Towards an Employee-Centered Design for Human-AI Collaboration: How Work Design Theory Informs the Design of AI Systems

Philipp Reinhard, University of Kassel, philipp.reinhard@uni-kassel.de
Mahei Manhai Li, University of Kassel, mahei.li@uni-kassel.de
Jan Marco Leimeister, University of St. Gallen, janmarco.leimeister@unisg.ch

Introduction

IT support is under growing pressure to ensure efficient, flexible, and scalable use of digital technologies (Kumbakara, 2008). As a result, technical support staff is affected by monotonous work and work overload (Schmidt et al., 2022). Our research aims to augment the precarious workplace of support agents with artificial intelligence (AI). To incorporate an employee-centered perspective a priori and ensure positive impacts, we propose a framework for combining work design theory (e.g. Demerouti et al., 2001) and design science theory (Peffers et al., 2007, Niehaves & Ortbach 2016). The advances in AI promise to leverage large potential in optimizing and enhancing service processes and workplaces (Huang & Rust, 2018, de Keyser, 2019). Introducing AI into service processes, imply effects on work characteristics (Larivière et al., 2017). By combining human and artificial intelligence we propose hybrid intelligence (Dellermann et al., 2019) as a suitable solution for mitigating the persistent issues of support workers and the possible negative impacts of AI. To a great extent, IS research emphasizes the implied impacts of AI use in workplaces (Verma & Singh 2022, Wang et al., 2020). As such, work design models are widely used to empirically evaluate the impacts of AI design (Sturm & Peters, 2020), but are rarely utilized to substantiate the design of AI-augmented work systems. Only Poser et al. (2022) and Zschech et al. (2021) recently applied such models. The goal of this paper is to overcome the lack of work design in design science research (DSR) for AI-based systems and to steer the development into desired socio-technological configurations. The here presented work is expected to answer : *How can work design theory inform the design of AI-augmented workplaces?* [RQ1] *How should a hybrid intelligence system be designed to augment IT support agents' workplaces by incorporating work design theory?* [RQ2]

To systematically design the integration of AI, we make use of the DSR paradigm (Peffers et al., 2007). We first interview support agents and utilize the organizing move theory of Pentland (1992) and the technical support work theory of Das (2003) to ensure relevance. Based on a review of the IS literature on work design theories, we then derive a preliminary theoretical framework (Paul & Benito, 2018) [RQ1]. The framework represents a kernel theory for the development of meta design requirements. Contributing to the second research question, we design and subsequently evaluate the augmentation based on work-related outcomes [RQ2].

Problem statement

Based on 24 expert interviews with frontline support agents, we identified employee-related, pressing issues. Our analysis consolidates the prior research on organizing moves by Pentland (1992) and Das (2003) and complements the important task of retaining knowledge (Argote, 2003). Following the data structure by Gioia et al. (2013), we systematized the most crucial issues. The structure can be consulted in table 1.

Table 1: Systemization of practical issues

Dim.	Organizing moves	Issues	
Give problem away (Pentland 1992)	**Assign:** Delegate the incident to an appropriate agent and assign a priority	I1	Unsophisticated and unbalanced routing
		I2	Lack of prioritization
		I3	Human classification of tickets
		I4	Repetitive and simple requests for personal, system, and incident information
	Refer & Transfer: Move the problem to another colleague or expert within the frontline	I5	Lack of identification of eligible experts causes additional work steps
		I6	Lack of knowledge transfer between support agents
	Escalate: Relocate complex problems to more experienced and qualified experts	I7	Poor documentation of escalated requests causes additional work steps and prolongs the continuation of the processing
		I8	Lack of decision support for escalation of requests
Get help (Das 2003)	**Locate:** Search for existing knowledge and reuse material generated by the crowd.	I9	Large numbers of simple and recurring requests are distributed over various channels
		I10	Time-consuming solution search in articles
		I11	Multiple systems, media disruptions
	Adapt: Tailor-located solutions to comply with the individual incident.	I12	Inadequate knowledge base articles and solution material implies a slower processing
		I13	Local peculiarities
	Generate: Answer new, unknown requests and develop individual solutions.	I14	New, unfamiliar requests require a high attention span from the employee's attention span
Share solution (Argote et al. 2003)	**Retain:** Document and archive solutions as well as adaptions to make knowledge accessible.	I15	Lack of solution descriptions of solved problems similar to the current one (Incomplete descriptions of solution paths)
		I16	Cumbersome and time-consuming manual documentation of tickets
		I17	Inconsistent documentation of tickets / Inadequate quality of ticket documentation
		I18	Time-consuming quality assessment

Theoretical framework

A literature review on the application of work design theories in IS research resulted in 428 hits in top journals (basket of eight, from 2012 – 2022) and proceedings of key conferences (ECIS, ICIS, HICSS, from 2019 – 2022). Thereof 30 papers were selected based on title and abstract screening. 20 papers applied work design theories to investigate the impact of digital technologies on work outcomes. The major part of the analyzed papers utilized a combination of multiple work design models to cover the specific challenges of AI-enabled workplaces (e.g. Parent-Rocheleau & Parker, 2022, Parker & Grote, 2019). Our proposed antecedents, decisions, and outcomes (ADO) framework (Paul & Benito, 2018)

(Figure 1.) applies the job demands-resources model (Demerouti et al., 2001) as a theoretical foundation and integrates supplementary models as a broader inner model according to information system design theory (Niehaves & Ortbach 2016). While job demands can be broken down into workload, emotional demands, and job insecurity (Parent-Rocheleau & Parker, 2022), job resources can be constituted by job characteristics (Hackman & Oldham, 1980), knowledge characteristics (Parent-Rocheleau & Parker, 2022) and social characteristics (Karasek, 1979).

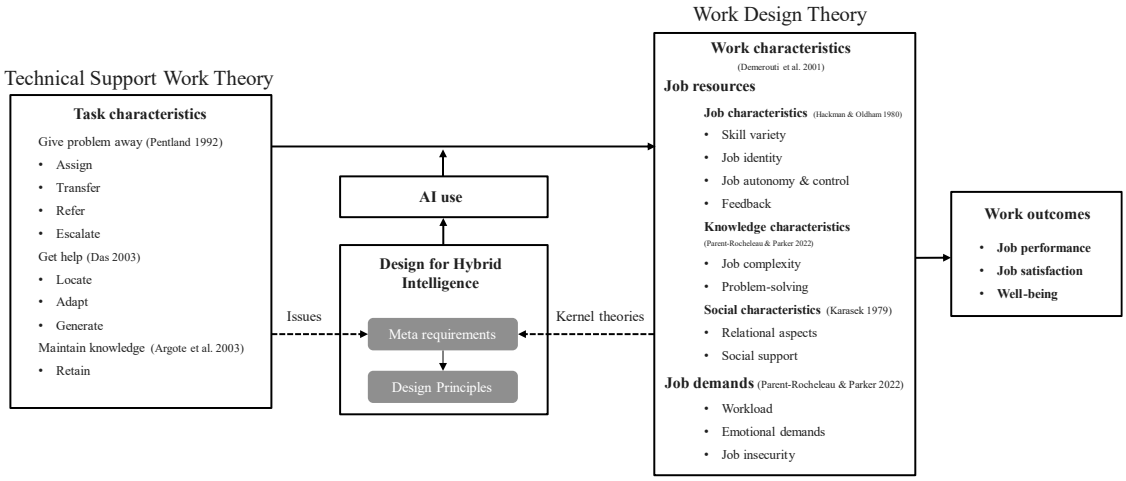

Figure 1: Theoretical framework for service support system design

Meta Requirements

Given the practical issues and the theoretical framework, we derived meta-requirements (MR). To ensure skill variety, job identity, and a balanced workload, tickets should be routed to agents based on existing routing data and to agents based on individual preferences and experiences (*MR1: I1-I4, Assign*). Agents should be supported by an AI-mediated crowd of experts and conversational agents that enable knowledge transfer and potentially service coaching (*MR2: I5-I6, Refer & Transfer*). For more complex incidents, frontline support gets AI-based decision support based on escalated tickets (*MR3: I7-I8, Escalate*). Agents retain autonomy and control by making the decision. In addition, they are supported by information retrieval tools that simplify the search for problem-solution pairs and knowledge base articles (*MR4: I9 - I11, Locate*). Locating solutions with help of AI should still ensure autonomy, control, agency, and skill variety. To augment the adaption of existing solutions, ticket solutions are extracted, curated, and extended by information on local peculiarities (*MR5: I12-I14, Adapt*). MR4 and MR5 are both reducing job demand while increasing job resources. Along the service process, incident information should be retrieved automatically and documentation of tickets should be augmented (*MR6: I15-I16, Retain*). Finally, ticket data quality should be automatically assessed and continuously improved grounded by human and AI collaboration (*MR7: I17-I19, Retain*).

Expected Conclusion & Discussion

At first, our work contributes to the research on technical support work theory by consolidating the theory of organizing moves by Pentland (1992) and the technical support work theory by Das (2003). Additionally, we add the field of knowledge management as a key task of support workers to ensure knowledge sharing (Argote et al. 2003). According to our results, the service support job comprises eight key tasks: *Assign*, *refer*, *transfer*, *escalate*, *locate*, *adapt*, *generate,* and *retain*. Additionally, our research shows how work design theories guide an employee-centered design of AI in service support. By consolidating traditional work design models (e.g., Demerouti et al., 2001, Karasek, 1979) and insights from IS research on work design and AI (e.g., Parent-Rocheleau & Parker, 2022, Parker & Grote, 2019), we developed a comprehensive framework for informing design science research with work design theory. This combination allows designing new forms of technology-augmented tasks in the service domain. The preliminary results are closely linked to Niehaves' and Ortbach's (2016) framework of an inner and outer model in explanatory design theory. The example of system design for an AI-augmented IT support workplace illustrates how both, practical issues and work design theory, specify meta requirements. The current research approach should be completed by developing concrete design principles and validating the instantiation by means of work outcomes through an ex-post evaluation. Further research might expand the work design theory for AI infusion in services by including additional AI-specific job characteristics (e.g., agency, identity) and examining AI-related skills and roles.

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