.g., from the Slack App Directory). However, in both cases, adding a chatbot to a conversational thread leads to the emergence of new affordances for the other members of this channel. The channel in which a chatbot is added to and in which the corresponding affordances are eventually actualized is socially determined by the actualizing user. Thus, the same IT artifact can be put into different social contexts by the appropriating user and, thus, different kinds of affordances may emerge, e.g., individualized, collective or shared affordances (Paul M Leonardi, 2013) as well as constraints. For example, a chatbot to capture a Trello task within Slack (Affordance 3.1) may be used individually, thus, leading to an individualized affordance. However, a user may put the same chatbot to a shared conversational thread. Shared affordances describe the similar use of the features of an IT artifact by all considered actors (Paul M Leonardi, 2013) and emerge "as soon as several individuals know a function" (Balci, Rosenkranz, & Schuhen, 2014, p. 8). Collective affordances are collectively created by all actors of a group allowing the group to achieve something, which otherwise would not be possible (Balci et al., 2014; Paul M Leonardi, 2013). As such, the characteristic described above (i.e., visibility of the actualization by one user for other users) can be seen to facilitate shared as well as collective affordances. However, our results show how these higher-level affordances may not only be enabling, but also constraining, e.g., if members of a shared conversational thread do not share the same goals. This is where we see the biggest value and likewise the biggest challenge arising from chatbots that are integrated in shared conversational threads (e.g., by facilitating reactions, discussions, ambient awareness).

High actualization effort. Prior research suggests that the actualization and, accordingly, the realization of effects, is influenced by the actualization effort and the expected outcome (Bernhard et al., 2013). In our research, the perceived expected outcome depends on how other members of the channel act. In fact, our results reveal constraints, such as information overload. At the same time, the perceived expected outcome can also change over time. Affordances have to be seen in the context of the alternatives, because employees constantly compare affordances (Glowalla et al., 2014). Thus, our results indicate, that the actualization effort has to be in balance with the perceived expected outcome to facilitate the actualization of the respective affordances and thus the successful use of the IT artifact.

Implications for Theory

Through backing our research endeavor with the affordance theory, we contribute three important theoretical implications to the extant body of knowledge. First, though several authors focus on the interrelationship of affordances (e.g., through an affordances dependency diagram (Strong et al., 2014)), it remains unclear how the actualization of affordances affects the context-specific perception of affordances and constraints of other users (Bloomfield, Latham, & Vurdubakis, 2010; Strong et al., 2014). Against this backdrop, our research illuminates how the actualization of one user may facilitate the emergence and the consecutive perception by another user. In contrast, prior research has shown dependencies between individual affordances (Glowalla et al., 2014) and dependencies between different unit of analyses, e.g., individual and organizational affordances (Strong et al., 2014). Second, drawing on the concept of individualized, shared, and collective affordances of Leonardi (2013), we detail how the use of chatbots in diverse social contexts may lead to the emergence of either individualized, shared, and collective affordances through affecting the techno-organizational context. Third, following the thinking of Bygstad et al. (2016) the manipulation of the techno-organization context (i.e., entangled networks of human, social and technical objects) through the actualization of affordances is supposed to affect not only the emergence, perception, and actualization of affordances but also the emergence of constraints. Through eliciting the constraints of the use of chatbots, we contribute empirical insights on how the actualization of an affordance affects the techno-organizational context and, in turn, the emergence, perception, and actualization of affordances.

Implications for Practice

These findings have implications for organizations that design instance messengers and chatbots as well as for organizations that use chatbots.

First, designers of instant messengers need to acknowledge that, given a particular chatbot, members of group channels perceive different higher-level affordances and constraints (see Figure 17 and Figure 27). Our results suggest that offering options to individually mute channels does not solve this issue, because the perceived constraints (e.g., message postings leading to information overflow) are not in line with the perceived relevance of human conversations in group channels (e.g., muting its team channel may not be an option for its manager, however, a chatbot that floods the corresponding channel with operational details may be perceived as constraining). Furthermore, providing chatbot developers with graphical user interface elements may help to reduce the relatively high actualization effort.

Second, designers of chatbots should consider the affordance-related dependencies between individual users to counter the disadvantage of rare symbolic expressions (while preventing information overflow). Specifically, we have shown that the visibility of the actualization of an affordance by one user may lead to its perception by other users (and hence, may foster adoption), or also to the emergence of constraints such as information overflow. Furthermore, designers of chatbots should try to foster affordance actualization by reducing the relatively high actualization effort through the exploitation of graphical user interface elements (e.g., reducing effort for data input through buttons).

Third, the three discussed affordance-theoretical peculiarities of chatbots need to be considered by organizations that use chatbots. In particular, the social context in which chatbots are introduced (i.e., the group channel) influence to a large extend what higher-level affordances and constraints emerge. Before introducing chatbots, employees should consciously consider their set of group channels and the corresponding needs of group members.

Conclusion and Future Research

In summary, we shed light on the previously unexplored and novel phenomenon of chatbots in the context of enterprise messengers by pointing out 14 lower-level affordances and constraints along four categories: receiving messages, getting and setting triggers, executing queries and invocations, and enriching messages. Our results further reveal patterns in the form of similarities and differences in how employees weigh the perception of these identified affordances against the perception of constraints. Perceptional similarities include that employees perceive affordances related to receiving messages from third-party systems as higher compared to all affordances and that the relevance of chatbots is assessed as highest in group channels that are related to projects at work. Perceptional differences among employees are highlighted along five different factors that show that chatbots within enterprise messengers are viewed (1) as operational assistants, (2) as central information hubs, (3) as difficult to use black boxes and worse alternatives to dedicated tools, (4) as shadow IT in restrictive and closed legacy environments, and (5) as spammy and process-enforcing burden. Emergent from the actualization journeys of the lower-level affordances and constraints, we elaborate higher level affordances, such as consolidating communication (e.g., have messages from multiple people and third-party systems in a chronologic thread) and automating information and work flows (e.g., ensure discipline, relieve employees, shorten feedback cycles).

We contribute to the body of social information systems by elucidating how chatbots augment social information systems with the affordances of traditional enterprise systems proposed by Mettler and Winter (2016). In a broader perspective of paradoxical tensions, we contribute a novel perspective on how to balance novel digital with traditional systems, flexibility and malleability with stability and control, exploration with exploitation, and agility with discipline. Further, we contribute to the body of affordance literature by discussing affordance-theoretical peculiarities of chatbots, e.g., how the actualization of an affordance by one user may affect the affordance perception of other users (see Figure 27). At last, the paper at hand informs practitioners about affordances as well as constraints of enterprise messengers such as Slack and Microsoft Teams as well as by discussing implications for practice within the dedicated sections.

Nevertheless, our findings are subject to limitations. Due to the qualitative and interpretive research design, exhaustiveness cannot be guaranteed, and we cannot provide a verified theory. Therefore, future quantitative studies can further enrich our results in drawing on them and critically reflecting and verifying them. While our research considered multiple enterprise messengers, the focus was on one tool, that is Slack, within different organizational contexts. This may lead to biases in the identified affordances and constraints. On the one hand, other tools may simply have different material properties leading to the emergence of different affordances and constraints. On the other hand, the selection of the tool may influence the sample of users in that they have special characteristics. Finally, our interviewees were mainly based in Germany and Switzerland, which might affect our research findings. As counter measure, we conducted a preliminary analysis of the Slack directory, and triangulated our findings with material provided by our interviews. Anchored in the split of the Glaserian school (Glaser, 1992) from the Straussian school of grounded theory (Corbin & Strauss, 1990; Strauss & Corbin, 1990), the following question arises: “At what point does the researcher’s intervention or techniques force, instead of allow for, emergence?” (Walker & Myrick, 2006, p. 553). By following Strauss and Corbin (1990), we strived to “never impose anything on the data” (p. 94) and, at the same time, applying their principle of theoretical sensitivity that encourages the use of analytic tools such as the affordance theory in order to allow for emergence of insights. Still, the use of analytical tools such as existing theory goes along with the risk to force the data in preconceived ways, thus, potentially leading to confirmation-bias.

We see four avenues for future research. First, we acknowledge the fruitful avenue for design-oriented research in the context of chatbots. Our research illuminating the affordances emergence of chatbots in the enterprise context as well as the discussed affordance-related peculiarities could be used as a starting point for eliciting and developing design propositions and a design theory for chatbots. In particular, it would be interesting how design decisions for chatbots have to be depended on the techno-organizational context to reduce the effort needed to actualize the affordances of chatbots and how these propositions need to take contextual conditions into account under which constraints emerge from chatbots in shared conversational threads.

Second, as enterprise messengers such as Slack become available for a broader audience of users (aside from software developers), future research can investigate how chatbots can be used to assess the work conducted by employees and to provide timely automated feedback. Furthermore, prior research has shown that the visibility and transparency on the progress of tasks (e.g., through agile practices such as daily stand-ups) have self-motivating effects (McHugh et al., 2011). Future research should clarify if this applies as well to feedback provided by chatbots (e.g., the chatbots in Figure 18 discloses velocity metrics).

Third, as we selected Slack as representative enterprise messenger platform, future research is needed to confirm and extend our research findings using additional platforms (e.g., Microsoft Teams) and organizational contexts. Specifically, different quantitative approaches can be adopted for verification.

Fourth, future research should investigate further domain-specific enterprise systems that benefit from an integration in social information systems. For example, research on product development is emphasizing the increasing need for collaboration, knowledge exchange and communication within and across geographically distributed teams and suggests that social software applications can support tasks across various phases of the new product development process (Bertoni & Chirumalla, 2011; Ming et al., 2008; Roch & Mosconi, 2016; Rohmann, Heuschneider, & Schumann, 2014). Chatbots may be harnessed to integrate domain-specific enterprise systems, e.g., Computer Aided Design (CAD) systems and Product Lifecycle Management (PLM) systems into social information systems.

Appendix A - Heatmaps of Card Sorting Values

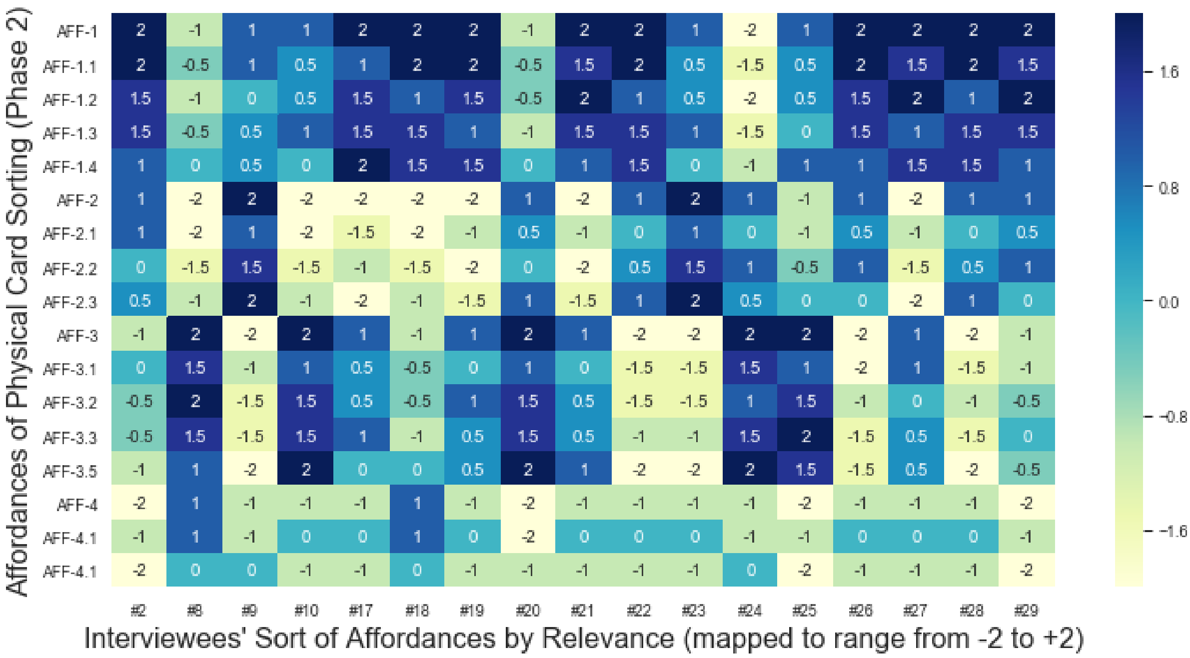

Figure 28. Results of Physical Card Sorting from Phase 2.

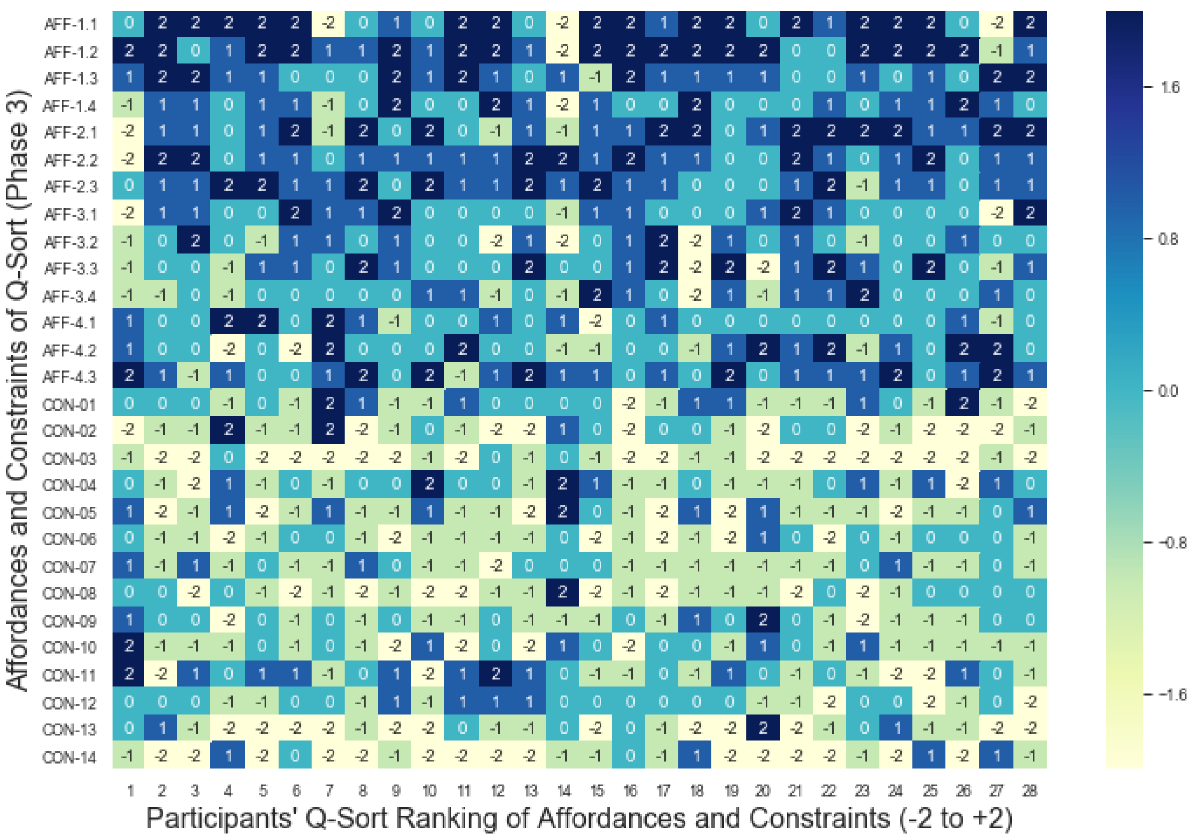

Figure 29. Results of Q-Sort from Phase 3.

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Part C - Appendix

Appendix A - Complete List of Publications

Publications in chronological order from new to old; official order of authors that indicates the contributions of the authors.

Published and Accepted Journal Articles

Type[6]	*Meta-data of Publication*	*Ranking*[7]
1 J-F Art. V	**Stoeckli, E.**, Dremel, C., Uebernickel, F., and Brenner, W. (2019). "How Affordances of Chatbots Cross the Chasm Between Social and Traditional Enterprise Systems," *Electronic Markets.* 10.1007/s12525-019-00359-6	WI: A VHB: B IF: 3.553
2 J-F Art. I	**Stoeckli, E.**, Dremel, C., and Uebernickel, F. (2018). "Exploring Characteristics and Transformational Capabilities of InsurTech Innovations to Understand Insurance Value Creation in a Digital World," *Electronic Markets (28:3),* pp 287–305. 10.1007/s12525-018-0304-7	WI: A VHB: B IF: 3.553

Published Articles in Conference Proceedings

Type	*Meta-data of Publication*	*Ranking*
3 C-F	Lechler, R., **Stoeckli, E.**, Rietsche, R., and Uebernickel, F. (2019). "Looking Beneath the Tip of the Iceberg: The Two-Sided Nature of Chatbots and Their Roles for Digital Feedback Exchange," in *Proceedings of the 27th European Conference on Information Systems (ECIS 2019)*, Stockholm-Uppsala, Sweden.	WI: A VHB: B
4 C-F	Rietsche, R., Frei, D., **Stoeckli, E.**, and Soellner, M. (2019). "Not All Reviews Are Equal – A Literature Review on Online Review Helpfulness," in *Proceedings of the 27th European*	WI: A VHB: B

[6] Type refers to the publication outlet, i.e., Journal (J), Conference (C), and Working Paper (W) as well as to the degree of maturity, i.e., completed research as Full Papers (F) and research in progress as Short Papers (S).

[7] Ranking according to 'WI-Orientierungsliste' (http://wi.vhbonline.org/zeitschriftenrankings/), VHB-JQ3 (http://vhbonline.org/VHB4you/jourqual/vhb-jourqual-3/gesamtliste/), and Impact Factor (IF) from the websites.

	Conference on Information Systems (ECIS 2019), Stockholm-Uppsala, Sweden.	
5 W-F Art. II	**Stoeckli, E.** (2019). "Feedback in Information Systems Research: Seven Feedback Domains," *Working Paper, Institute of Information Management of the University of St. Gallen* (Accessible via Alexandria Repository at https://www.alexandria.unisg.ch/257203/).	WI: n.a. VHB: n.a.
6 C-F Art. IV	**Stoeckli, E.**, Uebernickel, F., Brenner, W., Hess, S., and Weierich, A. (2019). "Digital Feedback for Digital Work? Affordances and Constraints of a Feedback App at InsurCorp," in *Proceedings of the 14th International Conference on Wirtschaftsinformatik (WI 2019)*, Siegen, Germany.	WI: A VHB: C
7 C-F	Dremel, C., **Stoeckli, E.,** Wulf, J., and Brenner, W. (2019). "A Socio-Technical Approach to Manage Analytics-as-a-Service – Results of an Action Design Research Project," in *Proceedings of the 14th International Conference on Wirtschaftsinformatik (WI 2019)*, Siegen, Germany.	WI: A VHB: C
8 C-F	Dremel, C., **Stoeckli, E.,** Wulf, J., and Herrmann, A. (2018). "Archetypes of Data Analytics Providers in the Big Data Era," in *Proceedings of the 24th American Conference on Information Systems (AMCIS 2018)*, New Orleans, USA.	WI: B VHB: D
9 C-F	Hehn, J., Uebernickel, F., **Stoeckli, E.**, and Brenner, W. (2018). "Designing Human-Centric Information Systems: Towards an Understanding of Challenges in Specifying Requirements within Design Thinking Projects" in *Proceedings of the Multikonferenz Wirtschaftsinformatik (MKWI) 2018*, Lüneburg, Germany.	WI: B VHB: D
10 C-S	**Stoeckli, E.**, Gerard, N., Uebernickel, F., and Brenner, W. (2017). "Towards an understanding of how and why Design Science Research scholars evaluate," in *Proceedings of the 28th Australasian Conference on Information Systems (ACIS 2017)*, Hobart, Tasmania, Australia.	WI: C VHB: n.a. ** Best Paper Nomination

11 C-F Art. V	**Stoeckli, E.**, Uebernickel, F., and Brenner, W. (2018). "Exploring Affordances of Slack Integrations and Their Actualization Within Enterprises – Towards an Understanding of How Chatbots Create Value," in *Proceedings of the 51th Hawaii International Conference on System Sciences (HICSS 2018)*, Waikoloa Village, Hawaii, USA.	WI:C VHB: B ** Best Paper Nomination
12 C-F Art. III	**Stoeckli, E.**, Uebernickel, F., and Brenner, W. (2017). "Capturing Functional Affordances of Enterprise Social Software," in *Proceedings of the 23rd American Conference on Information Systems (AMCIS 2017)*, Boston, USA.	WI: B VHB: D
13 C-F	Leitner, P., Cito, J., and **Stoeckli, E.** (2016). "Capturing Functional Affordances of Enterprise Social Software," in *Proceedings of the 9th IEEE/ACM International Conference on Utility and Cloud Computing (UCC 2016)*, Shanghai, China.	WI: n.a. VHB: n.a.

Book Chapters

14 B-F	**Stoeckli, E.**, Dremel, C., Uebernickel, F., and Brenner, W. (2019 forthcoming). "Auswirkungen von InsurTech auf die Wertschöpfungslogik der Versicherungsindustrie im Digitalen Zeitalter," *Digitale Geschäftsmodelle Edition HMD*. Springer Vieweg, Wiesbaden.	WI: n.a. VHB: n.a.

Journal Articles in Review

15 J-F	Dremel, C., **Stoeckli, E.,** Wulf, J., and Brenner, W. (in Review). "Management of Analytics-as-a-Service - Results from an Action Design Research Project," *Electronic Markets Journal.*	WI: A VHB: B IF: 3.553

Appendix B - Curriculum Vitae

Personal Data

Name	Emanuel Simon Stöckli
Date of Birth	14th April, 1990
Place of Birth	Hofstetten-Flüh, SO
Nationality	Switzerland

Academic Education

2015 – 2019	University of St.Gallen (HSG), St.Gallen, Switzerland; PhD in Management with specialization in Business Innovation at the Institute of Information Management (IWI).
2019	Stanford University, California, USA; Visiting Scholar.
2013 – 2015	University of Zurich (UZH), Zürich, Switzerland; Master of Science (M.Sc.) in Informatics - summa cum laude.
2014	Uppsala University, Uppland, Sweden; Exchange Semester.
2008 – 2011	University of Zurich (UZH), Zürich, Switzerland; Bachelor of Science (B.Sc.) in Informatics - magna cum laude.
2005 - 2008	Gymnasium Kirschgarten (GKG), Basel, Switzerland; Matura in Mathematics and Physics.

Employment

10/2015 – 06/2019	*Research Associate* at the Institute of Information Management of University of St. Gallen (IWI-HSG) in collaboration with Allianz Technology; St.Gallen, Switzerland and München, Germany.
10/2015 – 10/2018	*Design Thinking Coach* at the Institute of Information Management of University of St. Gallen (IWI-HSG); St.Gallen, Switzerland.

02/2015 – 10/2015	*Software Engineer* at JLS Digital AG - 30% part-time job beside the Master studies; Zürich, Switzerland.
01/2009 – 10/2015	*Freelancing Software Engineer* with Projects Landskroner Bräu, University of Applied Sciences of Special Needs Education, Haufe Lexware/ University of St. Gallen; Zürich, Switzerland.
08/2012 – 05/2013	*Software Engineer* in the context of the Swiss Civilian Service at Swiss Federal Institute for Forest, Snow & Landscape Research (ETH Domain); Birmensdorf, Switzerland.
02/2012 – 07/2012	*Project Officer Data Asset Management* in the context of the Swiss Civilian Service at Biovision Foundation; Zürich, Switzerland.
06/2009 – 01/2012	*Accountant and Software Engineer* at Exima Treuhand GmbH – 20% part-time job beside the Bachelor studies; Zürich, Switzerland.
06/2010 – 09/2010	*Software Engineer* at Pulsmesser; Zürich, Switzerland.