Investigating Technologically Advanced Job Interview Approaches

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Zusammenfassung

Die technologische Entwicklung stellt Unternehmen vor die Herausforderung informierte Entscheidungen über technologische Lösungen für organisationale Prozesse zu treffen. Besonders auffällig ist das im Falle von Bewerbungsgesprächen, bei denen in der Praxis wenig erforschte Technologien verwendet werden. Infolgedessen können Unternehmen über die Einflüsse technologiegestützter Bewerbungsgespräche (z.B. digitale Interviews) auf den Interviewprozess nur spekulieren. Meine Doktorarbeit soll die Forschung zu technologiegestützen Bewerbungsgesprächen in vier Schritten modernisieren. Erstens entwickle ich eine psychometrisch fundierte Skala zur Messung von *Creepiness.* Diese soll die Forschung zur Akzeptanz neuer Technologien unterstützen. Zweitens vergleiche ich digitale Interviews mit Videokonferenz-Interviews. Die Ergebnisse zeigen, dass digitale Interviews weniger akzeptiert und dass Bewerbende in digitalen Interviews besser bewertet werden. Drittens antizipiere ich die Zukunft des Bewerbungsgesprächs und untersuche ein algorithmusbasiertes Bewerbungsgespräch. Das algorithmusbasierte Bewerbungsgespräch führte zu negativeren Bewerberreaktionen als ein Videokonferenz-Interview. Im vierten Schritt erweitern zwei weiteren Studien die vorangegangenen Erkenntnisse indem versucht wird, negative Bewerberreaktionen durch Informationen zu technologisch fortschrittlichen Bewerbungsgesprächen vorzubeugen. Die Ergebnisse zeigen eine komplexe Beziehung zwischen Informationen und Akzeptanz. Weiterhin scheinen rechtfertigende Informationen besser als Prozessinformationen zu sein, um Bewerberreaktionen zu verbessern. Zusammengefasst zeigt meine Dissertation, dass die Anwendung neuer Technologien für die Personalauswahl wohl durchdacht sein sollte und dass Forschung zu klassischen Bewerbungsgesprächen möglicherweise nicht auf technologisch fortschrittliche Bewerbungsgespräche übertragbar ist. Schlussendlich ruft meine Dissertation zu weiterer Forschung bezüglich des Einflusses neuer Technologien in der Personalauswahl auf.

General Abstract

Technology and its use has an immense effect on our daily lives. For instance, the recent rapid technological evolution has led to a myriad of technological solutions for organizational procedures. This challenges organizations to stay up-to-date and to make informed decisions about implementing and investing in technologically advanced procedures. In the context of job interviews, the technology that is used in practice has outpaced the research on the use of these technologies. As a consequence, researchers and practitioners can only speculate about how modern job interviews (e.g., digital interviews) affect outcomes such as applicant reactions and interview performance ratings. My dissertation therefore aims to update the research on technologically advanced job interviews in four steps. First, I provide a study on the development of a psychometrically sound measure of creepiness as a new perspective on research involving acceptance of technology-based situations. Second, I present a study comparing the emerging interview form of digital interviews with videoconference interviews showing that digital interviews can impair applicants' reactions but increase applicants' performance ratings. Third, I attempt to foreshadow the future of job interviewing technology by investigating an algorithm-based job interview with a virtual agent as the interviewer; results showed diminished applicant reactions compared to videoconference interviews. Fourth, two additional studies incorporate the aforementioned findings and attempt to buffer negative applicant reactions with information preceding technologically advanced job interviews. The results indicate a complex relation between information and acceptance and that justification information is better than process information to improve applicant reactions. All things considered, my dissertation implies that careful design is needed for personnel selection technology, that previous research in non-technological job interview settings might not translate to situations including novel technologies, and it calls for further research to investigate the influence of technology on personnel selection.

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Diese Arbeit entstand in einer Arbeitsatmosphäre, die man als lecker, nerdig, buzzwordig, musikalisch, unterstützend und einfach nur einzigartig beschreiben kann. Ich möchte mich hiermit bei allen bedanken, die die Jahre meiner Promotion unvergesslich gemacht haben.

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Index of Publications

This publication-oriented dissertation[1] (German: publikationsorientierte Dissertation) is mainly based on two publications and three manuscripts submitted for publication. The author of this dissertation is the first author of all of these publications and manuscripts which are inserted in this dissertation in their most recent version (with slight changes due to formatting). To answer the call for open research, all of these studies were pre-registered on the Open Science Framework (osf.io).

Study 1: Langer M., & König, C. J. (2017). *Development of the Creepiness of Situation Scale (CRoSS).* Manuscript submitted for publication to Applied Psychology: An International Review.

Study 2: Langer, M., König, C.J., Krause, K. (2017). Examining digital interviews for personnel selection: Applicant reactions and interviewer ratings. *International Journal of Selection and Assessment, 25*, 371-382. doi:10.1111/ijsa.12191

Study 3: Langer M., König, C. J., & Papathanasiou, M. (2017*). When algorithms have the power: Examining acceptance of technologically advanced personnel selection and training methods.* Manuscript submitted for publication to Human Resource Management.

Study 4: Langer, M., König, C.J., Fitili, A. (2017). Information as a double-edged sword: The role of computer experience and information on applicant reactions towards novel technologies for personnel selection. *Computers in Human Behavior. 81*, 19-30. doi:10.1016/j.chb.2017.11.036

Study 5: Langer, M., König, C.J., & Hähne, V. (2018). *Spare me the details: The impact of the type of information on applicant reactions towards novel technologies for personnel selection.* Manuscript submitted for publication to Computers in Human Behavior.

[1] The layout of this dissertation follows the model of Fell (2016) and Bühl (2017).

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3 General Introduction

Technology has taken great strides in the last several decades and it affects our daily lives to an increasing extent (Stone, Deadrick, Lukaszewski, & Johnson, 2015). Nowadays, people do not bother with some household chores such as cleaning the floor, as there are robots designed to do these types of work (Oh, Choi, Park, & Zheng, 2004). Additionally, technological influences extend beyond conveniences at home into social interactions. For instance, the process of engaging in small talk may be considered a waste of time because basic information about the other person can be easily accessed in advance through social networking platforms (Gross & Acquisti, 2005). Consequently, technological changes have permeated our daily habits. Sensors can monitor our sleep and tell us if we slept well (Yang & Hsu, 2010), virtual characters assist us in various circumstances (e.g., training of social skills, Hoque, Courgeon, Martin, Mutlu, & Picard, 2013), self-driving cars change the way we travel (Urmson & Whittaker, 2008), and novel algorithms can help us to determine if the person whom we met for a coffee had romantic interests (Ranganath, Jurafsky, & McFarland, 2013) or they can aid to reveal our own sexual orientation (Wang & Kosinski, in press).

However, these technological developments are not limited to household or private aspects, but also strongly impact people's working life (Stone et al., 2015; Strohmeier, 2007). For instance, humans and robots are working side by side (Tsarouchi et al., 2017), augmented reality helps designers to plan and assemble new products (Wu, Zhu, Wu, & Ding, 2013), and algorithm-based analysis of verbal and nonverbal behavior determines if a person will be successful in a job (Schmid Mast, Frauendorfer, Gatica-Perez, Choudhury, & Odobez, 2017). All of the aforementioned developments indicate a need for up-to-date research about the impact of novel technologies for the workplace.

For organizations, failure to stay up-to-date and to make informed decisions can detrimentally affect the implementation of novel technologies (Kim & Kankanhalli, 2009).

Particularly important for the successful implementation of technologies in any given context is their acceptance (i.e., willingness to use the technology, trust in the technology, and fairness of the technology-enhanced procedures; Gilliland, 1993; Venkatesh, Morris, Davis, & Davis, 2003). In other words, no matter if a company wants to sell self-driving cars or if an organization wants to implement algorithm-based personnel selection procedures, in order to rewardingly establish these novel technologies they first need to be accepted by their users (cf., Venkatesh et al., 2003). However, in the case of personnel selection, there is a discrepancy in the development and application of novel technologies and corresponding acceptance research. This stands out when comparing the selection procedures used in practice in the last two decades and research conducted in the same timeframe. Founded in 2004, the American company HireVue provides digital interviews (interviews in which applicants send videos to the hiring organization without any contact to a representative of the organization), and has developed algorithms to automatically evaluate these interviews based on nonverbal (e.g., smiling) and vocal behavior (e.g., voice pitch; HireVue, 2017). Since 2012, the German company Precire offers an algorithm-based telephone interview where applicants are evaluated based on their verbal behavior (e.g., use of positive emotion words; Precire, 2017). In 2013, Hoque and colleagues demonstrated that virtual characters can help applicants prepare for job interviews, implying that in combination with algorithms from the aforementioned companies, virtual characters could autonomously conduct interviews and evaluate interviewees. In contrast, Blacksmith, Willford, and Behrend (2016) published a meta-analysis examining acceptance research on technology-mediated job interviews for the last two decades which focused predominantly on telephone and videoconference interviews with human interviewers. These researchers focused on classical technology-mediated interview approaches instead of investigating novel interview approaches (e.g., digital interviews), or preemptively examining cutting-edge interview

technology (e.g., algorithm-based interviews with virtual characters). A consequence of studying more traditional technologies rather than providing up-to-date research about technologically advanced job interviews is that researchers and practitioners must rely on outdated findings or make assumptions for technologies where no research yet exists.

Therefore, the general goal of my dissertation is to update acceptance research regarding technology-based job interviews. To achieve this goal, the first study was conducted in order to develop a measure to capture creepiness as a previously neglected aspect of novel technologies in personnel selection. The second study examined applicant reactions and interviewer ratings in digital interviews, an interview technology that is well-established, but still neglected in research (with the exception of Brenner, Ortner, & Fay, 2016). The third study was intended to examine the future of technologies for job interviews and applicant reactions to an algorithm-based interview with a virtual character as the interviewer. The previous studies revealed negative applicant reactions to novel job interview approaches, therefore the last two studies investigated whether having different kinds of information might serve as potential strategies to buffer the negative impact on applicant reactions.

In the following sections, I first provide an overview of technology for human resource management. Afterwards, I present the evolution of technology in job interviews. Then, there is a brief introduction to applicant reaction research and to the importance of different applicant reaction variables. In the end of the general theoretical background, I introduce four research questions on technologically advanced job interviews and link these questions to the studies included in my dissertation.

4 General Theoretical Background

4.1 Technology for Human Resource Management Purposes

Technology for human resource management (HRM) has a long history (Ruël & Bondarouk, 2014). In the past, technology in HRM focused on managing administrative tasks (e.g., payroll management; Strohmeier, 2007), e-learning solutions (e.g., web-based training for standardized learning material; Sitzmann, 2011), online recruitment activities (e.g., online job advertisements; Dineen, Ash, & Noe, 2002) or web-based personnel selection screening procedures (e.g., online personality tests; Chapman & Webster, 2003). These classical technology-enhanced HRM tasks all facilitate the management of relatively structured information and data. For instance, learners during classical e-learning receive slides or videos containing information about a topic, such as fire safety, and they can dive into the topic whenever and wherever they want, with information being equal for every learner (Sitzmann, 2011). In the case of online recruitment, applicants can easily search through numerous job advertisements or recruiting websites but these advertisements and websites will likely be the same for every applicant (Dineen, Ling, Ash, & DelVecchio, 2007). For web-based personnel selection screening, applicants may fill out standardized online cognitive ability tests (Chapman & Webster, 2003), which have pre-defined questions and analysis procedures (e.g., summing up results) .

However, there are HRM tasks where there is a need to handle more unstructured data. For instance, applications may consist of motivation letters (Campion, Campion, Campion, & Reider, 2016) and CVs in different formats (e.g., video CVs; Nguyen & Gatica-Perez, 2016). A decade ago, human recruiters would need to go through these pieces of information and evaluate applicants' job fit as classical technology-enhanced HRM approaches were not able to handle this unstructured data. Another example is the training of social skills, such as negotiations or presentations. With classical technology-based HRM

methods, employees may receive standardized information on an e-learning platform regarding negotiation strategies or tips how to prepare their next presentation (cf., Strohmeier, 2007) but no personalized feedback in order to improve these skills.

In sum, some of the most severe issues with the aforementioned more complex HRM tasks (i.e., evaluating applications, training of social skills) and similar ones are that a) there are large amounts of unstructured data (e.g., text, audio, video; Campion et al., 2016), b) human behavior needs to be observed (e.g., to provide feedback for presentation performance; Batrinca, Stratou, Shapiro, Morency, & Scherer, 2013) and c) unstructured data and human behavior data needs to be integrated and evaluated (cf., Campion et al., 2016; Langer, König, Gebhard, & André, 2016).

Through the technological developments from the last decade it became feasible to solve these problems. First, computers became faster and storage capacities have drastically increased (Chen, Mao, & Liu, 2014). Second, sensor devices to observe human behavior (e.g., microphones, cameras), became more available and the data they produce increased in quality (e.g., HD videos; Seshadrinathan, Soundararajan, Bovik, & Cormack, 2010). For instance, due to these developments it is now possible to analyze more pixels of human faces in video recordings leading to improved facial recognition opportunities (Oro, Fernández, Saeta, Martorell, & Hernando, 2011). Third, advances in machine learning have allowed integrating and evaluating of many sources of unstructured data (e.g., text, audio, video; Wu et al., 2013). Consequently, it is now possible to gather large amounts of data from different sources and to process this data so that is can be interpreted and evaluated automatically. This may lead to many opportunities for modern technology-enhanced HRM applications (Guzzo, Fink, King, Tonidandel, & Landis, 2015).

It is surprising that these opportunities were predominantly identified by computer scientists instead of industrial and organizational psychologists or economists who are better

positioned and who should have even more interest in novel HRM applications. For example, the computer scientists Hoque and colleagues (2013) developed a software to train social skills with a virtual character reacting to trainees' nonverbal behavior (e.g., smiling). Another example for research by computer scientists showed the possibilities of novel technology for HRM in a study by Naim, Tanveer, Gildea, and Hoque (2015) who demonstrated that automatically analyzed nonverbal and verbal behavior can be used to predict job interview success.

As late as 2016, researchers from industrial and organizational psychology started to realize the potential of these advanced technologies for HRM purposes. Campion and colleagues (2016) showed that motivational letters can be evaluated automatically using text mining (i.e., machine learning based analysis of unstructured text), and Langer and colleagues (2016) replicated and advanced the findings of Hoque and colleagues (2013) showing that virtual characters combined with automatic feedback on nonverbal and vocal behavior can successfully help with job interview preparation. However, these findings are only the beginning in a long line of needed research for testing the impact of novel technologies on HRM and highlighting the potential that lies within this field of research (Chamorro-Premuzic, Akhtar, Winsborough, & Sherman, 2017; Strohmeier, 2007).

4.2 Technology and Job Interviews

Job interviews serve as an excellent example to retrace the technological evolution over the last decades (Blacksmith et al., 2016; Chapman, Uggerslev, & Webster, 2003; Sears, Zhang, Wiesner, Hackett, & Yuan, 2013). Telephone interviews were the first step to technologize the job interview (Chapman et al., 2003). With the distribution of laptops with integrated cameras and the implementation of broadband internet connections, videoconference interviews added the possibility for applicants and hiring managers to see each other during the interview (Sears et al., 2013). At the same time, first ideas spread on

how to design job interviews more efficiently and consistently, such as interactive voice response approaches (Bauer, Truxillo, Paronto, Weekley, & Campion, 2004). This was the first time there was no interpersonal interaction between the applicant and the hiring organization in job interviews as applicants only responded to the interview questions by pressing keys on their telephone (Bauer et al., 2004). These ideas were developed further, resulting in digital interviews (Brenner et al., 2016). Until then, the evolution of the job interview was mainly driven by faster internet connections and by the wide availability of sensor devices (i.e., cameras). The next step of the job interview evolution included the use of machine learning approaches. Companies like HireVue (HireVue, 2017) or Precire (Precire, 2017) developed algorithm-based interviews. Similar to interactive voice response technologies, these interviews minimize the human influence on job interviews as interviews can be evaluated automatically using machine learning algorithms. However, in contrast to interactive voice response technologies, this evaluation can be more sophisticated, focusing on nonverbal (e.g., smiling), vocal (e.g., voice pitch) or verbal (e.g., applicants' use of words) information. It has to be emphasized here that there is initial evidence and research supporting the claim that these algorithm-based job interviews can validly predict both interview performance and job performance (Naim et al., 2015; Schmid Mast et al., 2017). The next step in the evolution of the job interview might be interviews with virtual characters as they are equally flexible and efficient as algorithm-based job interviews, but they reintroduce some interpersonal warmth by adding a virtual character as the interviewer (cf., Niewiadomski, Demeure, & Pelachaud, 2010).

4.3 Acceptance of Technology in Personnel Selection

Despite all of the possible positive aspects of technology-enhanced job interviews (e.g., efficiency, flexibility, and standardization; Brenner et al., 2016; Stone et al., 2015), this form of interviewing seems to have a negative effect on applicant reactions (Blacksmith et

al., 2016). Several researchers in the last decade have found classical technology-mediated job interviews (i.e., telephone and videoconference interviews) to be less fair (Chapman et al., 2003), offering less chance to perform, or being less job related (Sears et al., 2013). Additionally, previous research has pointed towards differences in acceptance of different forms of technology-mediated job interviews, thus highlighting the importance of research comparing different job-interview technologies (e.g., telephone and videconference interviews; Chapman et al., 2003)

However, some argue that these findings are outdated and might not generalize to modern technology-based job interview approaches (e.g. Blacksmith et al., 2016; Strohmeier, 2007). This issue becomes obvious by the fact that applicant reaction research on technology-mediated interviews focused nearly entirely on telephone and videoconference interviews and have just recently regained attention through a study focusing on digital interviews (Brenner et al., 2016). However, the study by Brenner and colleagues (2016) neglected to compare digital interviews to other interview approaches, thus it is still an open question if findings regarding more classical technology-mediated interview approaches translate to digital interviews. Moreover, no study so far has examined algorithm-based interview approaches or job interviews using virtual characters; leaving researchers and practitioners uncertain about the impact of these technologically advanced procedures on applicants. Furthermore, most applicant reaction research has been limited to applicant reaction variables based on aspects of procedural fairness as described by Gilliland (1993) potentially underestimating reaction measures covering the fact that technology is used during the interview (e.g., privacy concerns; Bauer et al., 2006).

4.4 The Importance of Novel Applicant Reaction Variables

Undoubtedly, Gilliland's 1993 model on applicant reactions during the selection process is one of the most important models in the area of applicant reaction research. With

his model, he was one of the first to describe the importance of procedural justice (e.g., opportunity to perform during a job interview), distributive justice (e.g., equality of outcomes) and their impact on individual (e.g., applicants' self-esteem) and organizational outcomes (e.g., organizational attraction). Based on this model, Bauer and colleagues (2001) developed their selection procedural justice scale (SPJS) which is used by many applicant reaction studies (e.g., Bauer et al., 2004; Chapman, Uggerslev, Carroll, Piasentin, & Jones, 2005; Sears et al., 2013; Truxillo, Bauer, Campion, & Paronto, 2002).

However, there are other perspectives on applicant reactions that need to be addressed when evaluating technologically advanced job interview procedures. First, preventing privacy concerns seems to be important to ensure acceptance of novel technologies for HRM (Bauer et al., 2006). All modern job interview procedures request applicants to submit personal data (e.g., videos) over the internet. Indeed, Gilliland (1993) mentions invasion of privacy as a variable potentially impairing acceptance of a selection procedure but he is rather referring to invasions of privacy through inappropriate questions (e.g., asking if the applicant is pregnant) instead of privacy concerns related to novel technologies. To my best knowledge, no study on technology-enhanced job interviews has yet evaluated applicants' technology-related privacy concerns during the interview.

Second, novel technologies can lead to negative affective impressions which can have a detrimental effect on their acceptance (Tene & Polonetsky, 2015). This negative affective impression might be captured by the concept of creepiness (Tene & Polonetsky, 2015), which could be defined as a negative emotional impression paired with ambiguity towards a novel technology (Langer & König, 2018). For instance, creepiness can be evoked when organizations capture too much private data about a person (Shklovski, Mainwaring, Skúladóttir, & Borgthorsson, 2014), when algorithms interpret human behavior (Tene & Polonetsky, 2015), or during interactions with virtual characters (Mori, 1970; Mori,

MacDorman, & Kageki, 2012). When focusing solely on measuring applicant reactions through the SPJS, creepiness would not be covered. It is therefore possible that previous research neglected to measure an important aspect of acceptance for technology-based job interviews. Unfortunately, there is no psychometrically sound measurement of creepiness that would allow to capture feelings of creepiness as a new applicant reaction perspective.

To conclude, applicant reaction research in the context of novel technologies for job interviews lags behind the technological potentials and even behind the job interview approaches, which are already used in practice. More specifically, there is a lack of research regarding technologically advanced job interview approaches and previous studies may have neglected to assess some important applicant reaction variables. Consequently, there is potential to update research on technologically advanced job interviews.

4.5 Open Research Questions

My dissertation aims to answer the call for more innovative and proactive research about novel technologies in HRM (see Strohmeier, 2007) focusing on the topic of technologically enhanced job interviews. There are four questions that I will address. First, is there a way to measure creepiness and is creepiness an important novel perspective on applicant reactions during technology-based job interview approaches? Second, how do digital interviews relate to others forms of technology-mediated interviews regarding applicant reactions and interviewer ratings? Third, what are the implications of more technologically advanced job interview approaches (e.g., algorithm-based interviews with a virtual character as the interviewer) for applicant reaction research? Fourth, is there a possibility to alleviate negative applicant reactions to technologically advanced job interview approaches (e.g., providing information before the interview)?

4.6 Dissertation Outline

In the following chapters I will describe five studies developed to answer the aforementioned questions. Study 1 addresses part of the first question about the potential to measure creepiness and includes four sub-studies used to develop and validate the Creepiness of Situation Scale (CRoSS) as a new measure for reactions to novel technologies. During this scale development study, I developed items, explored and confirmed the assumption that creepiness consists of two sub-dimensions (emotional creepiness and creepy ambiguity), provided support for convergent and divergent validity, and tested the scale in a field context to show its sensitivity for experimental manipulations based on theoretical assumptions. Consequently, Studies 2-5 answer the other part of the first question and used the sub-dimensions from the CRoSS as dependent variables to support its importance in the context of applicant reactions to technology-based job interviews.

Study 2 relates to the second question regarding the relation of digital interviews and other forms of technology-mediated job interviews. This study used Potosky's framework of media attributes (Potosky, 2008) to compare the interview approaches regarding applicant reactions and interviewer ratings. Participants took part in either a videoconference interview or a digital interview, reported a range of applicant reaction variables, and trained raters evaluated their interview performance. Additionally, this study examines the impact of the interview approaches on organizational attraction as one of the most important outcomes in applicant reaction research (Gilliland, 1993; Highhouse, Lievens, & Sinar, 2003).

Study 3 analyzes the third question concerning the effects of technologically advanced job interviews on applicant reactions. This study also relies on Potosky's framework of media attribute (Potosky, 2008) but compares the acceptance of videoconference interviews and an algorithm-based job interview with a virtual character as the interviewer. Furthermore, it contrasts the use of technology-based approaches for training

and personnel selection purposes, as two areas in which algorithm-based technologies are likely to change the future of human resource management (Langer et al., 2016; Naim et al., 2015). In other words, Study 3 also investigates the importance of the context regarding acceptance of technology-based approaches for human resource management.

Study 4 and Study 5 respond to the fourth question regarding the possibilities to alleviate applicant reactions to technology-based job interviews as their aim was to improve applicant reactions to an algorithm-based job interview. More precisely, for Study 4 I consulted previous research about ways to positively affect applicant reactions to selection procedures (e.g., McCarthy et al., 2017; Truxillo, Bodner, Bertolino, Bauer, & Yonce, 2009) and concluded that information before the start of the interview procedure might be an efficient and effective way in order to promote positive perceptions of the algorithm-based interview. Furthermore, related literature suggested that computer experience might also lead to more positive reactions to job interview approaches involving novel technologies (Bauer et al., 2006; Wiechmann & Ryan, 2003). More specifically, computer experience could have similar effects like information (e.g., increased ability to see through and understand the interview approach). Therefore, Study 4 investigated the difference between low and high levels of information for computer science and social science students (i.e., as a quasi-experimental manipulation of computer experience) on applicant reactions to an algorithm-based job interview which participants watched on video.

Finally, Study 5 builds upon the findings of Study 4, as well as on the results of Lahuis, Perreaul, and Ferguson (2003) examining different types of information and their impact on applicant reactions. Both, Study 5 and the results of Lahuis and colleagues (2003), indicated that different kinds of information may have positive and negative effects simultaneously. Therefore, in Study 5 I manipulated process information (i.e., information about what is happening during the job interview procedure) and process justification (i.e.,

information about why this job interview approach was chosen for selecting applicants) before participants watched the same video as in Study 4 and reported their reactions towards the algorithm-based job interview. This study highlights the importance of well-designed information and its findings in combination with the findings of Studies 2-4 point towards the necessity to develop new methods for improving applicant reactions on technology-based job interviews.

In sum, this dissertation provides a novel measure for acceptance research, new results regarding technology-enhanced job interviews, and anticipatively investigates possible directions for the future of personnel selection technology.

5 Study 1: Development of the Creepiness of Situation Scale (CRoSS)

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All studies in this manuscript are pre-registered on the Open Science Framework (Sub-study 1: osf.io/h35qx; Sub-study 2: osf.io/d4kpb; Sub-study 3: osf.io/8ph54; Sub-study 4: osf.io/we7m3). Correspondence concerning this article should be addressed to Markus Langer, Universität des Saarlandes, Arbeits- & Organisationspsychologie, Campus A1 3, 66123 Saarbrücken, Germany. Phone: +49 681 302 4767. E-mail: Markus.Langer@uni-saarland.de

5.1 Abstract

When people interact with novel technologies (e.g., robots), the word “creepy” regularly pops up. We define creepy situations as ambiguous situations involving uneasy feelings. A common metric for creepiness would help evaluating creepiness of situations and developing adequate interventions against creepiness. Following psychometrical guidelines, we developed the Creepiness of Situation Scale (CRoSS) across four studies with a total of N = 882 American and German participants. In Substudies 1-3, participants watched a video of a creepy situation involving technology. Sub-study 1 used exploratory factor analysis in an American sample and showed that creepiness consists of emotional creepiness and creepy ambiguity. In a German sample, Sub-study 2 confirmed these subdimensions. Sub-study 3 supported validity of the CRoSS as creepiness correlated positively with privacy concerns and computer anxiety, but negatively with controllability and transparency. Sub-study 4 used the scale in a 2 (male vs. female experimenter) x 2 (male vs. female participant) x 2 (day vs. night) field Sub-study to demonstrate its usefulness for non-technological settings and sensitivity to theory-based predictions. Results indicate that participants contacted by an experimenter at night-time reported higher feelings of creepiness. Overall, these studies suggest that the CRoSS is a psychometrically sound measure for research and practice.

Keywords: Scale development; creepiness of situations; reliability and validity; technology acceptance; uncanny valley

5.2 Introduction

Technology advances rapidly leading humans to be constantly confronted with novel and unknown situations. Nowadays, virtual characters tell you how to use nonverbal behaviors in social situations (Langer, König, Gebhard, & André, 2016), and algorithms decide who you could date next (Toma, 2015). Ten years ago, humans were only exposed to these situations in science-fiction books and movies – today, people routinely experience these situations in their everyday life.

These situations need to be handled cautiously, and technology within such situations needs to be designed carefully as user reactions towards technologically-enhanced situations are crucial for their effectiveness, usefulness, and potential application (Mathieson, 1991). Fortunately, there are different approaches to evaluate technology-enhanced situations. For example, the technology acceptance model (TAM, Davis, Bagozzi, & Warshaw, 1989; Venkatesh, Morris, Davis, & Davis, 2003) has generated an enormous body of research. The TAM is useful for a general evaluation of technology and its acceptance in different situations. Consequentially, various scales have been developed based on this model (see Venkatesh et al., 2003). Other evaluation approaches assess users' reaction with user experience scales like the User Experience Questionnaire (UEQ, Laugwitz, Held, & Schrepp, 2008) to assess quality, novelty, and usability aspects of technology.

However, situations involving novel technologies often lead to ambiguous situations - situations that are hard to judge and in which people do not really know how to behave (Shklovski, Mainwaring, Skúladóttir, & Borgthorsson, 2014; Tene & Polonetsky, 2015). In these situations, people might have queasy feelings that are hard to describe or express (Tene & Polonetsky, 2015). An example for the latter assumption are situations in which virtual agents or robots become very human-like but there are still slight differences in behavior or appearance. In such situations, people commonly report that they felt uneasy when introduced

to virtual agents or robots – a phenomenon that is commonly referred to as the uncanny valley (Mori, 1970; Mori, MacDorman, & Kageki, 2012)

For lack of a better description, people often refer to ambiguous situations, or ones they have difficulty judging, or that evoke uneasy feelings as “creepy”. If such situations and technologies are evaluated with usability scales or scales based on the TAM, feelings of ambiguity and uneasiness will not be adequately covered. This might be a reason why the uncanny valley hypothesis is nearly half a century old (Mori, 1970), but related research is still inconsistent, and findings are unclear (Kätsyri, Förger, Mäkäräinen, & Takala, 2015). As such, a common metric for assessing the creepiness of situations could aid not only research regarding the uncanny valley, but also have several practical implications. For instance, movie producers could evaluate their movies’ creepiness and try to decrease such feelings before the release date. This could potentially help prevent movie flops (cf., Geller, 2008; Misselhorn, 2009). More generally speaking, creepiness would become comparable between situations and therefore better understandable, predictable, and preventable.

Unfortunately, as of yet, no psychometrically sound measure of creepiness exists. Therefore, the aim of the current four studies was to develop and investigate the psychometric properties (i.e., dimensionality, reliability, convergent, and divergent validity) of the Creepiness of Situation Scale (CRoSS) to offer a consistent measure for creepiness that can be used for assessing the creepiness of everyday situations and novel technologies.

5.3 Theoretical Background

5.3.1 Creepiness

Creepiness is a rather new concept in research. In their study ”On the nature of creepiness”, McAndrew and Koehnke (2016) analyzed creepy situations and why they were classified as such. For instance, why does being approached by a stranger in the night lead to

feelings of creepiness (McAndrew & Koehnke, 2016). Furthermore, McAndrew and Koehnke (2016) argued that unpredictability evokes creepiness. For example, they proposed that people with unusual patterns of nonverbal behavior or physical characteristics outside the social norm (e.g. outstanding style of clothing) can elicit feelings of creepiness in other people as they seem to be less predictable than people who dress or behave more ordinarily. Thus, McAndrew and Koehnke (2016) argued that this unpredictability leads to uneasy feelings about these nonconformist people and to ambiguity about how to behave and how to judge them.

Another area of research offering particularly useful ideas to understanding creepiness is human-computer interaction. Within this field, scholars and practitioners (e.g., Kätsyri et al., 2015; Saygin, Chaminade, Ishiguro, Driver, & Frith, 2012; Seyama & Nagayama, 2007; Tinwell, 2009; Walters, Syrdal, Dautenhahn, Te Boekhorst, & Koay, 2008) extensively debate the phenomenon of the uncanny valley (Mori, 1970; Mori et al., 2012), which describes feelings toward robots or virtual agents. More precisely, the uncanny valley theory assumes that people accept virtual agents and robots more when they become more human-like. However, if their appearance becomes very human-like but they are still artificial in some way (e.g., talking in a robotic voice, moving choppily; referred to as the "mismatch hypothesis", Kätsyri et al., 2015), acceptance drops rapidly. The movie "Polar Express" is commonly cited as being a victim of the uncanny valley (cf., Geller, 2008; Ho & MacDorman, 2010; Kätsyri et al., 2015; Walters et al., 2008) as people tended to describe this movie as creepy, which is assumed to have impaired audience reactions towards the movie.

The drop of acceptance (i.e., the uncanny valley) is often assumed to be caused by feelings of creepiness when humans are exposed to robots or virtual characters (Kätsyri et al., 2015; MacDorman, 2006; Mori et al., 2012). The mismatch between the human-like appearance on the one hand, and the artificial behavior on the other hand might lead to a

feeling of unpredictability of what the robot or virtual agent will be doing next (similarly to humans behaving strangely, see Kätsyri et al., 2015). As a result, people feel uneasy about interacting with such robots and virtual agents, but they also feel ambiguity about how to behave and how to judge them.

Tene and Polonetsky (2015) provided an excellent overview of creepiness elicited by novel technologies and technologies used in novel situations. In their "Theory of Creepy", Tene and Polonetsky include examples of technologies and situations involving the use of technology which are supposed to be creepy. For example, they describe personalized analytics (i.e., exploiting users' information on social media or web searches for personalized advertising) as potentially creepy. An example of creepy personalized analytics are algorithms predicting whether there is a pregnant person in a household and when the person will give birth (see Tene & Polonetsky, 2015), thus personalized advertising for baby products is provided. This might be useful for organizations selling baby products, but people who are confronted with such personalized advertisements might feel uncomfortable because they do not really know why websites they visit are suddenly providing them with suggestions on where to buy baby products. This feeling might be produced by unpredictability about which information "the web" has gathered about them and by uncertainty about how this advertisement has been produced.

Another example of a creepy situation is a situation where social listening is applied. Tene and Polonetsky (2015) describe a situation where a person having problems with their TV calls their friend for help. Shortly after making the phone call, the person is contacted by the TV's producing company offering help with the TV. However, the user has no idea how the company knew there was an issue with the TV. It could be that the TV producing company monitors all problems with their TVs and calls users having severe issues. It could also be that the user assumes that the company has monitored their call with their friend. The

unpredictability of the companies' behavior can lead to uneasy feelings and feelings of ambiguity on how to judge the situation (e.g., "is it good that they want to help me or is it bad because they listen in on all my phone calls?") or how to behave during the situation (Shklovski et al., 2014; Tene & Polonetsky, 2015).

To summarize, all the aforementioned work on creepiness is similar in that creepiness seems to be elicited by unpredictable people, situations, or technologies. It seems that this induces rather unclear feelings of discomfort paired with uncertainty about how to behave during a creepy situation or with a creepy person or technology. Therefore, we propose that creepiness consists of the two subdimensions: emotional creepiness and creepy ambiguity. More precisely, we define emotional creepiness as a rather unpleasant affective impression that potentially comes with creepy ambiguity, defined as a lack of clarity on how to act and how to judge a situation. Combined, these two subdimensions define creepiness as a potentially negative and uncomfortable emotional response paired with feelings of ambiguity towards a person, technology or even during a situation.

Previous studies capturing creepiness have not used a consistent creepiness scale, nor did they investigate the psychometrical properties of their creepiness measures. In all of these studies, creepiness was measured with a single item (e.g., *not at all creepy* to *very creepy* see McAndrew & Koehnke, 2016 but also Inkpen & Sedlins, 2011; Watt, Maitland, & Gallagher, 2017). This might be useful to capture the general creepiness of a situation, but it makes it hard to determine reliability. Moreover, this kind of measure does not distinguish emotional parts of creepiness from the ambiguity parts. Therefore, it is harder to discern what exactly about the situation has led to high creepiness values. Distinguishing between emotional creepiness and creepy ambiguity might help to understand which part of a situation needs to be adjusted to decrease creepiness.

In the following sections, we will describe the scale development approach for the CRoSS in which we closely followed recommendations by Hinkin (1998). The scale development process consisted of four studies. In the first sub-study, we collected data from an American sample on our initial set of items to carry out an exploratory factor analysis (EFA) to enhance understanding of the dimensions of creepiness. Additionally, we reduced the amount of items to increase efficiency of the scale. In the second sub-study, we collected data from a German sample to apply a confirmatory factor analysis (CFA) to support the factors found in the first sub-study. In the third sub-study, we examined the convergent (using privacy concerns, transparency, controllability and computer anxiety) and divergent validity (using extraversion and conscientiousness) of the CRoSS. In the last sub-study, we used the CRoSS in a field experiment to provide further validity evidence, to show that it is sensitive to experimental manipulations based on theoretical assumptions, and to show that the CRoSS is useful in situations extending beyond the use of technology. In this sub-study, experimenters (male vs. female experimenters) approached people on the street (male vs. female participants) to respond to a questionnaire, either during the day or at night.

5.3.2 Item Generation

The authors consulted the literature for studies on creepiness to obtain an overview of existing theories and measurement models of creepiness. Based on the research of McAndrew and Koehnke (2016), Mori (1970), Mori and colleagues (2012), Shklovski and colleagues (2014), and Tene and Polonetsky (2015), the authors discussed the definition of creepiness and the proposed dimensionality of creepiness. Following the guidelines of Hinkin (1998), we developed 14 items for two assumed creepiness dimensions (six items for **emotional creepiness** and eight items for **creepy ambiguity**, see Table 5-1). The items for emotional creepiness were written to represent unclear and queasy feelings towards a situation, whereas the items for creepy ambiguity were written to reflect uncertainty on how

to judge a situation and how to behave during a situation. Items were generated in German, translated to English, sent to a native English-speaking proofreader, translated to German and checked for coherence with the original items. Concerning the response format, we decided to use a seven-point rating scale from 1 (*Strongly Disagree)* to 7 (*Strongly Agree).*

5.4 Sub-study 1[1]: Exploratory Factor Analysis, and Scale Analysis in an American Sample

5.4.1 Sub-study1: Method

Following Hinkin's (1998) recommendation, we used EFA to examine the dimensionality of the scale, assessing factor loadings for the items, and potentially excluding items from the scale.

Amazons' Mechanical Turk (Buhrmester, Kwang, & Gosling, 2011; Landers & Behrend, 2015) was used to collect data for the EFA. Following suggestions by Bortz and Schuster (2011) as well as Hinkin (1998) regarding required sample size for an EFA, we collected data until our final sample consisted of 300 participants (46% female) from the US with a mean age of 36 years (*SD* = 10.98). Participants received a small amount of money for participating. During the study, participants watched a video where a situation similar to one of the creepy situations described by Tene and Polonetsky (2015) was shown. The video was recorded with a camera in the first person view to enhance participants' immersion. In this video, a person sits in front of a computer screen using a word processing software when suddenly the computer produces an audible error signal; the person uses the mouse but nothing happens (i.e., the screen freezes). As a result, the person turns off the computer. Following, the person tries to restart the computer, but it does not turn on again. Afterwards, the person reaches for their smartphone and starts texting a friend for help. In the video, the screen of the smartphone is visible so participants can read what the person is writing. It is also made clear that the person is writing to a friend, because there is already a texting history

clarifying that they know each other (i.e., a message is visible from some hours ago; the person in the video addresses the friend with "buddy"). Once it is clear that the person asks a friend for help but before the message is sent to the friend, the person receives a call from an unknown number and starts acting confused over the call (e.g., hesitates to answer the call, uses confused hand gestures). The person presses the button to answer the call. Then the caller with a foreign accent starts speaking and says: "Hello? This is Chris from Computer Solutions. We heard that you are having problems with your computer? You were writing something but suddenly you could not move the mouse anymore and now the computer is not turning on again? Fortunately, this is a common problem with your computer series, I can help you fix this right now. You just need to execute the following steps…". We dubbed this phone call to ensure that participants can hear it loud and clearly. Then, the video fades out without any further information. After watching the video, participants completed the 14 initial CRoSS items and provided demographic information. Additionally, participants had to describe what happened during the situation as a manipulation check. The manipulation check was to ensure whether participants had watched the video attentively and to explore if they perceived the situation displayed in the video as ambiguously as intended (e.g., if different participants came up with different explanations on what has happened during the situation).[2]

5.4.2 Sub-study 1: Results

As a first step of Sub-study 1, we analyzed the open-ended manipulation check question that asked participants for a description of what has happened during the situation. Table 5-2 shows the most common explanations that participants came up with. These explanations showed that participants watched the video and that the video generated a variety of ideas about what has happened during the situation. These commentaries showed that the video evoked reactions varying from a neutral description of the situation to the fear

of privacy invasion and a hacker attack. Furthermore, there was a substantial number of participants who described the situation as “creepy”.

For the EFA we used a principal component analysis with oblique rotation on the 14 CRoSS items because the two proposed scales of creepiness are non-orthogonal (Fabrigar, Wegener, MacCallum, & Strahan, 1999). To assess dimensionality, we used three criteria: The Kaiser-Guttman criterium (eigenvalues larger than 1; Kaiser, 1960), drops of eigenvalues in the scree plot, and comparison of the eigenvalues to random eigenvalues for 14 items with 300 participants (i.e. parallel analysis, Horn, 1965). Results indicate a two-factorial solution accounting for 61 percent of variance. We then analyzed the items regarding potential item removal (Hinkin, 1998). Ten of the initial fourteen items loaded substantially (> .50) on their supposed factors, two items loaded on both factors equally (E1, A8) and two more items did not load substantially on any factors (A1, A5); accordingly, these four items were removed from the scale (cf., Hinkin, 1998) (see Table 5-1).

For the remaining ten items, we conducted another principal component analysis with oblique rotation that resulted in two factors explaining 68 percent of variance. Every item loaded substantially (> .50) on its supposed factor. The correlation between the two factors was r = .52. In line with our expectations, results showed a two-factor solution with five items on each factor. The first factor reflected emotional creepiness, with the items capturing an emotional response to a potentially creepy situation. The second factor reflected creepy ambiguity, with items describing insecurity about how to behave during the situation and how to judge the situation.

Following, we conducted a scale reliability analysis to ensure reliability of the entire scale and the two subscales. For the entire scale we found a good reliability (cf., Cortina, 1993) of Cronbach’s α = .90 (emotional creepiness Cronbach’s α = .87; creepy ambiguity Cronbach’s α = .89).

5.5 Sub-study 2: Confirmatory Factor Analysis in a German Sample

5.5.1 Sub-study 2: Method

For the next step of the scale development, the goodness of fit of the resulting factor structure needs to be assessed (Hinkin, 1998). As such, we followed suggestions by Hinkin (1998) regarding the required sample size for a CFA and collected data from 306 German participants in an online study. Participants were recruited through social media, in psychology and economics courses at a German university, and on an online survey platform on which researchers take part in online survey in exchange for other people to take part in their surveys. Three participants were excluded because of technical problems, and one participant was excluded because he stated that he did not take the study seriously. The final sample consisted of 302 participants (67 percent female) with a mean age of 26 years (*SD* = 8.37). During the study, participants watched the same video as in the first study and afterwards responded to the ten CRoSS items and to demographic questions. Similar to Sub-study 1, participants had to describe what happened during the situation as a manipulation check.

5.5.2 Sub-study 2: Results

Similar to Sub-study 1, we analyzed the open-ended manipulation check question; Table 5-3 shows the most common explanations that participants came up with. The only difference between the two samples was that no participant in the German sample questioned the abilities of the user in the video. Comparable to the American participants, the German participants explained the situation either very descriptively as it was, thought it was a "strange" situation or they imagined a hacker attack. This shows support for the fact that the situation in the video was also perceived ambiguously by the German participants.

Since this sample was collected in Germany, where one might expect different results for the factors and reliability of the CRoSS compared to the American sample, an EFA with

oblique rotation was conducted for the items. Results showed two factors explaining 62 percent of the variance and all items loaded substantially (> .50, see Figure 5-1) on their supposed dimension. The correlation between these two factors was $r = .47$. Furthermore, reliability for the scale was Cronbach's $\alpha = .87$ (emotional creepiness Cronbach's $\alpha = .85$; creepy ambiguity Cronbach's $\alpha = .82$). These results indicate that there are no substantial differences in the results of the EFA of the American sample from Sub-study 1 and of the German sample from Sub-study 2. As the video in Sub-study 1 was the same as in Sub-study 2, we also compared creepiness ratings between the countries based on $N = 602$ participants. There were no differences between the countries for emotional creepiness (America $M = 4.51$, $SD = 1.47$; Germany $M = 4.70$, $SD = 1.32$, $t[592.45] = 1.66$, $p = .10$, $d = 0.14$), nor for creepy ambiguity (America $M = 4.38$, $SD = 1.47$; Germany $M = 4.55$, $SD = 1.28$, $t[588.66] = 1.50$, $p = .13$, $d = 0.12$).

Additionally, a CFA was conducted using the SPSS plugin AMOS. Creepiness consisted of the two factors emotional creepiness and creepy ambiguity, both loading on a common underlying factor called Creepiness. For this hypothesized model (Model 1 in Table 5-4, displayed in Figure 5-1), results showed that all of the paths between the factors and respective items were significant, as were the paths between the two factors and general creepiness. Furthermore, Table 5-4 shows fit indices of the proposed Model 1 in comparison to an alternative one-factor model and an orthogonal two-factor model. All things considered, Model 1 fits the data significantly better than the other two models regarding χ^2 statistics, and it showed a better fit on all other fit indices. It is necessary to mention that the χ^2 statistic for Model 1 was significant, indicating a less-than-perfect fit for the proposed model. However the χ^2 statistic is sensitive to sample size (Marsh, Balla, & McDonald, 1988), thus other fit indices should also be considered and they indicated an acceptable fit (Root mean square error of approximation RMSEA = .08; MacCallum, Browne, & Sugawara, 1996) or a good fit

(for goodness-of-fit index GFI, adjusted goodness-of-fit index AGFI, >.90 and comparative fit index CFI > .95; Bollen, 1990; Hu & Bentler, 1999).

To conclude, the CFA indicated that the two factors emotional creepiness and creepy ambiguity which both loaded on the same general creepiness factor represented the data well. Accordingly, the next step of scale development is to gather evidence of construct validity. For this purpose the next two section cover an online and a field experiment to examine validity of the CRoSS.

5.6 Sub-study 3: Convergent and Divergent Validity

For the development of a new scale it is important to show that it is measuring a meaningful construct (Hinkin, 1998). Therefore, it is necessary to demonstrate correlations with other relevant constructs (convergent validity) and at the same time distinguishability from unrelated constructs (divergent validity). This step of scale development is especially important in the case of creepiness, which research has just started to examine (cf., McAndrew & Koehnke, 2016).

5.6.1 Convergent validity

In an attempt to support convergent validity of the CRoSS, we propose correlations between creepiness and the constructs privacy concerns, computer anxiety, transparency, and controllability. Below, we provide theoretical support for each of the proposed correlations.

Privacy concerns are an important variable to measure feelings of privacy invasion through novel technologies (Smith, Dinev, & Xu, 2011). When people hold privacy concerns, they are under the impression that their personal data might be collected without their knowledge, that they have no control about which data are collected, that there might be errors in the data collection, and that personal data might be misused (Shin, 2010; Smith et al., 2011). Consequently, privacy concerns can lead to less trust in the organizations which

elicited these concerns (Smith et al., 2011; Tene & Polonetsky, 2015). This can detrimentally affect important organizational outcomes such as, applicant reactions, provision of personal information, and online sales revenue (Bauer et al., 2006; Malhotra, Kim, & Agarwal, 2004; Phelps, Nowak, & Ferrell, 2000; Shin, 2010).

Shklovski and colleagues (2014) proposed that creepiness will be present in situations where there are privacy concerns. For instance, they describe the invasion of privacy through smartphone apps. If people perceive privacy concerns because an app requests access to their pictures and contacts, although the app is for a game that has nothing to do with pictures or contacts, they can get a feeling that this somehow feels wrong (Shklovski et al., 2014). This feeling of "wrongness" (Shklovski et al., 2014, p. 2347) leads to users' desire to distance themselves from the app to regain control over their privacy. As such, we propose that creepiness relates to privacy concerns as both feelings can be elicited through uncontrollable situations (see also Phelps et al., 2000; Shin, 2010). In fact, privacy concerns seem to decrease if people have at least the impression that they are more in control of their data (Phelps et al., 2000; Smith et al., 2011). Additionally, privacy concerns, similar to creepiness, relate to people's affective impressions about technologies. More precisely, if people are concerned about their privacy, it can induce uneasy feelings (Powell, 2013). Therefore, we propose:

Hypothesis 1a: Creepiness is positively correlated to privacy concerns.

Computer anxiety can be defined as an uncomfortable feeling when interacting with a computer or when there is the possibility that one has to use a computer (Barbeite & Weiss, 2004; Chua, Chen, & Wong, 1999). Accordingly, creepiness relates to computer anxiety as people who are generally more anxious when it comes to interacting with a computer might also be people who will experience higher levels of creepiness when it comes to technology-related situations. Thus, we propose:

Hypothesis 1b: Creepiness is positively correlated to computer anxiety.

Transparency of a situation is given if people understand what is going on during this situation (McCarthy et al., 2017; Truxillo, Bodner, Bertolino, Bauer, & Yonce, 2009). In contrast, if people conceive that there is something shady about the situation or that they do not see through a situation, this reduces transparency. It is likely that situations that are not transparent are also creepy because if a situation is not instantly clear, people might come up with several (possibly wrong) explanations about this situation, thus increasing ambiguity (see also Studies 1 and 2). For instance, in the case of personalized advertising for baby products, people might start to wonder how the providers of these advertisements know about a woman's pregnancy. Conversely, if the providers of the advertisement made clear from where they received their information, this situation would be less ambiguous, more predictable, and thus less creepy. We therefore propose:

Hypothesis 1c: Creepiness is negatively correlated to transparency. This relation might be more pronounced for creepy ambiguity.

The more people perceive that they are able to influence a situation, the more they think it is controllable (Ajzen, 2002). If a person's behavior makes no difference regarding the outcome of a situation, the situation is uncontrollable, possibly leading to negative feelings about the situation and everything associated with it (Venkatesh et al., 2003). For example, people trying to avoid personalized advertising might be successful so long as their friends and family do not spend time on the internet. When a friend allows apps to access contact information on their smartphones, advertisement can become personalized for the person who originally tried to avoid it (Shklovski et al., 2014). Consequentially, these people no longer feel in control of personalized advertising because no matter what they do, advertisers will be able to obtain information about them that they will use to personalize advertisements. This lack of control might also lead to unpredictability, as it is less possible

to influence the future within uncontrollable situations. As such, perceived control also relates to creepiness as decreased predictability increases the creepiness of situations (McAndrew & Koehnke, 2016; Tene & Polonetsky, 2015). Furthermore, low controllability might especially be related to emotional aspects of creepiness, as low controllability seems to relate to negative affective impressions (cf., Tamir, John, Srivastava, & Gross, 2007). We thus propose:

Hypothesis 1d: Creepiness is negatively correlated to controllability. This relation might be more pronounced for emotional creepiness.

5.6.2 Divergent validity

To provide evidence for divergent validity, we chose the personality dimensions extraversion and conscientiousness, as both are expected to be unrelated to creepiness. In the case of extraversion, it should not matter if a person is especially outgoing or rather reserved in judging the creepiness of a situation. In the case of conscientiousness, a person who is rather lazy should be equally influenced by a creepy situation like a person who closely keeps track of their daily schedule. Therefore, we propose:

Hypothesis 1e: Creepiness is not (or at least to a lower extent in comparison to the convergent validities) correlated to extraversion.

Hypothesis 1f: Creepiness is not (or at least to a lower extent in comparison to the convergent validities) correlated to conscientiousness.

5.6.3 Sub-study 3: Method

We used G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) to calculate that $N = 153$ participants are necessary for an assumed correlation of $r = .20$ and a power of $1-\beta = .80$. Three participants were excluded because they stated that their data should not be used for the analysis, one participant was excluded because of very fast response times to the items (e.g., taking only 2 seconds for four items), and one further participant was excluded because

of staying on the page on which the video was shown for nearly 15 minutes, indicating that s/he did not pay attention to the video. Participants were recruited via social networks and an online survey platform on which researchers take part in online surveys in exchange for other people to take part in their surveys. The final sample consisted of 153 German participants (73% female) with a mean age of 23.61 years (*SD* = 12.13) and a range of 18 to 60 years. Participants were predominantly students (84%). Most of the participants studied psychology (62%), and 12 percent of the participants studied business. Additionally, more than half of the participants (51%) indicated that they were currently working (65% of these part time, the rest on average 45 hours).

The study was conducted via an online survey platform and participants watched the same video as in the first and second sub-study. Afterwards they responded to the CRoSS, the other measures assessing convergent and divergent validity, demographic questions, and (similar to Substudies 1 and 2) to an open-ended question in which they were required to describe what has happened during the situation in the video.

5.6.4 Sub-study 3: Measures

All measures except for extraversion and conscientiousness were rated on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

Privacy concerns were measured with six items adapted to the purpose of this study; two of them were taken from Malhotra and colleagues (2004), two from Langer, König, and Krause (2017), one from Smith (1996), and one from Langer and colleagues (2018). A sample item was: “Such situations threaten privacy”.

Computer anxiety was measured using four items Barbeite and Weiss’s (2004) scale. A sample item was: “Working with a computer would make me very nervous.”

Transparency was measured with three items. Two of these items were taken from Langer, König, and Fitili (2018) and adapted to the purpose of this study and we developed one additional item ("It was clear what was happening during the situation in the video.")

The four **controllability** items were taken from Langer, König, and Krause (2017) who followed suggestions from Ajzen (2002). We adapted these items to the purpose of this study. These items were: "I am convinced that I could control the situation shown in the video.", "I think that I would be able to control a situation similar to the one shown in the video.", "Situations like the one shown in the video are uncontrollable.", and "For people who find themselves in similar situations like the one shown in the video it is easy to be in control of the situation."

For **conscientiousness** and **extraversion** we used a German measure of the Big Five Inventory by Rammstedt and John (2005) with four items for each of the dimensions rated from 1 (*disagree strongly*) to 5 (*agree strongly*). A sample item for conscientiousness was: "I see myself as someone who does things efficiently." A sample item for extraversion was: "I see myself as someone who is outgoing, social."

5.6.5 Sub-study 3: Results

Table 5-5 shows a few examples participants provided on their explanations for the situation. Findings showed that they came up with similar explanations to participants in Studies 1 and 2.

Table 5-6 presents correlations and reliabilities of the study variables. Regarding convergent validity, Hypotheses 1a-d were all supported as the results showed significant correlations between the creepiness scale and privacy concerns, computer anxiety, transparency, and controllability. As hypothesized, privacy concerns and computer anxiety were positively correlated, whereas controllability and transparency were negatively

correlated with creepiness. Furthermore, we found additional support for Hypothesis 1c as the results showed that transparency was only correlated with creepy ambiguity, whereas there was no significant correlation between transparency and emotional creepiness.

In contrast to the second part of Hypothesis 1c, there was no difference in the magnitude of correlations between the subdimensions of creepiness and controllability. This indicates that correlation between emotional creepiness and controllability is not stronger than the correlation between creepy ambiguity and controllability.

Regarding divergent validity, the results (cf. Table 5-6) show support for Hypotheses 1e and 1f. Neither the entire creepiness scale, nor its subdimensions correlated significantly with extraversion and conscientiousness.

In a last explorative step, we assessed the relations between creepiness and participants' gender and age. The results showed that females expressed higher feelings of creepiness compared to male participants, and that there was no significant relation between creepiness and participants' age.

To summarize, the results of Sub-study 3 increased our understanding of the construct of creepiness and its nomological network. Sub-study 3 showed that creepiness is positively related to computer anxiety and privacy concerns, negatively related to transparency (especially creepy ambiguity) and controllability, whereas it is not related to conscientiousness, extraversion, or participants' age. Taken together, these results provide support for the convergent and divergent validity of the CRoSS and its subscales. Lastly, Sub-study 3 showed initial support of the assumption by former research that females might express higher feelings of creepiness than males (McAndrew and Koehnke, 2016). In the experimental design of Sub-study 4, this finding will be investigated more closely, together with the assumption that creepiness is a feeling that can also be expressed in real-life situations.

5.7 Sub-study 4: Validation in a Real-Life Situation

In this last step of our scale development, we applied the CRoSS to a real life-situation. Throughout the previous three studies, participants only watched a video involving a creepy situation with a technology. However, creepiness might also be present in situations that do not use technology. Therefore, in Sub-study 4, participants were either approached by a male or a female experimenter in a public place where they were asked to respond to the CRoSS items. This was either done during the day, or at night.

McAndrew and Koehnke (2016) proposed that men will be evaluated as being creepier than women. A reason for this could be that males are, in general, more physically threatening and underlie the stereotype of being more violent than women (McAndrew and Koehnke, 2016). On the one hand, this could mean that people are more afraid of men. On the other hand, this also implies that men are perceived as being less predictable and potentially less controllable than women, so other males and females might be constantly aware of a possible threat by males.

Additionally, McAndrew and Koehnke (2016) proposed that women in general feel more creepiness in most situations. This might be true because "being weak" is a common stereotype for females (Eagly & Steffen, 1984; Rosette & Tost, 2010). People who think they are weak might also think that they are less able to control a variety of situations. Therefore, we propose:

Hypothesis 2a: A male experimenter will evoke more creepiness than a female experimenter.

Hypothesis 2b: Women will report more creepiness than men.

Furthermore, environmental aspects can also evoke creepiness. For instance, McAndrew and Koehnke (2016) describe a dark tunnel as an example of a creepy environment. In addition, Watt, Maitland, and Gallagher (2017) stated that people are more

likely to come across creepy people at night, and Boomsma and Steg (2014) proposed that people feel more queasy at night. The night relates to our concept of creepiness such that at night people might have the feeling that they are less able to predict what will happen, and that situations that occur at night are less transparent, simply because people cannot perceive their surroundings as well as during the day. Thus, we propose,

Hypothesis 2c: The experimental situation during the night will evoke more creepiness than during the day.

Exploratory Hypothesis 2d: Female participants contacted by a male experimenter at night will express more pronounced feelings of creepiness.

5.7.1 Sub-study 4: Method

For the fourth sub-study we calculated the required sample size using G*Power (Faul et al., 2009). For a power of 1-β = .80 and a moderate effect size for the interaction effect, a sample size of 128 participants was required. Therefore, we collected data from 128 participants (53% female) with an average age of 34 years (*SD* = 12.09), ranging from 18 to 69 years.

In a 2x2x2 design (male experimenter vs. female experimenter; male participant vs. female participant; day vs. night) we chose one public place to contact participants (see Figure 5-2). Our experimenters received a script instructing them to dress similarly, to not smile at participants, and to not behave especially friendly, but still politely. In addition, they were told to never collect data at the same time as the other experimenter. The experimenters were both Caucasian, had blue eyes and bright skin, and were 26 years old. The female experimenter was 171 cm tall (5’6’’) and the male experimenter was 174 cm (5’7’’). In two weeks in May (only on weekdays, and only on days/nights when it was not raining), the experimenters went to the public place and approached people to fill out the CRoSS items. Participants were instructed to rate the situation they had just experienced (i.e., the situation

of being contacted by a stranger to fill out a questionnaire). The hours of data collection during the day were between 3pm and 6pm, for data collection that took place at night, the hours were from 10pm until 12pm.

5.7.2 Sub-study 4: Results

Table 5-7 presents correlations between the study variables. Reliability for Creepiness was Cronbach's $\alpha = .92$ (emotional creepiness Cronbach's $\alpha = .89$; creepy ambiguity Cronbach's $\alpha = .86$).

To evaluate Hypotheses 2a-d we used an ANOVA with three factors. Means and standard deviations of the groups are presented in Table 5-8. In Hypothesis 2a it was assumed that a male experimenter will evoke more creepiness than a female experimenter. However, we found that the female experimenter evoked more creepiness $F(1,120) = 4.16$, $p < .05$, $\eta^2_p = .03$, thus Hypothesis 1 was not supported.

Furthermore, we found support for Hypothesis 2b, as women reported more creepiness than men, $F(1,120) = 13.81$, $p < .01$, $\eta^2_p = .10$. In addition, Hypothesis 2c was supported as participants who were approached at night expressed more creepiness than participants who were approached during the day, $F(1,120) = 5.63$, $p < .05$, $\eta^2_p = .05$. Lastly, exploratory Hypothesis 2d suggested that female participants contacted by a male experimenter at night will express more pronounced feelings of creepiness. However, results showed no support for this idea.

5.8 Discussion

The current paper introduced the Creepiness of Situation Scale as a measure to examine creepiness of various situations. Following rigorous psychometrical guidelines for scale development by Hinkin (1998), the four current studies show that the CRoSS offers a reliable measure of general creepiness and its two subdimensions emotional creepiness and

creepy ambiguity. It therefore offers an additional perspective to evaluate novel technologies over and above scales based on the TAM and on usability aspects. Sub-study 1, which used an American sample, showed that the CRoSS consists of two subdimensions. Sub-study 2 confirmed these two correlated subdimensions of creepiness in a German sample. Finally, Studies 3 and 4 supported the validity of the CRoSS in a technological and in a real-world context. Additionally, the results from Sub-study 4 indicated that the CRoSS is sensitive to experimental manipulations based on theoretical assumptions.

As we explained in the introduction, organizations nowadays constantly come up with new services in which algorithms judge human behavior (e.g., personalized advertising, Shklovski et al., 2014), people are repeatedly exposed to novel technological inventions (e.g., self-driving cars, Tene & Polonetsky, 2015), and humans increasingly interact with virtual characters and robots (Langer et al., 2018). One word to describe feelings of uncertainty about how to feel during these situations and how to judge these situations seems to be "creepy". Previous research has tried to define the term creepiness (e.g., McAndrew & Koehnke, 2016; Tene & Polonetsky, 2015), and has measured creepiness with single-item measures (e.g., Inkpen & Sedlins, 2011; Watt et al., 2017). However, no study so far has attempted to integrate theoretical assumptions regarding creepiness to develop a sound measure for creepiness.

One shortcoming of previous creepiness measures is that they were not developed to fulfill basic psychometrical standards. For creepiness research to evolve however, and to make results from different studies on creepiness comparable, there is need for a psychometrically sound measure of creepiness. For single-item measures, it is not possible to provide information about Cronbach's Alpha reliability values. The CRoSS shows good to very good Cronbach's Alpha values throughout all four current studies. For measures lacking theoretical background, it is hard to come up with theoretical assumptions about its relation to

other important measures. It is even harder to develop specific hypotheses. This might be a reason why research has yet to provide data on the relations between creepiness and other measures. To be clear, these issues address the validity of a measure. Regarding validity of the CRoSS, it was possible to generate theory-based hypotheses concerning the relation of creepiness with other relevant measures and to predict the direction of these relations (e.g., a positive correlation with transparency, but only for creepy ambiguity). All in all, our results regarding reliability and validity suggest that the CRoSS is a potentially useful scale to advance research on creepiness.

An additional contribution of the current set of studies is that the findings suggest that creepiness consists of creepy ambiguity and emotional creepiness, which can help to increase our understanding of the creepiness concept. One example for this increased understanding can be found in Sub-study 3 which found that non-transparent situations evoke creepy ambiguity, but to a lesser extent emotional creepiness. This indicates that increasing transparency may help to decrease creepy ambiguity, but negative emotional impressions may still occur. In contrast, influencing situations which involve the affective dimension of creepiness might require other interventions. For example, it is imaginable that emotional creepiness will be reduced through long-term exposure with a creepy situation. Similar to other negative emotional impressions (e.g., anxiety, Powers & Emmelkamp, 2008), emotional creepiness potentially declines if people are constantly exposed to a situation and if the situation becomes more familiar. These insights would not have been possible with a single-item measure of creepiness built upon (at best) blurry theoretical assumptions. At this point, the authors would like to repeat that capturing creepiness with a single item measure (e.g., Inkpen & Sedlins, 2011; McAndrew & Koehnke, 2016; Watt et al., 2017) might be adequate for certain situations (e.g., getting a general idea about the creepiness of a situation), but it does not account for the different subdimensions of creepiness.

5.8.1 Theoretical implications

Speaking in favor of the value of the CRoSS for research on creepiness, the current studies support and extend previous research regarding creepiness (e.g., McAndrew & Koehnke, 2016; Tene & Polonetsky, 2015). Our studies show that creepiness relates to variables that are associated with the predictability of a situation (i.e., less transparency and controllability). This enhances our understanding of the creepiness concept as the results provide insight into creepiness' nomological network.

Sub-study 4 also lends further support for the relation of creepiness and predictability. During the day, it might be more common to interact with people who contact you to fill out some questionnaires, whereas an experimenter who approaches people at night to fill out a questionnaires is rather uncommon. Therefore, participants who realized that an experimenter is approaching them during the night had a harder time predicting what will happen next than participants exposed to the same situation during the day.

Furthermore, our findings support assumptions of Shklovski and colleagues (2014) who proposed that privacy concerns are related to creepiness. Studies 1-3 exposed participants to a situation which was interpreted as evoking privacy concerns. Participants concluded that the customer support was acting like "Big Brother" (see Table 5-3), or that the situation was a "disturbing breach of privacy" (see Table 5-2). At the same time, Sub-study 3 found that participants who perceived the situation as a more severe instance of privacy invasion, also reported higher feelings of creepiness.

Another field of research that could benefit from the CRoSS is research regarding the uncanny valley. As stated in the theoretical background, this field of research has produced mixed results (cf., Kätsyri et al., 2015). We posit that the CRoSS will be a useful tool to explore the uncanny valley in a more standardized fashion. Future studies regarding the

uncanny valley may use the CRoSS as a uniform way of measuring its impact, thus making results more comparable.

Aside from its usefulness within technological settings, the CRoSS also seems to be a valuable measure for assessing creepiness in other real-life situations. For instance, we found support for assumptions by McAndrews and Koehnke (2016), showing that women in general express higher feelings of creepiness. This result is similar to findings from previous research which has shown that women tend to report more pronounced affective reactions than men (Ashmore, 1990). This supports the assumption that creepiness has an affective component. In contrast, our results question the expectation of McAndrews and Koehnke (2016) that men evoke higher feelings of creepiness. The results from Sub-study 4 indicate that a female experimenter induced more creepiness, implicating that women possess characteristics (e.g., body language, facial expressions, behavior) that are equally or even more likely to induce creepiness compared to physical threat evoked by men (cf., McAndrews & Koehnke, 2016). One possible explanation for this result is that we told our experimenters to be polite, but not to smile. Since females tend to be more emotionally expressive (Kring & Gordon, 1998), it might have been more unfamiliar for participants to be contacted by a female experimenter who did not smile as opposed to a non-smiling male experimenter, thus leading to higher feelings of creepiness. If the reason for more creepiness was unfamiliarity of the situation, this would again speak in favor of the assumption that predictability is related to creepiness. More precisely, people in unfamiliar situations possess less knowledge about the situation and therefore they might be less able to predict what will happen next (cf., Eagly & Steffen, 1984). However, it is important to note that the current study only showed initial support that creepiness relates to concepts associated with predictability (e.g., transparency, controllability, familiarity). The exact paths and causal relations between these concepts and creepiness need to be addressed in future experimental studies.

5.8.2 Implications

If researchers evaluate novel technologies, they might consider using the CRoSS as an additional evaluation criterion. Above and beyond scales based on the TAM and on usability aspects of technologies, the CRoSS offers an efficient and valid way of assessing participants' affective reactions towards technology-enhanced situations. Previously, evaluations of technologies might have missed these aspects, as feelings of creepiness were not included in previous scales developed to assess user reactions (see Venkatesh et al., 2003).

Furthermore, companies could use the CRoSS to improve acceptance of new products and services. For instance, organizations providing personalized advertising can investigate the creepiness of their services and try to decrease it. As our results show that transparency can diminish creepiness, it might be a promising way to provide information about how personalized advertisement is generated to reduce creepiness. In general, providing information might be impactful to decrease creepiness (see also McCarthy et al., 2017).

In addition, organizations producing robots or virtual characters (e.g., within movies) might be able to assess if their product is at risk of descending into the uncanny valley. For example, movie producing companies could show their virtual characters to a test audience, adapt and use the CRoSS, and compare different versions of their virtual characters regarding creepiness. This way, undesirable surprises at the launch of the movie could be prevented.

5.8.3 Limitations

There are at least two limitations that need to be addressed. First, Sub-study 1 was conducted in an American sample, whereas the other three studies were conducted with German participants. Therefore, implications of Studies 2-4 regarding reliability and validity of the CRoSS might not be generalizable to the English version of the scale. However, comparing Sub-study 1 and the other studies shows that the two-factor solution that was

found in the American sample generalized to the German samples, that Cronbach's α of the scales was similar for all of the studies, and that there were no differences between the countries regarding the level of creepiness induced by the experimental video. This provides initial support that the German and English version of the CRoSS are comparable.

Second, Studies 1-3 were all conducted online and participants only watched a video instead of interacting directly within a creepy situation. A consequence of this could be that results would have been different if people had interacted directly within the situation. However, Sub-study 4 supports the assumption that the CRoSS also works to evaluate creepiness in real-life situations.

5.8.4 Future research

Future research should aim to examine the predictive validity of the CRoSS. For instance, it would be interesting to examine the mismatch hypothesis (i.e., the hypothesis that a mismatch between the human-like look of a virtual character or robot and its potentially artificial behavior is one reason for the uncanny valley; Kätsyri et al., 2015) using the CRoSS. Participants could interact with virtual characters or robots, which are experimentally manipulated regarding different levels of mismatch, and the CRoSS can be used to assess if increases in mismatch also increases creepiness.

Furthermore, we assumed that creepiness is negatively related to familiarity. Therefore, it would be interesting to expose participants to a creepy situation (e.g., interacting with a robot) in a longitudinal study. After being exposed to this situation several times, familiarity would rise and creepiness would potentially decrease.

Additionally, it could be a fruitful approach to experimentally manipulate the level of creepiness through reducing controllability and transparency of a technology. For instance, a virtual trainer providing feedback for nonverbal behavior (cf., Langer et al., 2016) might be less creepy if it provides participants with information about its functionality, and if it

appears to be manageable and clear that participants can influence outcomes and feedback through their own behavior. Such studies could help to further enhance our understanding of the creepiness construct.

Additionally, the authors would like to stress that the CRoSS is not restricted to situations using novel technologies; rather its uses can be extended to other real-life situations that are supposed to elicit queasy feelings and ambiguity. For instance, the CRoSS could be used to evaluate the creepiness of a public parking deck. If participants report that they perceived creepiness when walking through the parking deck, installation of further illumination could help reduce those feelings.

Lastly, translating and validating the CRoSS in other languages might lead to intercultural comparability of the creepiness concept. It could be that there are cultures and countries whose people experience lower feelings of creepiness. For instance, people in countries scoring low on Hofstede's dimension of uncertainty avoidance (cf., Hofstede, 1984) might be less sensitive to creepiness as they tend to be better at handling uncertainty, unpredictability, and ambiguity. Hence, it might be a fruitful direction for future research to investigate creepiness in different cultures.

5.8.5 Conclusion

The current study increased our understanding of the creepiness concept. With the CRoSS, we developed and validated a scale that can advance research on creepiness. Moreover, the CRoSS might provide a new, formerly neglected, perspective on the evaluation of technologies in research and practice.

5.9 Footnotes

1. Following the call for open science (Open Science Collaboration, 2015), every study of this paper was pre-registered. This means, before we collected any data we pre-registered our hypotheses as well as the intended data collection and analysis approaches. The pre-registrations can be made available on request.
2. In a pre-study with 9 participants we tested if the video evoked enough variance in participants‘ responses. This data is not included in the data from Study 1.

5.10 References

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5.11 Tables and Figures

Table 5-1

Initial Items in German and English and Proposed Dimensions of these Items

Item number	Original Item English	Original Item German
~~E1~~	This was a strange situation.	Dieses Situation war merkwürdig.
E2	During this situation, I had a queasy feeling.	Ich hatte ein mulmiges Gefühl während der Situation.
E3	I had a feeling that there was something shady about this situation.	Ich hatte während der Situation das Gefühl, dass etwas faul ist.
E4	I felt uneasy during this situation.	Ich fühlte mich unwohl während der Situation.
E5	I had an indefinable fear during this situation.	Während der Situation hatte ich eine undefinierbare Angst.
E6	This situation somehow felt threatening.	Die Situation fühlte sich irgendwie bedrohlich an.
A1	I did not know how to judge this situation.	Ich wusste nicht wie ich die Situation einschätzen sollte.
A2	During this situation, I did not know exactly what was happening to me.	Ich wusste während der Situation nicht genau, was mit mir passiert.
A3	During this situation, things were going on that I did not understand.	Während der Situation sind Dinge vorgegangen, die ich nicht verstanden habe.
~~A4~~	During this situation, I did not know if how I was being treated was OK.	Während der Situation wusste ich nicht, ob es in Ordnung ist, was gerade mit mir gemacht wird.
A5	I did not know exactly how to behave in this situation.	Ich wusste nicht genau, wie ich mich in dieser Situation verhalten sollte.
A6	I did not know exactly what to expect of this situation.	Ich wusste nicht genau, was ich in der Situation zu erwarten habe.
~~A7~~	This situation was unpredictable.	Die Situation war unvorhersehbar.
~~A8~~	I had a feeling that I was not in control of the situation.	Ich hatte das Gefühl, keine Kontrolle über die Situation zu haben.

Note. E = Emotional creepiness, A = Creepy ambiguity, ~~x~~ = These items were removed from the scale after the exploratory factor analysis.

Table 5-2

Explanation that Participants came up with in Sub-study 1

Explanation type	Example
Creepy Situation	- A girl was typing on her computer. Her mouse stopped working. She turned the computer off. Then she couldn't get anything to work. She was texting her friend when all of a sudden somebody called her who knew what was going on with her computer. Creepy. - Person's computer froze up and they didn't know what to do so they turned off the computer and texted their friend for help, and almost instantly got a really creepy unsolicited call offering to help which was either some new terrible business idea or someone scamming the computer user. - Somehow the man who called saw my message and chimed in to help fix my computer problem, but this seems like a disturbing breech of privacy to me.
Hacker attack	- He was being scammed remotely. They shut down and locked his PC, then called him offering to help fix it. - Someone was able to take over the pc and make it stop working. Then they called - they're going to ask for credit card info, etc. as they're hackers and crooks trying to get me to give them personal info in order to steal it and use it. - He was a victim of some sort of Malware and basically his PC is now being held for a ransom. I'm a PC technician and I've seen this a lot come through my door
Users' fault	- Dude's mouse and keyboard stopped working so he shut off his computer which is the stupidest first move anyone could do in that situation. - Her computer froze up and she SERIOUSLY didn't even bother to ctrl+alt+del to see if it was the program malfunctioning and instead went RIGHT for the shutdown like some kind of noob. - Guy was trying to get his homework done. He unplugged the mouse and claimed to be having trouble with it. He made an excuse up to not to the work.
Description of the situation	- A lady was typing something and her computer's mouse stopped working. She turned off the computer and was called by customer support. - A person was typing and the computer froze. Someone called saying they could help even though nobody was told about the trouble yet. - The man was working on his computer when it locked up on him and he turned it off. As he was texting a friend for help, his phone rang with a private number, and the person (with a foreign accent) on the other end was telling him that he was from computer support, that he could help him, if he fulfilled the following steps.

Table 5-3

Explanation that Participants came up with in Sub-study 2

Explanation type	Example
Creepy Situation	- Problem with the computer. Suddenly a shady call. The caller inexplicably knows the problem and offers help. - The person has problems with the computer and texts a friend. Suddenly someone calls and says what the person texted the friend. This is totally crazy, like being under surveillance! - The moment the person who was writing on her computer wanted to contact a friend for help via smartphone, there was a call from customer support which strangely knew exactly what kind of a problem there was with the computer. Big brother is watching.
Hacker attack	- The computer was hacked and knocked out with a virus. - PC crashed during an important paper work. Maybe the virus reacted exactly to this situation and afterwards panic, fear, and helplessness of the user will be exploited. Wouldn't happen to me as I work with cloud storage. - PC crash – restart fails – Whatsapp message to a friend – call from an unknown number – somebody who is obviously no native English speaker knows what has happened; new form of PC/smartphone/cloud hacking with potential service in return, key word: blackmailing???
Description of the situation	- There were word problems. Without asking for it, the support called the user to help. - The computer crashed. Whilst texting a friend and describing what has happened, a person from customer support called and already knew about the situation, without being informed before. - The computer crashed and a supposed employee of the customer support called with an anonymous number and knew details that he actually could not know.

Note. These explanations were translated from German.

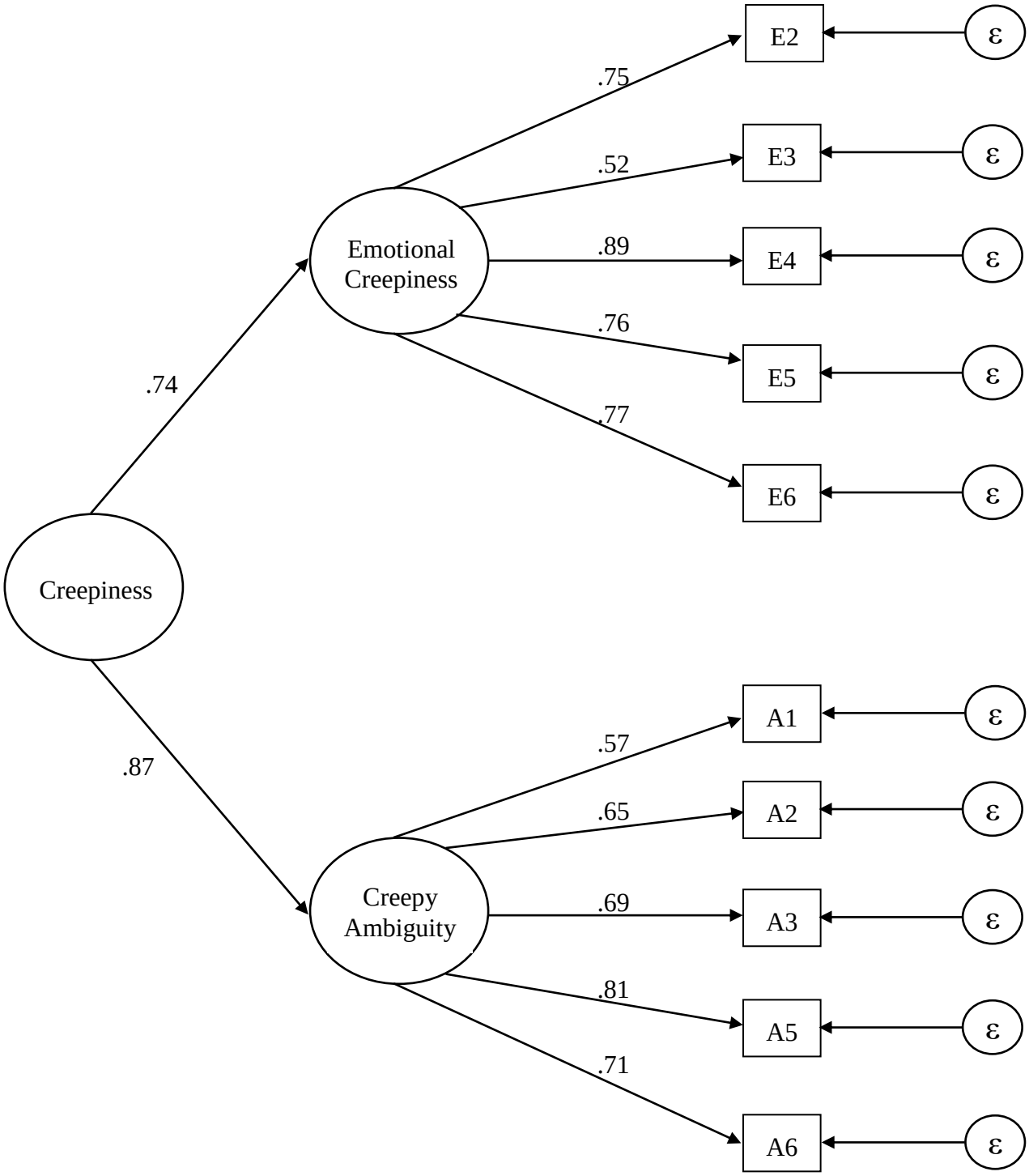

Figure 5-1. Resulting model of the confirmatory factor analysis in Sub-study 2. Numbers represent standardized loadings. E2 - E6 = items of the scale emotional creepiness, A1 – A6 = items of the scale creepy ambiguity.

Table 5-4

Model Fit Indices for the Hypothesized Model 1 and Two Alternative Models

Model	χ^2 (*df*)	$\Delta\chi^2$ (*df*)	CFI	GFI	AGFI	RMSEA
1. Hypothesized correlated two-factor model	101.60** (34)	-	.95	.94	.90	.08
2. One-factor model	310.04** (35)	208.44** (1)	.79	.78	.65	.16
3. Orthogonal two-factor model	209.64** (35)	108.04** (1)	.87	.89	.83	.13

Note. $\Delta\chi^2$ indicates the difference between Model 1 and the respective model. CFI = Comparative Fit Index; GFI = Goodness-of-Fit Index; AGFI = Adjusted Goodness-of-Fit Index; RMSEA = Root Mean Square Error of Approximation.
**$p < .01$.

Table 5-5

Explanation that Participants came up with in Sub-study 3.

Explanation type	Example
Creepy Situation	- The computer froze and did not restart. During texting a friend (but before sending the message) a supposed customer support called. - Computer crashed. Person reacts hectically, searches for help and contacts a fried. Receives a call from an employee of the technical support within her company. She is obviously being monitored.
Hacker attack	- Somebody was hacked and is supposed to provide her data and pay money. - During the use of a chat-program the data were submitted to someone else.
Description of the situation	- Writing a document – computer did not respond any more – texting a friend for help – instantly called by the computer service that offered help. - A person worked at the computer as the mouse suddenly stopped working. Afterwards, the person shut down the computer and texted someone for help. Then the person received a call offering solutions.

Note. These explanations were translated from German.

Table 5-6

Correlations between the Study Variables of Sub-study 3.

	Scale	*M* (*SD*)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1.	Emotional Creepiness	4.77 (1.21)	*.82*										
2.	Creepy Ambiguity	4.54 (1.25)	.59**	*.78*									
3.	Creepiness	4.66 (1.09)	.89**	.89**	*.86*								
4.	Age	23.61 (12.13)	.03	-.11	-.05	-							
5.	Gender	-	-.30**	-.27**	-.32**	.01	-						
6.	Privacy Concerns	5.55 (1.01)	.34**	.29**	.36**	-.04	-.08	*.86*					
7.	Transparency	4.13 (1.40)	-.14	-.34**	-.27**	-.05	.12	.09	*.81*				
8.	Controllability	3.45 (1.15)	-.35**	-.34**	-.39**	.03	.21**	-.24**	.22**	*.81*			
9.	Computer Anxiety	2.28 (1.20)	.25**	.24**	.27**	-.13	-.26**	.08	-.12	-.26**	*.88*		
10.	Conscientiousness	3.85 (0.63)	-.06	-.04	-.06	.07	.02	-.07	-.06	-.03	-.02	*.70*	
11.	Extraversion	3.55 (0.98)	-.07	.02	-.02	-.08	-.08	-.14	-.12	.05	.04	.19*	*.90*

Note. Coding of Gender: 1 = female, 2 = male. The numbers in the diagonal represent Cronbach's alpha of the scales. $N = 153$.
$^{*}p < .05$, $^{**}p < .01$.

Figure 5-2. Pictures of the public place where participants were contacted during the day or the night. Copyright Josephine Malsch.

Table 5-7

Correlations between the Study Variables of Sub-study 4.

	Scale	*M* (*SD*)	1.	2.	3.	4.	5.	6.
1.	Emotional Creepiness	2.25 (1.14)						
2.	Creepy Ambiguity	3.00 (1.29)	.73**					
3.	Creepiness	2.62 (1.13)	.92**	.94**				
4.	Participants' Age	33.52 (12.09)	.06	.01	.04			
5.	Participants' Gender	-	.33**	.27**	.32**	.00		
6.	Experimenters' Gender	-	.07	.19*	.14	-.20*	-.03	
7.	Time of the Day	-	.15	.27**	.23**	-.14	.06	.00

Note. Coding of participants' and experimenters' gender: 1 = male, 2 = female, coding of time of the day: 1 = day, 2 = night. $N = 128$.

*$p < .05$, **$p < .01$.

Table 5-8

Means and Standard Deviations for the Combinations of the Independent Variables Gender of the Experimenter, Gender of the Participant and Time of the Day.

Group	Male Experimenter				Female Experimenter			
	Male Participant		Female Participant		Male Participant		Female Participant	
	Day *M* (*SD*)	Night *M* (*SD*)	Day *M* (*SD*)	Night *M* (*SD*)	Day *M* (*SD*)	Night *M* (*SD*)	Day *M* (*SD*)	Night *M* (*SD*)
Emotional Creepiness	1.65 (0.77)	1.67 (0.93)	2.13 (1.11)	2.94 (1.21)	2.40 (1.22)	2.83 (1.15)	2.13 (1.00)	1.91 (1.05)
Creepy Ambiguity	1.93 (0.86)	2.60 (0.94)	2.59 (1.21)	3.69 (1.01)	3.13 (1.40)	3.75 (1.31)	2.99 (1.31)	3.08 (1.32)
Creepiness	1.79 (0.69)	2.13 (0.79)	2.36 (1.09)	3.32 (1.02)	2.77 (1.23)	3.29 (1.16)	2.56 (1.09)	2,49 (1.07)
n	17	12	15	20	17	16	15	16

Note. $N = 128$.

6 Study 2: Examining digital interviews for personnel selection: Applicant reactions and interviewer ratings

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6.1 Abstract

Digital interviews are a potentially efficient new form of selection interviews, in which interviewees digitally record their answers. Using Potosky's framework of media attributes, we compared them to videoconference interviews. Participants (N = 113) were randomly assigned to a videoconference or a digital interview and subsequently answered applicant reaction questionnaires. Raters evaluated participants' interview performance. Participants considered digital interviews to be creepier and less personal, and reported that they induced more privacy concerns. No difference was found regarding organizational attractiveness. Compared to videoconference interviews, participants in digital interviews received better interview ratings. These results warn organizations that using digital interviews might cause applicants to self-select out. Furthermore, organizations should stick to either videoconference or digital interviews within a selection stage.

Keywords: personnel selection, interview, new technologies, applicant reactions

6.2 Introduction

Technology offers convenient ways to screen and select applicants. An emerging form of technology-based employment interviews is the digital interview, wherein interviewees digitally record their answers to (typically) digitally-presented interview questions, without live interaction with an interviewer (Brenner, Ortner, & Fay, 2016; Chamorro-Premuzic, Winsborough, Sherman, & Hogan, 2016). Providers of digital interviews and companies applying these interviews promote them to be more time- and cost-efficient than face-to-face interviews and other forms of technology-based interviews.

However, previous research has found negative impacts of other technology-mediated interview methods (e.g., phone and videoconference) in terms of applicant reactions and interviewee performance ratings (Blacksmith, Willford, & Behrend, 2016; Chapman, Uggerslev, & Webster, 2003; Sears, Zhang, Wiesner, Hackett, & Yuan, 2013). Given that digital interviews separate the interviewee and interviewer even more than other technology-mediated methods, we use Potosky's framework of media attributes (2008) to compare videoconference interviews with the lately emerging interview approach of digital interviewing regarding interviewer ratings and applicant reactions.

6.3 Background and Development of Hypotheses

6.3.1 Technology for job interviews

Technology is widely used to improve the efficiency of job interviewing, to get a first personal impression of applicants, and to screen applicants before conducting personal face-to-face interviews (Bauer, Truxillo, Paronto, Weekley, & Campion, 2004). Over the years, technology has been used for job interviews in several ways. First, within telephone interviews, a representative of the organization asks applicants interview questions via telephone, meaning that interviewer and interviewee communicate solely through voice.

Second, in videoconference interviews, interviewer and interviewee get to hear and see each other through camera technologies. Third, in digital interviews, interviewees record themselves whilst answering interview questions which they receive through text, audio or video on an online platform, and interviewers can watch and rate these recordings at any time (Brenner et al., 2016).

Although digital interview technology in its basic form is not entirely different from videoconference interviews, digital interviews promise to offer much more flexibility (no need for scheduling), standardization (no influence of the interviewer on the interviewee), and analytical possibilities (possible automatic evaluation of the interviews) compared to telephone or videoconference interviews. Consequently, organizations seem to be highly interested in this type of interview, and digital interviews are described as one of the rising stars in personnel selection practice (Brenner et al., 2016; Chamorro-Premuzic et al., 2016; Schmerling, 2017). A web search for digital interview providers reveals more than 70 companies offering digital interview solutions (Software Advice, 2017). Moreover, HireVue, the largest provider of digital interviews in America, and viasto, HireVue's counterpart in Germany, deliver their digital interview solutions to many customers from several market sectors (HireVue, 2017a; viasto, 2017).

6.3.2 Applicant reactions to technology for job interviews

A meta-analysis by Blacksmith and colleagues (2016) revealed that compared to face-to-face interviews, conventional technology-mediated interview approaches are less accepted by interviewees. This finding can be a starting point for research investigating effects of new technology on interview outcomes. However, all of the studies included in the meta-analysis focused on telephone (e.g., Chapman et al., 2003) and videoconference interviews (e.g., Sears et al., 2013) (except for one study by Bauer et al., 2004, who used interactive voice response

technology), and it is therefore necessary for research on digital interviews to go beyond these findings.

6.3.3 Investigating differences between videoconference interviews and digital interviews as a first step of hypothesis development

For the purpose of the current study, we need to understand what distinguishes videoconference and digital interviews, and Potosky's (2008) framework of media attributes for personnel assessment processes might be helpful. Although digital interviews did not yet exist when this framework was developed, it offers general ideas on attributes that possibly differ between administration media for personnel assessment processes. In the following paragraphs, we introduce Potosky's four general attributes of administration media and use them to clarify differences between videoconference and digital interviews. These attributes are: social bandwidth, interactivity, transparency, and surveillance.

First, social bandwidth describes the extent to which relevant communication information (e.g., verbal and nonverbal content) is exchangeable: A medium high on social bandwidth provides communicators with many possibilities to offer communication information. In contrast to videoconference interviews, digital interviews provide fewer communication channels and thus less social bandwidth. For instance, interviewers and interviewees do not see each other, they cannot direct nonverbal behavior at each other, and they cannot use backchanneling behavior (e.g., nodding; Frauendorfer, Schmid Mast, Nguyen, & Gatica-Perez, 2014).

Second, interactivity of a medium describes the extent to which it is possible to interact during a conversation (Potosky, 2008). In the case of digital interviews, interviewers only watch a recorded video of the interviewee answering interview questions. Even if a videoconference interview is completely structured, it still contains more interactivity than a digital interview.

Third, high transparency is given if there are no obstacles during communication and if the communicators do not realize that they are using a medium to communicate (Potosky, 2008). Transparency might be lower in digital interviews than in videoconference interviews: In digital interviews, interviewees have to record themselves whilst constantly only watching their own appearance on the screen. This reduces the transparency compared to videoconference interviews, as interviewees are interacting with the medium rather than with another person. In videoconference interviews, interviewees might realize that they are communicating with the interviewer through microphone and camera over the internet. However, unless there are severe technical issues, these aspects might not be salient after some time in the conversation, as interviewees become accustomed to the situation.

The fourth aspect in Potosky's (2008) framework is surveillance, which encompasses the fact or feeling that it might be possible for a third party to interrupt or monitor the conversation. Accordingly, communication through a medium high on surveillance appears to be public and observable by other people. It might be possible for a third party to hack into and interrupt or monitor a videoconference interview. However, as videoconference interviews are real-time interactions, it seems more obvious and likely that recorded digital interviews might be stored in a place where non-authorized persons could access the recordings. Thus, surveillance might be higher in digital interviews.

6.3.4 Investigating applicant reactions to digital and videoconference interviews as a second step of hypothesis development

All in all, regarding the attributes put forward by Potosky (2008), digital interviews seem to offer less social bandwidth, lower interactivity, lower transparency, and higher surveillance than videoconference interviews, leading to the assumption that applicant reactions to these interview approaches are likely to differ as well. As a next step of hypothesis development, and based on the ideas generated by Potosky's (2008) framework, it

is possible to shed light on applicants' potential reactions to the two interview approaches concerning: (a) their affective reactions to the selection procedure (by examining the creepiness of the procedure), (b) privacy concerns regarding the procedure, (c) perceived behavioral control during the procedure, (d) procedural fairness of the procedure (taking a closer look at the facets two-way communication, interpersonal treatment, and chance to perform), and (e) global fairness perceptions of the procedure.

Creepiness can be elicited by unfamiliar interactions with technologies (Tene & Polonetsky, 2015), and can be defined as a queasy feeling paired with uncertainty about how to behave or how to judge a situation (Langer & König, 2016). Videoconference interviews have been relatively commonplace for over a decade (Chapman et al., 2003). By contrast, digital interviews are a relatively new way of conducting selection interviews (Brenner et al., 2016), and this might already be sufficient to evoke feelings of creepiness. In addition, applicants do not interact with any representative of the organization during digital interviews but interact with software. Consequently, transparency as defined by Potosky (2008) is low because applicants are constantly reminded that they are communicating through technology, which could lend a strange feeling to the digital interview procedure.

Hypothesis 1a. Digital interviews will induce more creepiness than videoconference interviews.

Privacy concerns relate to the aspect of surveillance in Potosky's (2008) framework, because people with privacy concerns might feel that their privacy is being invaded through new technologies or selection procedures (Stone-Romero, Stone, & Hyatt, 2003). During both interview methods, sensitive personal data (e.g., face of the candidate, voice, and interview answers) are transferred via the internet. In the case of videoconference interviews, the interview can possibly be recorded to be rated later by additional interviewers, whereas

for digital interviews, the recording is mandatory. This could result in more awareness of possible privacy concerns.

Hypothesis 1b. Digital interviews will induce more privacy concerns than videoconference interviews.

People in interpersonal interactions perceive behavioral control if they have the feeling to be, or in fact are, in control of their own behavior during such situations (Ajzen, 2002b). The social bandwidth of digital interviews appears to be lower than that of videoconference interviews (e.g., because applicants cannot receive or send nonverbal communication information). Thus, the controllability of the situation might be impaired. A reason for this could be that reduced social bandwidth and interactivity may partially deter applicants from using impression management, which is an especially impactful phenomenon used to gain control over the interview (Ingold, Kleinmann, König, & Melchers, 2015; Roulin, Bangerter, & Levashina, 2014). Although both interview approaches have in common that interviewees can use nonverbal impression management (e.g., smiling; Barrick et al., 2009), and self-focused impression management (e.g., applicants exaggerate their achievements; Peeters & Lievens, 2006), digital interviews restrain applicants from applying specific interviewer directed behavior and other-focused impression management (e.g., ingratiating with the interviewer or using mimicry behavior, cf. Chartrand & Bargh, 1999; Peeters & Lievens, 2006).

In conclusion, digital interviews seem to bear the potential to negatively impact several powerful possibilities to control and guide the interview in a direction beneficial for applicants (cf., Blacksmith et al., 2016).

Hypothesis 1c. Digital interviews will be evaluated lower on perceived behavioral control than videoconference interviews.

Different selection procedures can lead to differing applicant reactions on procedural justice facets covered by the model of Gilliland (1993). Most relevant for the comparison of digital interviews and videoconference interviews, and closely related to the aspects of social bandwidth and interactivity, are interpersonal perceptions, expressed with the facets two-way communication, interpersonal treatment, and chance to perform.

Two-way communication is given if it is possible for applicants to ask questions, and to interact with the interviewer or organization (Bauer et al., 2001). Due to lower interactivity (i.e., asynchrony) of digital interviews, it is not possible to interact with the interviewer. In contrast, even if videoconference interviews are strictly structured, interviewees interact with interviewers in real time, and they might at least have the feeling that it is possible to ask questions during the interview.

Hypothesis 1d. There is less two-way communication in digital interviews than in videoconference interviews.

During a procedure in which applicants perceive good interpersonal treatment, applicants feel respected and treated with dignity and human warmth (Bauer et al., 2001). As there is no real interpersonal interaction in digital interviews, applicants cannot feel treated badly by an interviewer, but they might not feel "treated" in any way at all. This could send a negative signal to interviewees, making them aware that they are just one of many applicants.

A negative characteristic of videoconference interviews is inflexibility, as interviewees need to make time for the interview when the interviewer is available. In comparison, in digital interviews, applicants can record their interview answers at any time. This might be beneficial for the assessment of digital interviews. Nevertheless, this positive aspect of digital interviews might not compensate for the lack of interpersonal contact during the interview

Hypothesis 1e. Digital interviews will be evaluated lower on perceived interpersonal treatment than videoconference interviews.

The final facet of procedural fairness examined in this study is chance to perform, defined as applicants' feeling of being given enough possibilities to put their best foot forward (Bauer et al., 2001). The same interview questions can be asked in videoconference interviews as in digital interviews; thus, objectively speaking, applicants have the same answering opportunities in both interview approaches. However, in videoconference interviews, applicants see the interviewer who shows, perhaps not even consciously (cf., Wilhelmy, Kleinmann, König, Melchers, & Truxillo, 2016), direct feedback on their interview answers (e.g., shaking his/her head), so applicants can adapt their answer accordingly, unlike in digital interviews. Lacking feedback can evoke insecurity over whether an answer was good or bad, and consequently add to applicants' feeling of being offered less chance to perform during the interview.

Hypothesis 1f. Digital interviews will offer less chance to perform than videoconference interviews.

Global fairness evaluations can be impaired if applicants' expectations of justice regarding selection procedures are violated (Ployhart & Ryan, 1998). In digital interviews, interpersonal communication – an aspect applicants particularly value (cf., Blacksmith et al., 2016) – is eradicated. Thus, modifying answers or adapting to the interviewer can be harder or even impossible, which might violate applicants' expectations of justice when reflecting on selection interviews (cf., Ployhart & Ryan, 1998).

Hypothesis 1g. Digital interviews will be evaluated as being less fair than videoconference interviews.

6.3.5 Effects of the interview approach on organizational attractiveness

Selection procedures can influence organizational attractiveness, which itself is crucial for the future of an organization, as high organizational attractiveness might lead to more organizational prestige, to being recommended as a good employer, and consequentially to a greater and more qualified applicant pool (Highhouse, Lievens, & Sinar, 2003). As we are comparing videoconference interviews and digital interviews, the aspect of organizational attractiveness is especially important, because these interview approaches can be used early in the selection process. Accordingly, a large number of applicants might experience them, implying that there is also a broad range of people who potentially complain about them (cf., Van Hoye & Lievens, 2009). In addition, applicants could withdraw their application if they are dissatisfied with the selection procedure at an early stage of the selection process (Hausknecht, Day, & Thomas, 2004; Uggerslev, Fassina, & Kraichy, 2012).

The above-described aspects are all variables which affect applicants' evaluation of the organizational attractiveness of the selecting organization, and they might mediate the relation between the interview approach and perceived organizational attractiveness. Thus, we propose that:

Hypothesis 2. Digital interviews will have a negative effect on organizational attractiveness, mediated by creepiness, privacy concerns, perceived behavioral control, interpersonal facets of procedural fairness, and global fairness.

6.3.6 Effects of the interview approach on interviewer ratings

Interviewer ratings are influenced by the way the interview is conducted (Blacksmith et al., 2016). In face-to-face interviews, applicants receive better interview ratings than in videoconference interviews. Reasons for this might be that technical problems can occur

during videoconference interviews, that there is less possibility for impression management, and that there are fewer communication channels available (Blacksmith et al., 2016).

In digital interviews, possibilities for impression management and communication channels are even more restricted. This could lead to similar effects on interviewer ratings as those found when comparing face-to-face to videoconference interviews (Sears et al., 2013). However, such effects can only be expected when comparing ratings of digital and videoconference interviews in which the interviewers who conducted the interview themselves rate the interviewee. When comparing ratings of digital interviews and ratings of recorded videoconference interviews (i.e. other interviewers rate the recorded videoconference interview), there should be no differences in interviewer ratings as there was no interpersonal interaction between raters of the recorded videoconference interview and interviewees. Thus, similar to the digital interviews, there is less possibility for impression management, and there are fewer communication channels available.

Hypothesis 3. Participants of digital interviews will receive lower interview ratings than participants of live-rated videoconference interviews. This difference will not occur between the ratings of recorded videoconference interviews and digital interviews.[1]

6.4 Method

6.4.1 Sample

All participants of this study were students who could choose between course credit or a small amount of money. We consulted the meta-analysis of Blacksmith and colleagues (2016) to get an idea about imaginable effect sizes between digital and videoconference interviews for applicant reaction as well as rating measures. Blacksmith and colleagues (2016) found small to medium effect sizes for interviewer ratings and for applicant reactions in favor of face-to-face interviews compared to technology-mediated interviews. As digital

interviews subtract interpersonal interaction more than videoconference interviews, we assume medium effect sizes in favor of videoconference interviews compared to digital interviews. In addition, we followed the results of Chapman, Uggerslev, Carroll, Piasentin, and Jones (2005) who found a small to medium relation of justice perceptions with organizational attractiveness for non-applicants, thus we expected a small to medium effect for the relation of our applicant reaction measures and organizational attractiveness. Consequentially, required sample size was determined following the suggestions of Fritz and MacKinnon (2007) who proposed that for detecting a mediation effect with a predicted medium effect size for the relation of the independent variable and the mediator (i.e., standardized regression weight of 0.39) and a small to moderate effect size for the relation of the mediator and the dependent variable (i.e., standardized regression weight of 0.26) of the mediation an *N* of 116 participant would be needed for a power of $1-\beta = 0.80$.

As issues might occur during data collection within online experiments (e.g., technical problems, slow internet connection, participants interrupting the experiment), we continued data collection until our sample consisted of $N = 122$ participants. We had to exclude one participant who mentioned that his data should not be used since he had not taken the experiment seriously. Furthermore, we excluded seven participants (four in the videoconference and three in the digital interview condition) due to technical problems. The final sample consisted of $N = 113$ German students (67% female), of whom 49% studied psychology. The mean age was 24.90 years ($SD = 3.14$). At the time of the study, 35% of participants were in their Bachelors' degree, 40% in their Masters' degree, 13% already had a Masters' degree and 10% did not specify their educational background, and 46% of participants had already experienced more than five job interviews, 51% had experienced one to four job interviews and only 3% did not have any job interview experience.

6.4.2 Procedure

Overview. In the first stage, participants visited an online survey platform, where they were randomly assigned to the videoconference interview group or the digital interview group. They were then given a brief description of the respective interview condition. In both conditions, participants were informed that the interview would be recorded. Additionally, they were instructed to download software and to submit their email address.

Participants were then contacted by the experimenter via email with a description of the application situation (similar to Buehl & Melchers, 2017):

You have applied for an attractive Master's degree at a university in another city. You have received an invitation for a Skype interview [digital interview] as a pre-selection tool, since many people have applied for this Master's degree. The aim of this procedure is to get a personal impression of all applicants above and beyond their résumés, and to make a valid decision on which applicants will be invited for a following personal interview.

In this email, participants were also requested to dress for the respective interview as they would in a real application situation. After the interview, participants were directed to an online survey platform to respond to the concluding questionnaire containing all applicant reaction measures.

Interview Questions. At the beginning of the interviews, participants were introduced to the procedure of the interview, and practiced the interview procedure by responding to a question in which they provided an identifier word to match videos and online survey answers.

In both interviews, interviewees were asked the same five interview questions (in German) which were taken from Buehl and Melchers (2017): 1. "What do you study and why did you decide to study this subject"; 2. "There are times when stress is very high. Can you remember a situation in which you had several deadlines at the same time; how did you

handle this situation?"; 3. "What did you do if you did not understand complex contents of a course?"; 4. "Imagine you are doing a group project with four of your fellow students and you have to divide topics and tasks between each other. You have an exact idea of which part you want to deal with. However, another person in your group would also like to work on this part. What would you do?"; 5. "Imagine you fail an important exam, even though you were well prepared. How would you prepare for the retry exam?".

Digital interviews. For the digital interview procedure, we followed the process of Brenner and colleagues (2016), common practices for digital interviews (Brenner, 2016; Schmerling, 2017), and suggestions provided during personal contact with F. S. Brenner[2] (November 15th, 2016). To manage recordings of digital interviews, we used the video recording tool Clipchamp (www.clipchamp.com).

In advance to their interview, participants were instructed to download Google *Chrome (*www.google.com/chrome). Then, they received an email with a link to an online platform where they could complete their digital interview within a deadline of five days after receiving the email. In the beginning of the digital interview, applicants read instructions on how the digital interview will be conducted. Every interview question was presented in text form and interviewees were presented with a countdown clock of 60 seconds to read the question. After these 60 seconds, the button for the recording disappeared and it was no longer possible for interviewees to record an answer for the respective interview question. After clicking on the recording button, a separate browser window opened, in which interviewees had to turn on their webcam and microphone. Interviewees then started the recording and had up to three minutes of recording time to answer the interview question. After stopping the recording, they clicked "submit video". After submitting the video, participants had up to 15 seconds before they were directed to the next interview question.

Videoconference interviews. All videoconference interviews were conducted by two Master's degree students of industrial and organizational psychology who received a two-hour frame-of-reference training session before their first interview (Roch, Woehr, Mishra, & Kieszczynska, 2012).

For the videoconference interviews, participants were instructed to download Skype (www.skype.com). Then they received an email where they could choose among different dates to schedule their videoconference interview. The videoconference interviews were recorded using ActivePresenter (www.atomisystems.com). At the beginning of the videoconference interview, the interviewer informed the interviewee that the interview would be a structured interview, and that there would therefore be no follow-up questions and the interviewee would not be permitted to ask any questions. We chose structured interviewing as it is more comparable to digital interviews, in which there are no follow-up questions and no possibility for interviewees to ask questions.

Interview scoring. For the live videoconference interview rating, interviewers who conducted the interview rated the interview performance directly after the videoconference interview. For the rating of the recorded videoconference interviews, we divided the videoconference interview into five parts. Each part showed the interviewee's answer to an interview question but did not show a picture or voice of the live interviewer, to avoid the second rater being influenced by the picture or voice of the live interviewer. For digital interviews, the same interviewers who conducted the videoconference interviews rated the digital interview recordings, which consisted of five videos (one for every answer of a participant).

Interviewer ratings. For all interviews (live and recorded videoconference interviews, digital interviews) ratings were generated with eleven items (see Appendix) rated from 1 (*does not apply)* to 7 (*does apply entirely).* Five of these items were taken from Buehl

and Melchers (2017), and represented rating keys for the respective interview question. The remaining six items were taken from Langer, König, Gebhard, and André (2016), and reflected the general impression of the interviewee.

Interrater reliability. At the end, half of the videoconference interviews and half of the digital interviews were rated by a human resource professional with three years of experience in a human resource department of a large German company to support the generalizability of the interviewer ratings. This rater received the same two-hour frame-of-reference training as the student raters (Roch et al., 2012). We calculated the interrater reliability of the ratings of the student raters in the interview conditions and the ratings of the HR professional. Interrater reliability for live rated videoconference interviews (based on $n = 27$) was $r = .51$, $p = < .01$, for ratings of recorded videoconference interviews (based on $n = 27$) $r = .50$, $p = < .01$, and for digital interviews (based on $n = 30$) $r = .55$, $p = < .01$.

Applicant reaction measures. The Appendix lists all applicant reaction items and item sources. The items were rated from 1 (*strongly disagree*) to 5 (*strongly agree*). Creepiness was measured with the Creepiness of Situation scale (Langer & König, 2016), which comprises 10 items, five for each of its facets (emotional creepiness and creepy ambiguity). Privacy concerns were measured with five items (Malhotra, Kim, & Agarwal, 2004; Smith, Milberg, & Burke, 1996). Perceived behavioral control was measured with eight items. The authors developed the items following the suggestions of Ajzen (2002). Two-way communication, interpersonal treatment, and chance to perform were each measured with four items taken from a German version of the Selection Procedural Justice Scale (Bauer et al., 2001; Warszta, 2012). Global fairness was measured with three taken from Warstza (2012). Organizational attractiveness was measured with 15 items (Highhouse et al., 2003; Warszta, 2012) adapted to fit the context of the experimental design as we were measuring attractiveness of a university.

6.5 Results

6.5.1 Applicant Reaction Hypotheses

Table 6-1 and Table 6-2 provide an overview of study variables' intercorrelations, descriptive statistics and results of the *t*-tests for the respective hypotheses. We used MANOVA and one-tailed follow-up *t*-tests (cf., Spector, 1977) for hypotheses 1a-g examining the difference between the interview conditions for creepiness, privacy concerns, perceived behavioral control, two-way communication, interpersonal treatment, opportunity to perform, and fairness. The overall MANOVA showed that videoconference and digital interviews differed significantly on the mentioned variables, $F(8, 104) = 15.67$, $p < .01$, *Wilks'* $\lambda = .45$.

As Table 6-2 shows, we found that participants in digital interviews reported weakly to moderately more creepy ambiguity, moderately more emotional creepiness, and digital interviews induced slightly more privacy concerns. Additionally, digital interviews were rated as permitting much less two-way communication and providing strongly worse interpersonal treatment. However, we found no difference between the interview methods for ratings of perceived behavioral control, chance to perform, and fairness. Therefore, hypotheses 1a, 1b, 1d, and 1e were supported, but hypotheses 1c, 1f, and 1g were not.

For Hypothesis 2, we conducted mediation analyses linking interview type with organizational attractiveness via the proposed mediators. However, consistent with the negligible zero-order relation between interview type and organizational attractiveness, we found both the direct and indirect effects to be zero.

6.5.2 Interviewer Rating Hypothesis

We expected digital interview ratings to be lower than live videoconference interview ratings, but not lower than recorded videoconference interview ratings. However, digital interviews ratings were weakly to moderately higher than ratings in live videoconference

interview and moderately higher than the recorded videoconference interview ratings (see Table 6-1). Hypothesis 3 was thus not supported.

6.6 Discussion

The goal of this study was to investigate digital interviews as an emerging technology for personnel selection (Brenner et al., 2016). To this aim, we compared them to the well-established technology-mediated interview approach of videoconference interviewing. The results showed that previous research on technology for job interviews might not apply to digital interviews, since considerable differences in applicant reactions, and even more strikingly, in interviewer ratings were revealed. In general, we found that using digital interviews can be detrimental for (a) affective, (b) privacy-related and (c) interpersonal aspects of applicant reactions compared to using videoconference interviews.

First, as a negative affective consequence of digital interviews, participants experienced more creepiness during digital interviews than during videoconference interviews. Drawing on theoretical arguments on creepiness in the context of novel technologies (Tene & Polonetsky, 2015), we can reason that this difference might be due to the fact that digital interviews are not yet as common as videoconference interviews. If practitioners' and researchers' predictions that digital interviews will become increasingly popular come true (Brenner et al., 2016; Chamorro-Premuzic et al., 2016), this might reduce the creepiness felt during digital interviews. Nevertheless, the current results should raise awareness that digital interviews can evoke negative emotional consequences. Another explanation for the findings regarding creepiness might be drawn from the assumption that Potosky's (2008) aspect of transparency is lower in digital interviews because applicants have to record and constantly watch themselves answering interview questions, which results in a strange and seemingly creepy interaction. Creepiness might cause applicants to refrain from

taking part in interactions including such new technologies and to develop negative impressions of organizations that use such technologies (cf., Tene & Polonetsky, 2015). In the case of digital interviews, this might mean that applicants cancel the digital interview and, through word-of-mouth, have a negative influence on the perceptions of organizations using this approach (Van Hoye & Lievens, 2009).

Second, findings indicate that digital interviews can result in applicants having concerns about their privacy during such situations, which supports our assumption that Potosky's (2008) aspect of surveillance is more pronounced within digital interviews. Compared to having a conversation over the internet using a camera and microphone, digital interviews seem to induce more concerns about providing private data that might be misused, as applicants have to explicitly press buttons to record and submit videos to a selecting organization. This finding might be worrisome for organizations, because previous research has shown that increased privacy concerns lead to lower test-taking motivation and impaired organizational intentions (e.g., buying the organizations' products or recommending the organizations to friends, Bauer et al., 2006).

Third, interpersonal perceptions of procedural justice, more precisely two-way communication and interpersonal treatment, were found to be markedly lower in digital interviews, and we found surprisingly large effect sizes (over $d = 1.00$). The magnitude of effects is particularly striking given that our videoconference interviews were highly structured, meaning that there was no real two-way communication between the interviewers and interviewees other than interviewers reading questions, and thus no especially empathic interpersonal treatment. These results add to, and go beyond, previous research findings that technology for job interviews can be detrimental for interpersonal aspects of job interviews (e.g., Blacksmith et al., 2016; Chapman et al., 2003; Sears et al., 2013), because our results indicate that digital interviews seem to be perceived as even less personal than

videoconference interviews, which are already perceived as less personal than face-to-face interviews. Thus, especially high-potential applicants may self-select out of the selection procedure because they might have the feeling that they at least deserve a conversation with a representative of the organization instead of being treated like "one of many" applicants.

In spite of the negative effects of digital interviews on affective reactions, privacy concerns, and interpersonal perceptions, it might be comforting for providers of digital interviews and organizations using digital interviews that the use of digital interviews did not negatively affect organizational attractiveness. Furthermore, the results showed no differences between the interview conditions for perceived behavioral control, opportunity to perform, and fairness, although such null results should be treated with caution. In the case of perceived behavioral control, participants might have had less control over influencing the interviewer during digital interviews compared to videoconference interviews (cf., Blacksmith et al., 2016), but they had greater control over preparing their answers, and the two effects might have cancelled each other out. The greater control over preparing answers lay in the fact that participants had 60 seconds of preparation time before starting the interview, which is consistent with best practice of digital interviews (Schmerling, 2017).

This preparation time of 60 seconds might also have had consequences for the opportunity to perform and for fairness perceptions. Even though participants perceived a lower opportunity to perform because there was no interviewer to signal that they were on the right track with their answer, they did have the opportunity to prepare and structure their answer for 60 seconds, possibly resulting in stronger feelings of opportunity to perform. Moreover, although participants' justice expectation of an interviewer talking to them during an interview were not met, the 60-second preparation time possibly led to higher fairness evaluations. In addition, participants knew that their answer could be up to three minutes duration. This might also have provided an increased feeling of fairness, as such information

regarding the acceptability of the length of an answer is not provided during videoconference interviews. An interesting finding supporting this possibility is that in the general notes provided by the interviewers, participants in digital interviews were more often described as answering in a "detailed" manner (n = 21 in digital interviews vs. n = 10 in videoconference interviews), whereas participants in videoconference interviews were more often described as answering in a "short" manner (n = 2 in digital interviews *vs.* n = 17 in videoconference interviews).

The 60-second preparation time might also have impacted interview ratings. We found that participants in digital interviews received higher interview ratings, which is in contrast to our hypothesis. According to previous arguments and findings (Blacksmith et al., 2016; Ingold et al., 2015; Roulin et al., 2014), digital interviews should lead to lower interview ratings than videoconference interviews because they are even less interactive and there is less opportunity for impression management than in videoconference interviews, which themselves were found to evoke less favorable interview ratings than face-to-face interviews. However, the additional preparation time might have helped the digital interview participants to come up with more thought-through answers and thus to achieve higher interview ratings than participants in the videoconference interview condition. We would like to mention that all the potential effects of the preparation time (i.e., potentially increasing perceived controllability, fairness, interview ratings) indicate that there is a clear need for research to clarify its effects. For instance, less preparation time could lead to increasingly demanding interviews implying that it could be a parameter for organizations to strategically modify digital interviews.

Moreover, preparation time is just one small aspect of digital interviews which research has not yet understood. Further exemplary aspects are the administration form (e.g.,

questions in text or videos), automatic evaluation of digital interviews, and validity of digital interviews. Undoubtedly, we need more research on digital interviews.

6.6.1 Limitations

There are four limitations we need to address. First, participants did not experience a real application situation but a mock interview for a hypothetical Master's degree. Therefore, it remains to be shown whether our results can be generalized to real application situations, in which there is more at stake. Presumably, even more pronounced differences between the two interview conditions would be found within real application situations. Nevertheless, insights into interview ratings are at least likely to be generalizable, because the interrater reliability of the student raters and the HR professional rater was rather high. Moreover, the ratings of the HR professional and the student ratings revealed similar differences between the two interview types, with participants of digital interviews receiving higher interview ratings than participants of videoconference interviews, $t(55) = 3.10$, $p < .01$, $d = 0.82$. Second, as participants were predominantly students, the results might not apply for older applicants and applicants for hierarchically higher positions. However, for the screening of entry-level positions, the results of this study should be highly relevant. Third, we did not use any commercially available digital interview program, which might offer more convenient and more attractive-looking ways of conducting digital interviews. Nevertheless, we ensured that our digital interview followed best practice recommendations regarding preparation time, recording time, question delivery, and technical details. Furthermore, by not using a commercially available program, we were able to conduct independent research (i.e., participants had no reason to fear that our research was sponsored).

6.6.2 Main Practical Implications

Digital interviews are an exciting and flexible way to gain a first personal impression of an applicant, but organizations should be aware that they are not merely another type of

videoconference interview. Organizations should closely monitor whether digital interviews lead to applicants self-selecting out of the interview process because (a) they would have expected more interpersonal care from the organization, (b) they experienced negative affective reactions during the interview, or (c) they did not want to provide a recording of themselves to a selecting organization due to concerns about what would happen to their private data and where it would be stored. If an organization realizes that applicants start to withdraw from the application process because of the use of digital interviews, it might be time to go back to classical videoconference interviews or to think about ways to improve applicant reactions of digital interviews. An idea to improve applicant reactions could be to provide applicants with information about digital interviews (cf., McCarthy et al., 2017), however this assumption needs to be tested by future research.

In addition, organizations should not use both videoconference and digital interviews during the same selection stage. Even worse is the idea to allow applicants to decide whether they would like to take part in a digital interview or a videoconference interview (e.g., in an attempt to increase applicant reactions). Instead, organizations should choose to use either videoconference or digital interviews and stick to the same procedure for every applicant in a selection process. This way, the organization can prevent disparate treatment of applicants using distinct interview formats. Organizations might otherwise end up rejecting high-potential applicants just because they took part in a videoconference interview instead of a digital interview.

6.6.3 Future Research

Digital interviews offer tremendous possibilities for future research. For example, based on our findings on interview ratings, future studies could examine how ratings of face-to-face and digital interviews differ. It is possible that face-to-face interviews will lead to better ratings than digital interviews; however, it might also be the case that the effect of

preparation time leads to better interview ratings in digital interviews than in face-to-face interviews. Additionally, the digital interview was evaluated by human raters in the current study, but practitioners already use machine learning algorithms to automatically rate interviews (e.g., digital interviews offered by the company HireVue). It is highly important to conduct validity research to establish whether human-rated digital interviews or automatically rated interviews are as valid as face-to-face interviews. Furthermore, when automatically assessed digital interviews are used, there is no longer any human influence on the interview. Thus, it would be fruitful to look at applicant reactions to the automatic evaluation of digital interviews.

Additionally, negative applicant reactions might be mitigated using organization presentation videos before the actual digital interview begins. Providers of digital interviews (e.g., HireVue; HireVue, 2017b) promise that such videos, in which a recruiter presents the organization and the job to applicants, can be beneficial for applicant reactions. This could especially be true for applicant reactions covering interpersonal perceptions because applicants might feel treated with more respect if there is at least a video showing a representative of the organization who introduces the organization and the job.

Furthermore, we did not measure efficiency of the interview methods which might be a highly relevant measure regarding the comparison of different interview types. For instance, our interviewers reported that digital interviews were much easier to conduct than videoconference interviews (e.g., because there were no scheduling issues, they could rate the interviews whenever they wanted). Measures of efficiency were not covered in previous research on technology-mediated interviews and our study also missed to explicitly compare the efficiency of the interview forms. Therefore, future research could capture measures of efficiency (e.g., how much time was necessary to schedule the interview) to evaluate the practicality of different interview approaches.

Moreover, it is not yet clear how organizations and recruiters themselves evaluate digital interviews. It might be that they appreciate these interviews because of their flexibility and efficiency, but it is equally possible that they assess these interviews as threatening their own work. Digital interviews remove the interaction with applicants from the recruiter's job, which might be a part of the work that recruiters actually enjoy.

6.6.4 Conclusion

Job interview research has generated a tremendous amount of personnel selection research (Macan, 2009), and with digital interviews, this trend is likely to continue. Digital interviews are a novel alternative for conducting interviews and they offer many new directions for research. This study is among the first to shed light on the emerging interview approach of digital interviewing and will hopefully lead to researchers becoming as interested in this topic as practitioners already are.

6.7 Footnotes

1. Following the call for open research (Open Science Collaboration, 2015), this study was pre-registered. In the pre-registration, there were additional exploratory hypotheses, which we decided to exclude for reasons of readability; results can be provided on request.
2. Special thanks to Falko Brenner, who supported us with very useful insights.

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6.9 Tables

Table 6-1

Correlations and Cronbach's Alpha of the Study Variables

	Scale	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1.	Creepy Ambiguity	*.71*												
2.	Emotional Creepiness	.55**	*.81*											
3.	Privacy Concerns	.35**	.33**	*.79*										
4.	Perceived Behavioral Control	-.31**	-.38**	-.25**	*.71*									
5.	Two-Way Communication	-.28**	-.39**	-.33**	.29**	*.66*								
6.	Interpersonal Treatment	-.26**	-.33**	-.31**	.09	.70**	*.91*							
7.	Chance to Perform	-.34**	-.17	-.04	.49**	.38**	.29**	*.89*						
8.	Fairness	-.34**	-.23**	-.21*	.48**	.44**	.41**	.67**	*.85*					
9.	Organizational Attractiveness	-.23**	-.29**	.01	.30**	.26**	.20*	.31**	.29**	*.94*				
10.	Live Skype Ratings[a]	-.30*	-.01	-.18	.30*	.01	.24	.23	.21	.04	*.95*			
11.	Recorded Skype Ratings[a]	-.09	.13	.31*	.14	.09	.19	.13	.09	.05	.39**	*.96*		
12.	Digital Interview Ratings[b]	-.28*	-.34**	-.05	.37**	-.04	.03	.27*	.15	.10	-	-	*.96*	
13.	Interview Method	.19**	.29**	.17	.07	-.49**	-.71**	-.12	-.13	-.07	-	-	-	-

Note. Coding of interview method: 0 = videoconference interview, 1 = digital interview, [a] = based on 54 participants, [b] = based on 59 participants. N = 113. Numbers in the diagonal represent Cronbach's alpha of the scales.

$^{*}p < .05$, $^{**}p < .01$

Table 6-2

Descriptives and Results of the t-Tests for the Interview Conditions

Scale	Videoconference Interview *M* (*SD*)	Digital Interview *M* (*SD*)		*t*(111)	*d*	95% CI (for *d*)
Creepy Ambiguity	2.44 (0.60)	2.68 (0.67)		2.00*	0.38	[0.01, 0.75]
Emotional Creepiness	1.71 (0.53)	2.11 (0.76)		3.30**b	0.61	[0.23, 0.98]
Privacy Concerns	2.73 (0.73)	2.99 (0.80)		1.83*	0.34	[-0.03, 0.71]
Perceived Behavioral Control	3.73 (0.54)	3.81 (0.59)		0.76	0.14	[-0.23, 0.51]
Two-Way Communication	3.22 (0.67)	2.34 (0.88)		-6.00**b	-1.13	[-1.52, -0.72]
Interpersonal Treatment	4.41 (0.46)	3.19 (0.74)		-10.68**b	-1.98	[-2.41, -1.53]
Chance to Perform	2.86 (0.79)	2.67 (0.84)		-1.22	-0.23	[-0.60, 0.14]
Fairness	3.57 (0.81)	3.34 (0.87)		-1.42	-0.27	[-0.64, 0.10]
Organizational Attractiveness	3.66 (0.53)	3.58 (0.60)		-0.75	-0.14	[-0.51, 0.23]
Live Skype Ratings	4.83 (0.92)	-	versus Recorded Skype	-1.42a	-0.22	[-0.83, 0.41]
Recorded Skype Ratings	4.63 (0.98)	-	versus Digital Interviews	3.02**	0.57	[0.19, 0.95]
Digital Interview Ratings	-	5.23 (1.12)	versus Live Skype	-2.04*	-0.39	[-0.76, -0.02]

Note. For all rows except for the interview ratings, we compared videoconference and digital interviews, hence a positive *d* value indicates higher values for digital interviews. CI = confidence interval, [a] = for this comparison we used a dependent t-test with df = 53, [b] = for these *t*-tests df was corrected for inhomogeneity of variances. $n_{\text{videoconference interview}} = 54$, $n_{\text{digital interview}} = 59$.
*$p < .05$, **$p < .01$

6.10 Appendix

Table 6-3

Items Used in the Current Study

Scale	Items	Source
Interview Rating	*The applicant:*	
	Was able to present his study choice in an adequate manner.	Buehl & Melchers (2017)
	Showed resilience.	Buehl & Melchers (2017)
	Showed problem solving abilities.	Buehl & Melchers (2017)
	Showed that he/she is able to manage conflicts within a team.	Buehl & Melchers (2017)
	Showed that he/she can handle challenging situations.	Buehl & Melchers (2017)
	Is a suitable applicant.	Langer et al. (2016)
	Convinced me.	Langer et al. (2016)
	Is a suitable student for this Masters'degree.	Langer et al. (2016)
	Sold him/herself well.	Langer et al. (2016)
	Would receive a place at the university.	Langer et al. (2016)
	On a scale from 0-100, the applicant would receive XXX points.	Langer et al. (2016)
Creepiness		
Emotional Creepiness	During this situation, I had a queasy feeling.	Langer & König (2017)
	I had a feeling that there was something shady about this situation.	Langer & König (2017)
	I felt uneasy during this situation.	Langer & König (2017)
	I had an indefinable fear during this situation.	Langer & König (2017)
	This situation somehow felt threatening.	Langer & König (2017)
Creepy Ambiguity	During this situation, I did not know exactly what was happening to me.	Langer & König (2017)
	I did not know how to judge this situation.	Langer & König (2017)
	During this situation, things were going on that I did not understand.	Langer & König (2017)
	I did not know exactly how to behave in this situation.	Langer & König (2017)
	I did not know exactly what to expect of this situation.	Langer & König (2017)
Privacy Concerns	In such an interview, it is important to me to keep my privacy intact	Malhotra et al. (2004)
	In such an interview, I am concerned about my privacy.	Malhotra et al. (2004)
	Such interviews threaten applicants' privacy.	Self-developed
	Private data submitted during such interviews could be misused.	Self-developed
	During this interview, I provided private data that will be stored safely. (r)	Smith et al. (1996)

Scale	Items	Source
Perceived Behavioral Control	Through my performance, I could influence the result of the interview.	Self-developed
	I am sure that I was in control of the interview.	Self-developed
	During the interview, I think that I convinced my conversation partner that I have what it takes.	Self-developed
	This procedure is uncontrollable for the respective participant. (r)	Self-developed
	The result of the interview depends on the participants themselves.	Self-developed
	The interview is unpredictable. (r)	Self-developed
	During such an interview, it is possible to control the conversation.	Self-developed
	This interview allows applicants to present themselves as they intend to.	Self-developed
Two-way Communication	There was enough communication during the interview.	Bauer et al. (2001), Warstza (2012)
	I was satisfied with the communication that occurred during the interview.	Bauer et al. (2001), Warstza (2012)
	I would have felt comfortable asking questions about the interview if I had any.	Bauer et al. (2001), Warstza (2012)
	I was comfortable with the idea of expressing my concerns.	Bauer et al. (2001), Warstza (2012)
Interpersonal treatment	During the interview, I was treated politely.	Bauer et al. (2001), Warstza (2012)
	During the interview, I was treated with respect.	Bauer et al. (2001), Warstza (2012)
	I was satisfied with my treatment during the interview.	Bauer et al. (2001), Warstza (2012)
Chance to perform	I could really show my skills and abilities through the interview.	Bauer et al. (2001), Warstza (2012)
	This interview allowed me to show what my job skills are.	Bauer et al. (2001), Warstza (2012)
	This interview gave me the opportunity to show what I can really do.	Bauer et al. (2001), Warstza (2012)
	I was able to show what I can do on the interview.	Bauer et al. (2001), Warstza (2012)
Global Fairness	All things considered, this selection procedure was fair.	Warszta (2012)
	I think this interview is a fair procedure to select people for the job.	Warszta (2012)
	I think the interview procedure was fair.	Warszta (2012)
Overall organizational attractiveness	For me, this university would be a good place to study.	Highhouse et al. (2003)
	This university is attractive to me.	Highhouse et al. (2003)
	I am interested in learning more about this university.	Highhouse et al. (2003)
	A place for a Masters' degree at this university would be very appealing to me.	Highhouse et al. (2003)

Scale	Items	Source
	If this university invited me for a face-to-face job interview, I would go.	Highhouse et al. (2003)
	I would accept a place for a Masters' degree at this university.	Highhouse et al. (2003)
	I would make this university one of my first choices.	Highhouse et al. (2003)
	I would like to study at this university.	
	Students are probably proud to say that they study at this university.	Highhouse et al. (2003)
	This university probably has a reputation as being an excellent university.	Highhouse et al. (2003)
	There are probably many who would like to study at this university.	Highhouse et al. (2003)
	This is a reputable university to study at.	Highhouse et al. (2003)
	I would recommend this university to friends.	Warstza (2012)
	I have friends who would be interested in this university.	Warstza (2012)
	I would recommend others to apply at this university.	Warstza (2012)

Note. (r) = reverse coded. All items were presented in German.

7 Study 3: When algorithms have the power: Examining acceptance of technologically advanced personnel selection and training methods.

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7.1 Abstract

Technological advancements could revolutionize human resource management (HRM). In the era of Big Data, it is easy for organizations to gather large amount of data generated by current employees, trainees or applicants (e.g., videos, speech, text). This data can then be used to train machine learning algorithms which are the foundation of modern training and personnel selection tools. However, participants' reactions towards tools incorporating algorithm-based evaluation of participants are unclear. In a 2 (algorithm-based, video conferencing) × 2 (selection, training) experimental design, we examined reactions to a technologically advanced procedure for selection and training purposes and compared it to a video conferencing interaction. Participants (N = 123) watched videos depicting these situations and provided their assessment of them. Results indicate that algorithm-based interactions evoked more privacy concerns. In addition, algorithm-based personnel selection led to ambiguity and less perceived controllability. Decreased social presence and fairness mediated the negative relationship between the algorithm-based interaction and overall acceptance. In conclusion, implementing novel (possibly efficient) procedures for HRM should be done with care as they can negatively impact trainee and, to a greater extent, applicant reactions.

Keywords: human resource management, algorithm-based HRM, video conferencing, applicant reactions, trainee reactions.

7.2 Introduction

Technology has supported human resource management (HRM) for decades. Through technology, recruitment, personnel selection, and training can be done more easily and at reduced cost (Stone, Lukaszewski, Stone-Romero, & Johnson, 2013). Nowadays, organizations screen a considerable number of applicants through skype interviews, or asynchronous digital interviews (Langer, König, & Krause, 2017), many employees take part in e-learning sessions (Sitzmann, 2011) and some even train interpersonal skills with a virtual coach (e.g., Langer, König, Gebhard, & André, 2016). However, this is merely the beginning as there is more technology on the horizon to support HRM (Stone, Deadrick, Lukaszewski, & Johnson, 2015).

Indeed, novel approaches that combine machine learning algorithms (e.g., algorithms that automatically evaluate data, e.g. an automatic evaluation of applicants performance in digital job interview recordings) and sensor devices (i.e., devices capturing human behavior, e.g. nonverbal behavior through cameras) have the potential to revolutionize HRM as they can be effective tools for selection and for training (Langer et al., 2016; Naim, Tanveer, Gildea, & Hoque, 2015). Indeed, several of these approaches are already in place for automated training (e.g., job interview training; Langer et al., 2016) and personnel selection (e.g., automatic evaluation of job interviews; Guchait, Ruetzler, Taylor, & Toldi, 2014; HireVue, 2017; Schmid Mast, Frauendorfer, Gatica-Perez, Choudhury, & Odobez, 2017).

Researchers have called for studies investigating these novel HRM processes because their effects, and participants' perceptions of them remain unknown (Blacksmith, Willford, & Behrend, 2016; Huffcutt & Culbertson, 2010). For instance, it is unclear if there are any undesired by-products that may counterbalance the benefits of these methods. Unfortunately, few have answered this call so far, which is not surprising given the rapid and constant technological advances (Chamorro-Premuzic, Winsborough, Sherman, & Hogan, 2016) and

given the lack of paradigms to study these modern technologies. We therefore mimicked algorithm-based tools that have already been started to be used in modern training (see Langer, Schmid Mast, Meyer, Maass, & König, in press) and personnel selection practice (see HireVue, 2017). In the tool we present, a virtual agent (i.e., a computer character) acts as an interviewer whose actions are based on the sensor-driven detection and algorithm-based analysis of interviewees' social signal. Such social signals can be verbal (i.e., words used), paraverbal (e.g., speech-rate), or nonverbal (e.g., smiling), and they are measurable using depth-cameras and microphones, and analyzed by state-of-the-art computer science approaches (e.g., machine learning; cf. Langer et al., in press). In the current study, we present such a tool to participants as they would experience it in practice. In our experimental manipulation, participants either watched how the algorithm-based tool interviews a human interviewee or they watched a classical technology-mediated interpersonal interaction (i.e., a video conferencing interaction). The algorithm-based and the video conferencing interaction are compared in both training and personnel selection contexts since they represent two potential domains where such novel approaches can play a crucial role (Schmid Mast, Gatica-Perez, Frauendorfer, Nguyen, & Choudhury, 2015). Additionally, the comparison of training and personnel selection adds valuable insights for research and practice about how the context of the application of an algorithm-based HRM tool influences its acceptance.

Given that research on novel technologies for HRM is in its infancy, we first build upon Potosky's (2008) framework developing ideas about potential differences between algorithm-based and videoconferencing interactions. In order to examine acceptance of the presented HRM situations, we use acceptance variables stemming from classical procedural justice research (e.g., interpersonal treatment; Gilliland, 1993). Furthermore, we capture acceptance variables covering the fact that algorithm-based HRM approaches require new perspectives on participants' reactions. These variables have their roots in technology

acceptance research (i.e., privacy concerns and creepiness as an affective reaction towards novel technologies; Bauer et al., 2006; Langer, König, & Fitili, 2018). Finally, we investigate the impact of these acceptance variables on overall evaluations of novel technologies for training and personnel selection.

7.3 Background and Hypotheses Development

7.3.1 Technological advancements in HRM

Over the last few years, there has been great development in using technology to make HRM processes more efficient. This has occurred for at least four reasons. First, the "era of Big Data" (Lewis, Zamith, & Hermida, 2013, p. 38) evolved through improved computing power, mass data storage possibilities, and use of machine learning algorithms to interpret the data (Guzzo, Fink, King, Tonidandel, & Landis, 2015). Second, the area of affective computing has evolved to be an influential domain within computer science, as including human emotions into computer science research has opened the gate for entirely new insights and developments in human-computer interaction (Picard, 2010). Third, new sensors were invented that allowed us to more effectively collect data like nonverbal behavior (Langer et al., in press). Fourth, Big Data analyses, affective computing research, sensors, and machine learning algorithms have been incorporated into social sensing technologies (Schmid Mast et al., 2015) – technologies that allow automated recognizing, analyzing, and interpreting of social behavior. Through these social sensing technologies, algorithm-based HRM procedures for personnel selection and training purposes have become more realistic and applicable.

Previous studies have pointed towards the possible utility of such technologies for HRM purposes (Schmid Mast et al., 2015). For example, Langer and colleagues (2016) used state-of-the-art technology to successfully prepare applicants for job interviews: a virtual

character combined with a Kinect® camera, a microphone, and social sensing software, namely the Social Signal Interpretation Framework (SSI, Wagner et al., 2013) were used to recognize participants' nonverbal behavior and give automatic feedback. In practice, similar virtual training tools are already used to support human trainers in negotiation training (Langer et al., in press). In this negotiation training, nonverbal and paraverbal behavior are recognized automatically and participants receive feedback on their behavior during the negotiation paired with feedback to improve their behavior in future negotiations.

In the field of personnel selection, Schmid Mast and colleagues (2017) used social sensing systems to automatically recognize nonverbal behavior and to predict the job performance of student assistants. It is important to note that providers of automated personnel selection solutions like HireVue (HireVue, 2017) are already offering systems similar to the one examined by Schmid Mast and colleagues (2017) to their customers. More precisely, organizations provide HireVue with digital interview recordings (interviews in which applicants submit videos of themselves answering to interview questions) of current employees. These videos are then algorithmically analyzed to recognize (video-based) patterns of behavior differentiating high-performers from low-performers (e.g., their smiles, body posture). These patterns are then used on applicants' digital interview recordings to find applicants who fit the pattern of high-performance workers – and these applicants might then proceed to the next personnel selection stage.

7.3.2 Acceptance of technology in HRM

Unfortunately, until now, research is lacking on how trainees or applicants react when they are trained or selected through novel technologies. However, positive reactions towards and acceptance of HRM methods are crucial for their effectiveness (Stone et al., 2013). We define overall acceptance as a positive evaluation of a technology-enhanced situation. Undoubtedly, acceptance consists of multiple facets (Schwarz & Chin, 2007). This study

argues that to raise overall acceptance of a technology used in a social situation like personnel selection or training the following variables need to be evaluated: (a) the social quality of the technology (e.g., interpersonal treatment; Gilliland, 1993), (b) participants perceptions of controllability of the technology in a given situation (Ajzen, 2002b), (c) affective reactions towards the technology in the specific situation (Langer et al., 2018; Tene & Polonetsky, 2015), (d) uprising privacy concerns during the situation (Bauer et al., 2006), and (e) general fairness perceptions of the technology regarding the application in these situations (Colquitt & Zipay, 2015).

Regarding training, acceptance leads to better learning outcomes and ongoing use of the training (S. M. Lee, Kim, & Lee, 1995). Further, research on technology acceptance in training environments has found that virtual environments can be less accepted than classical training approaches (Bertram, Moskaliuk, & Cress, 2015). Importantly, negative attitudes towards virtual training approaches influence training outcomes detrimentally (Landers & Armstrong, 2017). However, if technologically-supported training is designed carefully, it can positively influence motivation, self-efficacy, and effectiveness (Gratch et al., 2007; Sitzmann, 2011; Sitzmann, Brown, Casper, Ely, & Zimmerman, 2008).

Concerning personnel selection, if applicants react negatively to selection procedures, selection justice perceptions (Bauer et al., 2001; Gilliland, 1993), and important organizational outcomes can suffer (e.g., organizational attractiveness; Highhouse, Lievens, & Sinar, 2003; Truxillo & Bauer, 2011). A recent meta-analysis by Blacksmith and colleagues (2016) showed that technology-mediated job interviews elicited more negative attitudes (e.g., less perceived chance to perform; Sears, Zhang, Wiesner, Hackett, & Yuan, 2013) towards the selection process and the organization than face-to-face interviews which could detrimentally impact the future of the organization (Bauer, Truxillo, Paronto, Weekley, & Campion, 2004). Even more importantly, applicant reactions to selection procedures can

also negatively influence organizational citizenship behavior and test scores which might then impact job performance (Konradt, Garbers, Böge, Erdogan, & Bauer, 2015; McCarthy et al., 2013).

Yet studies that have investigated acceptance of technology-supported HRM processes have mostly examined contexts that do not use state-of-the-art technology (e.g., e-learning training, videoconference interviews; Sears et al., 2013; Sitzmann et al., 2008). More precisely, previous studies neither operated in advanced virtual environments, nor did they incorporate algorithm-based evaluation of participants' behavior. These studies have quickly become outdated due to the strides technology has taken in recent years (Langer et al., 2018).

7.3.3 Factors differentiating video conferencing and algorithm-based interactions

This study compares video conferencing interactions to algorithm-based interactions, using a simulation context that can be used for both, training and selection purposes. The algorithm-based interactions we describe in this study use social sensing and machine-learning methods to try to make human-computer interactions as realistic as possible, whilst gaining massive opportunities to gather data about people. More precisely, our definition of algorithm-based interactions necessitates that the computer system can recognize nonverbal and paraverbal behavior (e.g., Langer et al., 2016), and uses that information to interact empathically with humans (Bee, André, Vogt, & Gebhard, 2010) and to train participants or evaluate their interview performance.

Comparing video conferencing and algorithm-based interactions regarding acceptance leads to a variety of features that might differ between those two interaction types. In this regard, Potosky's (2008) framework of media attributes provides a theoretical background to generate ideas about potential differences between the interaction types. Potosky developed her framework in order to provide a structured approach to compare different communication media. In the case of the current study, videoconference interactions as well as algorithm-

based interactions represent different kind of communication media, even if in the latter case, participants do not really interact with another human being. In the next paragraphs, we will briefly introduce Potosky's framework consisting of four attributes that distinguish communication media (i.e., social bandwidth, interactivity, transparency, and surveillance) and relate our acceptance variables to these attributes.

Social bandwidth relates to the possibility of exchanging communication information (e.g., verbal and nonverbal information) (Potosky, 2008). Videoconference interactions might provide more social bandwidth as people can send and receive many different verbal and nonverbal information. In algorithm-based interactions similar to the ones we describe, participants can also send and receive this kind of information, however as these technologies are still not as good as humans in recognizing and producing communicational content, social bandwidth should be relatively lower.

The second aspect of Potosky's framework is interactivity which focuses on the opportunity to interact with a communication partner (Potosky, 2008). As it is the case for social bandwidth, algorithm-based interactions might offer lower interactivity than videoconference interviews, because participants only interact with a virtual communication partner. Even the best algorithm-based tools nowadays will not offer the same interactivity (e.g., possibility to ask open-ended questions; Frauendorfer, Schmid Mast, Nguyen, & Gatica-Perez, 2014) as technology-mediated interaction between two humans.

Transparency of a medium is high, if participants do not realize that they are communicating through a medium and if there are no obstacles during the communication (Potosky, 2008). For instance, transparency would be low in cases in which there are video or audio interferences during videoconference interactions (Potosky, 2008). However, if there are no such problems, they might be more transparent than algorithm-based interactions where participants are constantly reminded that they are talking to a virtual character through

microphone and camera. Additionally, transparency in algorithm-based interactions might be reduced by the fact that participants do not really understand what is happening during such an interaction (Potosky, 2008). For instance, naïve participants will not have an idea about the capabilities of an algorithm (Langer et al., 2018). More precisely, they will not know whether the algorithm-based tool analyzes their nonverbal behavior, if it poses more importance on verbal information or if it ignores any visual cues. This might make it hard for humans to express themselves in a natural way, consequently decreasing transparency as defined by Potosky.

Surveillance as the last aspect of Potosky's framework, relates to the extent to which an interaction appears to be observable by a third party (Potosky, 2008). Many people nowadays use videoconference interactions and it might occur that people are concerned that their conversation is being monitored. In the case of an algorithm-based interaction however, it is much less clear if the video recording is just analyzed by an algorithm, if there are other people watching the video in a live stream or if the video recordings are later watched by unauthorized people. Thus, perceived surveillance of an algorithm-based interaction could be higher as it is unclear what happens to the recorded data.

To sum up, algorithm-based interactions should provide relatively lower social bandwidth, interactivity, transparency, and higher perceived surveillance. In order to measure the impact of these differences between algorithm-based and videoconferences interactions, the current study examines a variety of different acceptance variables relating to procedural justice research by Gilliland (1993) (i.e., social presence, interpersonal treatment, perceived behavioral control, consistency, fairness) as well as research about the acceptance of novel technologies (i.e., privacy concerns, creepiness) (Bauer et al., 2006; Langer et al., 2018; Tene & Polonetsky, 2015). Differences in social bandwidth and interactivity should condense in the acceptance variables social presence, interpersonal treatment, perceived behavioral

control (perceived controllability and perceived self-efficacy; Ajzen, 2002b), and consistency. Transparency should be reflected by perceived behavioral control and creepiness. Lastly, surveillance should relate to privacy concerns. Additionally, all of Potosky's attributes should affect general fairness evaluations.

The following sections take a closer look at the different acceptance variables and develop hypotheses about the effect of the difference between algorithm-based and videoconference interactions.

Social presence and interpersonal treatment

Social presence is defined as the feeling of present interpersonal warmth and empathy during an interaction (Walter, Ortbach, & Niehaves, 2015), whereas humans perceive positive interpersonal treatment if they are treated with respect and dignity (Bauer et al., 2001). Interpersonal interactions occur via various channels of verbal and nonverbal communication (Burgoon et al., 2002; Potosky, 2008). Humans use their entire body to communicate, to elicit sympathy in others (e.g., via mimicry, Gordon, 1995), to show empathy, connectedness and respect to each other (Haase & Tepper, 1972). Nowadays, computers are also able to identify and interpret aspects of nonverbal communication and computer scientists are working on making computers act more empathically (Bee et al., 2010; Gebhard et al., in press); this is work in progress so that algorithm-based interactions should still differ from video conferencing interactions' availability of communication channels, and thus social bandwidth and interactivity (Chapman, Uggerslev, & Webster, 2003). Addtitonally, algorithm-based interactions are not yet able to generate the same adequate social behavior (e.g., through virtual characters) as human beings can, thus possibly leading to less pleasant interactions.

Hypothesis 1a. Video conferencing interactions will be evaluated higher on social presence than algorithm-based interactions (in the following we call this independent variable interaction type).

Hypothesis 1b. Video conferencing interactions will be evaluated higher on perceived interpersonal treatment than algorithm-based interactions.

Perceived behavioral control

People perceive behavioral control if they hold the general belief that one can influence a specific situation (perceived controllability, Ajzen, 2002b) and if they themselves are confident of being able to execute a specific behavior and to control a situation (perceived self-efficacy; Ajzen, 2002b). In an interpersonal context like training and personnel selection, influencing other human-beings and the course of the conversation can be seen as an impactful behavior people execute frequently to be successful in such contexts (Barrick, Shaffer, & DeGrassi, 2009). One extensively discussed phenomenon of behavior representing interpersonal influence in HRM is the effect of impression management (Ingold, Kleinmann, König, & Melchers, 2015; Leary & Kowalski, 1990). For instance, through impression management applicants can improve their chances of being hired (e.g., by ingratiating with the interviewer; Barrick et al., 2009) and job interview training can specifically focus on training impression management behavior (e.g., smiling at the interviewer; Langer et al., 2016). It is doubtful that people believe that they are able to influence algorithm-based tools the same way they can influence humans as there is less social bandwidth, interactivity, and transparency (i.e., because people do not understand what exactly is happening during algorithm-based interactions); they may therefore lose confidence over their ability to execute impression management and other behavior (e.g., nonverbal behavior; cf., Stone-Romero, Stone, & Hyatt, 2003) to control the course of an interaction or the outcome of selection and

training procedures (Barrick et al., 2009; Potosky, 2008). Thus, feelings of behavioral control might be reduced.

Hypothesis 1c. Video conferencing interactions will be evaluated higher on perceived behavioral control (perceived controllability and perceived self-efficacy) than algorithm-based interactions.

Consistency

No matter how structured preconditions for interpersonal interactions are, human interactions are always susceptible to prejudice and biases (Sedikides, Campbell, Reeder, & Elliot, 1998), thus consistency in the sense of equal treatment during such interactions can be low. Race, gender, and attractiveness are just a few possible sources of discrimination between people (e.g., Pingitore, Dugoni, Tindale, & Spring, 1994; Prewett-Livingston, Feild, Veres, & Lewis, 1996). Algorithm-based interactions might be perceived as less prone to biases (Blacksmith et al., 2016) because computers would be able to ignore race, gender, or attractiveness. To be clear, this could be a positive outcome of the algorithm-based interactions' reduced social bandwidth and interactivity. As a result, participants might feel more equally treated (please note that people might only believe that computers will not be biased but humans are still in charge of programming suggesting that algorithms can learn human-like biases; Caliskan, Bryson, & Narayanan, 2017; Friedman & Nissenbaum, 1996).

Hypothesis 1d. Video conferencing interactions will be evaluated lower on consistency than algorithm-based interactions.

Creepiness

Creepiness can be defined as an unclear negative affective reaction towards a specific situation, paired with feelings of not knowing how to judge and handle this situation (Langer et al., 2018). Researchers in human-computer interaction often refer to the feeling of creepiness that can occur when communicating with virtual characters (Mori, 1970; Saygin,

Chaminade, Ishiguro, Driver, & Frith, 2012). In particular, unfamiliar situations with novel technologies seem to induce creepiness (Tene & Polonetsky, 2015) because they violate social norms, can be non-transparent, and it is difficult to predict what will happen next. In comparison, chances are higher that video conferencing interactions are more familiar and more transparent making them less prone to induce feeling of creepiness (Goldman, 2012).

Hypothesis 1e. Video conferencing interactions will induce less creepiness (emotional creepiness and creepy ambiguity) than algorithm-based interactions.

Privacy concerns

Through sensors like microphones and cameras, huge amount of data are collected when interacting with computers, potentially leading to privacy concerns (e.g., data abuse; Malhotra, Kim, & Agarwal, 2004). Stone-Romero and colleagues (2003) found that the invasiveness of selection procedures induces stress in applicants, and Bauer and colleagues (2006) found that selection procedures evoking privacy concerns relate negatively to organizational attraction. In the case of algorithm-based interactions, a large amount of private data are collected which can potentially be seen as invasive, as a camera records a person's face, body, and voice and as data are often stored somewhere in the cloud. In interpersonal interactions, a reasonable amount of private data might also be collected, but surveillance as defined by Potosky (2008) might still be lower than in algorithm-based interactions as people could be more aware of what is happening to their data.

Hypothesis 1f. Video conferencing interactions will induce lower privacy concerns than algorithm-based interactions.

Fairness

Even though interpersonal interactions are always a source of biases, they could still be seen as fair. In the interaction with a human being, perceived fairness is greater because it is possible to explain oneself, and to ask questions about how training feedback or selection

decisions have been made (Gilliland, 1993). In the case of algorithm-based interactions, explaining or correcting oneself can be harder (or even impossible) as these interactions might be much more automated. In the end, this could violate participants' justice expectations (cf., Ployhart & Ryan, 1998). Additionally, participants usually are only confronted with the output of the algorithm (e.g., training feedback, selection decision) without the algorithm explicitly explaining its decision-making process (Biran & Cotton, 2017). Even if there are explanations about the algorithm-based process, they might be hard to understand (see Miller, Howe, & Sonenberg, 2017) or raise concern about whether the process really is fair (see Langer et al., 2018).

Hypothesis 1g. Video conferencing interactions will be evaluated higher on fairness than algorithm-based interactions.

In the current study, acceptance is the main dependent variable as it is of crucial importance for the effectiveness and ongoing use of procedures like training and personnel selection (Highhouse et al., 2003; S. M. Lee et al., 1995). To evaluate overall acceptance, we draw on a concept from user experience studies, where overall acceptance is measured through perceived attractiveness of a procedure reflecting a simple "good versus bad" assessment of the respective procedure (Laugwitz, Held, & Schrepp, 2008).

Other than consistency, all of the above mentioned effects seem to be advantageous for the video conferencing interaction. As such, we expect them to mediate a positive effect of video conferencing interactions on the general attractiveness of the procedure.

Hypothesis 2. The positive effect of video conferencing interactions on the attractiveness of the procedure will be mediated by social presence, interpersonal treatment, perceived behavioral control, creepiness, privacy concerns, and fairness.

7.3.5 Factors differentiating between training and personnel selection contexts

Although the presented technology can be used for various purposes, in this study we discuss its application to training and personnel selection contexts as scalable and automated methods would be especially beneficial within these contexts (Chamorro-Premuzic et al., 2016). More importantly, comparing the acceptance of algorithm-based training and personnel selection tools highlights the importance of the context regarding acceptance research, indicating that the same tool might be more accepted for one context than for another. Specifically, there are differences between training and personnel selection that might have important implications for the use of advanced technologies in these settings.

First, in the case of training trainees exchange private information for direct improvement with a trainer whose interest should be to train the trainee. In the personnel selection context, applicants exchange private information for the chance of being hired by an organization, where the organization's primary interest is to find the best possible candidate (cf., Dineen, Ling, Ash, & DelVecchio, 2007). In the latter case, it is more uncertain how the private data will be used and a positive return of investment on private information is less likely than in training situations.

Hypothesis 3a. Personnel selection contexts elicit higher privacy concerns than training contexts (following we will call this independent variable context).

Second, personnel selection context are high-stake situations as they are important for ones' future and often induce stress (McCarthy & Goffin, 2004). In fact, applicants invest a lot of effort preparing job interviews (Maurer, Solamon, Andrews, & Troxtel, 2001), are afraid before the job interview (McCarthy & Goffin, 2004), and even lie to get a job (Buehl, Melchers, & Macan, 2018). Although training contexts can also be high-stakes situations, they might be less stressful and potentially life-changing than personnel selection contexts (McCarthy & Goffin, 2004).

Hypothesis 3b. Personnel selection contexts are evaluated as being more high-stake than training contexts.

The two differentiating factors of training and selection contexts suggest that training contexts induce less stress, can be completed more casually, and with less preparation than personnel selection contexts where people want to put their best foot forward (Jansen, König, Stadelmann, & Kleinmann, 2012). Therefore, it is likely that people prefer training situations compared to personnel selection situations.

Hypothesis 3c. Personnel selection contexts are perceived as being less attractive than training contexts.

7.3.6 Interaction effects between technology and the HRM procedure

Summarizing the theoretical assumptions so far indicates that people might react less favorably to algorithm-based interactions than to video conferencing interactions, and they might react less favorably to selection than to training contexts. Consequently, it is arguable that there will be an interaction between the context and the interaction type. This interaction could be especially detrimental for perceived creepiness and privacy concerns in algorithm-based personnel selection situations.

Feelings of creepiness should be relatively lower in algorithm-based training situations as the use of advanced technology for training purposes might be more familiar (Zyda, 2005). For instance, it is common that no human interaction takes place within flight training (Jones et al., 1999). Using advanced technology for personnel selection purposes like job interviews, however, is a new development in which computers and algorithms gain decision power over the future of an applicant. In this case, people find themselves in situations with low transparency interacting with novel technologies. As Tene and Polonetsky (2015) state, this can induce especially pronounced feelings of creepiness.

Hypothesis 4a. There will be an interaction between the interaction type and the context on the evaluation of creepiness of the situation such that algorithm-based personnel selection contexts will be evaluated as creepier than the other situations.

Privacy concerns should be highest in algorithm-based personnel selection contexts because applicants are providing sensitive information over their skills and professions to a data-gathering computer tool. It is uncertain if private data offered to the organization will lead to a positive outcome (e.g., a job offer) because applicants never know if the data they offered had any bearing on receiving a job offer (cf., Solove, 2013). Within algorithm-based training contexts, the same problems of unknown data storage and access rise but the positive return for offered private data (e.g., learning something through training) is much more certain.

Hypothesis 4b. There will be an interaction between the interaction type and the context on the evaluation of privacy concerns of the situation such that the algorithm-based personnel selection context will elicit more privacy concerns than any other situations.

As argued above, there should be more privacy concerns and creepiness in algorithm-based personnel selection contexts. As a result, overall acceptance of these situations might be especially low compared to the other situations that we describe in the current study.

Hypothesis 4c. There will be an interaction between the interaction type and the context on the evaluation of attractiveness of the procedure such that algorithm-based personnel selection contexts are evaluated less attractive than all the other situations.[1]

7.4 Method

7.4.1 Sample

To generate ideas about the possible effect size between the experimental conditions, we consulted the meta-analysis of Blacksmith and colleagues (2016) on the effect of

technology on applicant reactions. They found small to medium effect sizes for applicant reactions in favor of less technology-mediated interview methods (i.e., face-to-face interviews). Accordingly, we expected to find a moderate effect in the context of the current study. Sample size calculation with G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) revealed that under the assumption of a moderate effect of Wilk's $\lambda = 0.92$, a sample of $N = 124$ was necessary for a power of $1-\beta = 0.80$. Because of formerly experienced problems with online experiments (e.g., technical problems, and participants taking long pauses during the experiment), we oversampled until our sample consisted of $N = 132$ participants. We excluded three participants who stated we should not use their data as they did not execute the experiment seriously. Furthermore, we excluded two participants because of technical problems, one participant because he skipped one part of the manipulation, and four other participants because they interrupted the experiment for more than one hour. The final sample consisted of $N = 123$ German participants (57% female), 76% of which were students (53% of them studied psychology). The mean age was 25.12 years ($SD = 7.44$). Most participants (46%) had experienced one to three job interviews before, 29% had experienced four to five job interviews, 9% had experienced six to nine interviews, 10% of participants had experienced more than ten interviews and the rest had not experienced any job interviews before. Regarding technology-mediated interviews, 13% of participants had experienced at least one technology-mediated job interview before. Participants were rewarded with course credit and the possibility of winning a small price.

7.4.2 Design, procedure, and manipulation

The entire study was conducted via an online survey platform. Participants were randomly assigned to one of the groups of the 2×2 between subject design (video conferencing vs. algorithm-based interaction; personnel selection vs. training context). Participants first read the description of a situation where they were asked to imagine that a

friend was invited to a job interview. Afterwards, the two training context groups received information describing that their friend wants to prepare for the job interview and finds a human trainer or a virtual training tool respectively. They were informed that the trainer/training tool asks and answers questions and provides feedback for nonverbal behavior and speech. Furthermore, they were told that the trainer/training tool will provide feedback to the interview performance.

In the selection context groups, participants received information indicating that their friend's job interview will be conducted by a human interviewer or a virtual interview tool, respectively. They were informed that the human interviewer/the interview tool asks and answers questions and pays attention to interviewees' nonverbal behavior and speech. In addition, they were told that after the job interview, the human interviewer/the interview tool will decide independently if an applicant will be considered for a follow-up face-to-face interview.

Descriptions were equal in length and information, except for the experimental manipulation information. Afterwards, participants watched videos respective to the video conferencing and algorithm-based groups. After the videos, the two training context groups were informed that their friend waits for feedback regarding interview performance and that the trainer/training tool will provide feedback for nonverbal behavior, speech, and content to improve future interview performance. The two selection context groups received the information that the human interviewer/the interview tool will analyze nonverbal behavior speech, and content. Furthermore, they were told that the human interviewer/the interview tool will decide if the interviewee advanced to the next selection stage. In the end, participants answered to a questionnaire containing all dependent measures.

The videos

First, we had to determine how to design the video for the algorithm-based groups. We followed the general idea underlying algorithm-based training and personnel selection approaches as we decided to highlight the importance of verbal, paraverbal, and nonverbal behavior in order to train interpersonal situation (see Langer et al., 2016) or to predict job performance (see Naim et al., 2015; Schmid Mast et al., 2017). We used the approach of Langer and colleagues (2016) to create the video for the algorithm-based interaction type group. Langer and colleagues (2016) used a virtual environment to train job interviews. In this tool, the Social Signal Interpretation Framework (SSI, Wagner et al., 2013) uses input from a Kinect® camera (Microsoft, 2015) and a microphone combined with machine learning algorithms in order to detect and interpret speech and nonverbal behavior. For instance, the machine learning algorithms integrated in the SSI were trained with video data to recognize nodding or smiling (Wagner et al., 2013). Using the data from the SSI, the Visual Scene Maker (VSM, an authoring tool for virtual environments; Gebhard, Mehlmann, & Kipp, 2011) can then be used to further interpret interviewees' nonverbal behavior and to manipulate the virtual environment and the virtual character. For example, if the SSI recognizes an interviewee's smile, it can send that data to the VSM. In the VSM, designers can integrate contextually different ways how to handle a smile. For instance, the virtual character reacts with a smile to a user smile, but only in the beginning of the interview, whereas later in the interview, the virtual character may not smile back as adequacy of smiling differs for the stages of the interview (Ruben, Hall, & Schmid Mast, 2015).

Second, the authors had to generate ideas about how to make participants aware of the capabilities of the virtual interview tool. As a consequence, the video of the video conferencing/algorithm-based condition showed a female human/virtual interviewer interacting with the supposed friend of the participants; only the interviewer was visible. To

make sure that the observing participants were aware of the algorithm-based parts of the interview (i.e., that the interviewer recognizes and adapts to interviewees' nonverbal behavior and emotions), the interviewee in the video becomes nervous after being asked the second question and hesitates to answer the question. As a result, the interviewer says that she/it senses some nervousness. The interviewer emphasizes that being stressed is completely comprehensible and tries to calm the interviewee by acting very friendly. Afterwards, the interviewee recovers from her nervousness and answers to the question; then the video fades out.

The videos were similar in length; one identical video was used for both algorithm-based interaction contexts and one identical video for both video conferencing interaction contexts. In addition, the same audio track of the answers provided by the supposed friend of the participants was used for both videos.

7.4.3 Measures

Dependent and mediator variables

Social presence, perceived behavior control, creepiness, privacy concerns, and high-stake evaluation items ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). For consistency, interpersonal treatment, and fairness items ranged from 1 (*strongly disagree*) to 5 (*strongly agree*).

Social presence was measured with five items adopted from Walter and colleagues (2015). A sample item is "The interviewer acted empathically."

Perceived behavioral control was measured with eight items taken from Langer and colleagues (2017) who followed the suggestions by Ajzen (2002) that perceived behavioral control scales should consist of perceived self-efficacy and perceived controllability items. A sample item for perceived self-efficacy is "I am sure that I could control the shown procedure

through my behavior." A sample item for perceived controllability is "It is possible to manage such a procedure."

Consistency and interpersonal treatment were measured with three and four items from a German version of the Selection Procedural Justice Scale (Bauer et al., 2001; Warszta, 2012). A sample item for consistency is "This procedure is administered to all applicants in the same way." A sample item for interpersonal treatment is "During the interview, the participant was treated politely."

Fairness was measured with two items from Warszta (2012). A sample item is "I think the shown procedure is fair."

Creepiness was measured with ten items from Langer and colleagues (2018). The creepiness scale consists of two facets, namely emotional creepiness and creepy ambiguity, both measured with five items. A sample item for emotional creepiness is "During this situation, I had a queasy feeling." A sample item for creepy ambiguity is "I did not know how to judge this situation."

Privacy concerns were measured with six items. One item from Smith, Milberg, and Burke (1996), two items were taken from Malhotra, Kim, and Agarwal (2004), two items were taken from Langer and colleagues (2018) and one item was taken from Langer and colleagues (2017). A sample item is "Situations like the one shown threaten participants' privacy."

High-stake evaluations were measured with six items. These items were developed by the authors. A sample item is "Such situations are crucial for participants' future."

Attractiveness of the procedure was measured with six and three items from the User Experience Questionnaire (UEQ; Laugwitz, Held, & Schrepp, 2008). Items of the UEQ are pairs of opposites where people answer on a 7 point scale from -3 to +3 between the pairs of

opposites. For instance if a participant answered +3 for the sample item combination “bad-good” the procedure is evaluated as very good.[2]

Manipulation check measure

Two manipulation check items were provided that ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). To cover the contextual manipulation, the item was “The situation shown in the video was a training situation”, and to cover the interaction type manipulation the item provided was “The interviewer in the video was a human being”.

7.5 Results

7.5.1 Manipulation checks

Participants in the training context group were more likely to perceive the procedure as a training context than in the personnel selection context group, $t(121) = 6.43$, $p < .01$, $d = 1.16$. Furthermore, participants in the video conferencing interaction group were more likely to perceive the person shown as a human than in the algorithm-based interaction, $t(80.55) = 22.30$, $p < .01$, $d = 4.03$.

7.5.2 Testing the hypotheses

Table 7-1 provides an overview of descriptive statistics and intercorrelations.

We used MANOVA and single ANOVAs to assess the differences between the interaction types. Overall, there was a difference between video conferencing and algorithm-based interactions, $F(11, 109) = 3.06$, $p < .01$, Wilk’s $\lambda = .76$. Hypotheses 1 a)-g) examined the difference between video conferencing and algorithm-based interactions for social presence, interpersonal treatment, perceived behavioral control, consistency, creepiness, privacy concerns, and fairness. Results of the single ANOVAs and corresponding hypotheses are shown in Table 7-2 and Figure 7-1. Contrary to our hypotheses, there were no differences between the interaction types for social presence, interpersonal treatment, consistency, and

fairness. However, the findings support the hypotheses for the effect of the interaction type regarding perceived behavioral control (lower for algorithm-based interactions), and privacy concerns (higher for algorithm-based interactions). Additionally, there was partial support for the hypotheses that creepiness would be higher in algorithm-based interactions as we found this effect for creepy ambiguity.

In Hypothesis 2, we wanted to test the mediating effects of the dependent variables between the interaction type and the attractiveness of the procedure. Mediation significance tests were conducted with PROCESS (Hayes, 2013). Table 7-3 and Table 7-4 present the results. The findings indicate that overall, there was a positive indirect effect between the interaction type and the attractiveness of the procedure mediated by social presence and fairness. This partially supports Hypothesis 2 as the other dependent variables were not significant mediators. The resulting model is presented in Figure 7-2.

Furthermore, the overall MANOVA showed a significant difference between training and personnel selection contexts, $F(11, 109) = 2.59$, $p < .01$, *Wilk's* $\lambda = .79$. Hypotheses 3 a)-c) examined the difference between the contexts for privacy concerns, high-stake evaluations, and attractiveness of the procedure. Results of single ANOVAs and corresponding Hypotheses are shown in Table 7-2 and Figure 7-1. In contrast to our hypotheses there was no effect for privacy concerns but the results support our hypotheses that participants perceive personnel selection situations as more high stake and less attractive than training situations.

Regarding Hypothesis 4 a)-c), Figures 7-1g), 1h), 1i) and 1k) indicate that only Hypothesis 4a) was partially supported as there was a significant interaction effect for creepy ambiguity but not for emotional creepiness, privacy concerns, or attractiveness of the procedure. Furthermore, Figures 7-1c) and 1f) imply that there were unexpected interaction effects for perceived controllability and fairness.

7.6 Discussion

This study examined user acceptance of an algorithm-based tool for training and personnel selection purposes. Results show that the algorithm-based interaction, incorporating automatic evaluation of user data, was less accepted than a video conferencing interaction. This was especially true for the personnel selection context. Supporting the proposed differences in Potosky's (2008) media attributes, these findings imply that the algorithm-based tool distinguished from a more classical technology-mediated approach (i.e., videoconferences) as people reacted more negatively to the modern approach. Furthermore, our findings indicate that people are sensitive to the context in which acceptance research takes place as our participants were more critical about the algorithm-based tool for personnel selection than for training. Following, we will discuss the results for the different acceptance variables in more detail.

First, the findings indicate that participants were more skeptical of their ability to control a situation in which people are analyzed by an algorithm-based interview tool in comparison to when they talk to a human interviewer. This perceived lack of control was more pronounced for technologically advanced personnel selection contexts than for training contexts. Supporting our claim that algorithm-based interactions may be perceived as offering less social bandwidth, interactivity, and transparency as defined by Potosky (2008), these results could indicate that participants were concerned about reduced opportunity for impression management (see also Barrick et al., 2009; Blacksmith et al., 2016). This would also explain the especially low perceived control in algorithm-based selection situations as impression management is more important in such situations. Indeed, reduced opportunity for impression management might be a justified concern because algorithm-based personnel selection could be less transparent than personnel selection based on video conferencing. In the latter case, applicants gain some control over the situation by knowing how to influence

the interviewer (e.g., by ingratiating, smiling, nodding etc.; cf., Barrick et al., 2009) and the decision (as impression management impacts interviewer decisions; cf., Peck & Levashina, 2017). In cases in which decisions are made based on algorithms, feelings of "knowing how to influence" are likely reduced as interviewees might have no insight into which variables are used to determine if they are invited to next selection stage.

Furthermore, participants assessed the algorithm-based personnel selection context as being more ambiguous than video conferencing interactions or an algorithm-based training context. On the one hand, this indicates that Potosky's (2008) aspect of transparency appears to be relatively lower for algorithm-based personnel selection situations. On the other hand this is in line with former research that suggested that feelings of uncertainty and ambiguity are especially prevalent in novel situations where people do not know what to do, what to feel, or how to judge the situations (Tene & Polonetsky, 2015). This might also account for the result that algorithm-based training was less ambiguous, as it is more familiar and established than algorithm-based personnel selection (see also, Zyda, 2005). However, we were surprised by the fact that there was no difference in emotional creepiness between the groups, not even for algorithm-based personnel selection. One reason for this might be that people only observed the situation, thus they might not have experienced enough emotional immersion into the situation.

One of the most important outcomes of the current study is that participants evaluated technologically advanced personnel selection contexts as being particularly unfair. A reason for this could be that procedures that are widely used are evaluated as more accepted and fair than less applied procedures, as Steiner and Gilliland (1996) and Venkatesh, Morris, Davis, and Davis (2003) showed earlier. Moreover, participants might have interpreted that a computer gains decision power over a human being, which may be seen as less fair than a person being in charge of making personnel selection decisions (Ötting & Maier, 2018).

Although one could argue that participants' perceptions were not justified as some previous research suggests that algorithms are less biased than human assessors (e.g., Schmid Mast et al., 2017), other current research implies that algorithms can incorporate human-like biases, because algorithms learn from data which might be generated by people (e.g., supervisor performance ratings) (Caliskan et al., 2017). For instance, if the algorithm learned that employees with a low voice pitch receive higher supervisor performance ratings, it will likely select applicants with a low voice pitch ignoring many other facets that might not distinguish equally well. In this vein, it is important to note that even race differences are correlated with pitch differences ("ethnolects", see e.g., Cocchiara, Bell, & Casper, 2016; Kushins, 2014). To be clear, the issue at hand might be the lack of transparency of algorithm-based personnel selection situations. In the case of an interpersonal personnel selection situation, it might at least be possible to see through the decisions and understand recruiter biases (e.g., they did not like me), whereas this is much harder when algorithms have the power. Similar to reduced fairness evaluations, it seems that lower transparency was at least partly accountable for reduced perceived behavioral control and creepy ambiguity, indicating that differences in this aspect of Potosky's framework especially impacted the acceptance variables in the current study.

The findings regarding privacy concerns imply that modern algorithm-based interactions lead to more concerns about what is happening with ones' private data. This was true, for personnel selection and training situations, speaking in favor of the hypothesized differences in surveillance as defined by Potosky (2008). In contrast to our theoretical assumptions, a higher probability of positive outcomes for participants in training situations did not reduce privacy concerns compared to the rather uncertain outcomes in personnel selection situations. It seems that the algorithm-based interview tool led to privacy concerns no matter the potential benefit. However, this result might still be more alarming for the use

of similar technologies for personnel selection as previous research implies that privacy concerns relate negatively to organizational attractiveness (Bauer et al., 2006).

We also measured overall acceptance of the procedure as another important outcome of HRM procedures, and mediation results for this outcome raise further concern about the acceptance of algorithm-based tools for HRM purposes. Results indicate that the overall evaluation of the algorithm-based HRM approaches suffered from lower fairness perceptions and less perceived social presence. First, this implies that there are indeed differences for Potosky's (2008) aspects of social bandwidth and interactivity and that these differences detrimentally affect the overall evaluation of the algorithm-based tool. Second, these results add to former personnel selection research showing that technology-mediated interviews may be less accepted than face-to-face interviews (Blacksmith et al., 2016; Chapman et al., 2003; Sears et al., 2013) but they could at least more accepted than completely automated interviews.

Comparing the results of the ANOVAs (effects for perceived behavioral control, creepiness and privacy concerns) with the mediation results (indirect effects for fairness and social presence) might produce a diffuse picture as significant variables in the one analysis were not significant in the other. It is therefore important to note that within the ANOVA, fairness (p = .051) and social presence (p = .086) were approaching significance, whereas in the mediation analysis they significantly mediated the indirect effect. The reverse was true for perceived behavioral control, creepy ambiguity, and privacy concerns, which showed significant differences within the ANOVA but were not significant in the mediation analysis (see confidence intervals in Table 7-4). Supporting various previous research (Bauer et al., 2006; Blacksmith et al., 2016; Tene & Polonetsky, 2015), this means that perceived behavioral control, creepiness and privacy concerns are all important to distinguish technologically advanced HRM methods from video conferencing HRM methods. However,

when it comes to consequences regarding attractiveness of the procedure, social presence and fairness seem to be more important factors. These results should be kept in mind for future studies about novel technologies for HRM purposes. Please note that participants did not interact directly with the virtual environment. It is conceivable that effects might be even stronger within a real selection situation compared to hypothetical situation.

Considering the results for social presence, it is somewhat surprising that there was no effect of the interaction type for the conceptually related variable interpersonal treatment. A reason for this could be that the dialogue within the video was very friendly as the interviewer showed interpersonal connectedness, and reacted to the nervousness shown by the applicant. This is one of the few promising results for algorithm-based interactions as this could mean that even if such situations are perceived as less social present, carefully designed algorithm-based interactions (and behavior of virtual agents) can induce feelings of human-like interpersonal treatment (see also Gratch et al., 2007; K. M. Lee & Nass, 2003).

It was also surprising that we did not find any difference for consistency. A reason for this could be that people in the algorithm-based interaction group might have thought that the computer character can autonomously ask questions thus reducing comparability between applicants, this would then again point towards the fact that people ascribe human features to computers (Gratch et al., 2007; Nass, Steuer, & Tauber, 1994).

As a final contribution, the results of the current study show that it is crucial to examine acceptance of novel tools in different contexts. In the case of the current study we chose to compare personnel selection and training situations. On the one hand, this study is (somewhat surprisingly) the first one to explicitly test and provide data that personnel selection puts higher pressure on participants than training situations and that this seems to impair the attractiveness of the procedure.[3] On the other hand, the current findings imply that this contextual differences can transfer to the evaluation of novel technologies for HRM

purposes. More specifically, participants were actually presented with the same algorithm-based tool with equal technical features but still evaluations of this tool differed significantly based on the context.

7.6.1 Limitations

At least three limitations should be mentioned. First, participants only watched videos displaying the situations they should evaluate. Compared to asking participants to imagine themselves being in a situation (as in, e.g., Atzmüller & Steiner, 2010; Shelton & Stewart, 2004), the current approach introduces participants to an observer role, which has two advantages: (a) participants can judge the situation as if their friend had provided them with a detailed description of the situation she/he experienced (this is comparable to a word-of-mouth description of an application situation, which frequently happens in practice and influences organizational attraction, cf. Van Hoye & Lievens, 2009); and (b) this design allowed us to keep the information provided to participants in all conditions constant.

Second, participants were predominantly students, so results might not generalize to a more mature sample. However, a student sample was an appropriate sample for the current study as basic job interview training might be more relevant for entry level jobs (cf., Langer et al., 2016) and as algorithm-based solutions might be more useful to screen a large applicant pool (cf., Campion, Campion, Campion, & Reider, 2016) which might be more likely for entry level positions compared to jobs in higher management.

Third, we used a somewhat unusual measure of overall acceptance of an HRM situation drawn from usability research (i.e., the attractiveness scale of the user experience questionnaire UEQ, Laugwitz et al., 2008). However, this measure allowed us to directly compare training and personnel selection situations, something that would have been more problematic with more specific outcome measures (e.g., organizational attractiveness).

7.6.2 Main Practical Implications

Concerning practical implications, organizations should be careful when establishing similar algorithm-based tools for HRM purposes as they seem to be less accepted than video conferencing procedures. More precisely, negative reactions regarding algorithm-based HRM tools might result in practical problems in training contexts, where acceptance of a procedure is important for ongoing use of the procedure (S. M. Lee et al., 1995) and for its beneficial effects. However, implications of this study might be even more detrimental for personnel selection contexts, where word-of-mouth plays a crucial role (Van Hoye & Lievens, 2009). If applicants react negatively to novel procedures this might have aggravating outcomes for organizations using them. Not only would current applicants withdraw from the application process, but they could also advise their friends against applying for a job at an organization using algorithm-based procedures.

However, there are organizations that regularly use such novel procedures for training and selection. For them, and for organizations who would like to apply these approaches, it is recommended to think about ways to mitigate negative effects. For instance, it might be a good idea to provide participants with information about unfamiliar procedures, as this can decrease privacy concerns and improve participants' fairness perceptions (cf., McCarthy et al., 2017). However, information does not always lead to better acceptance and its effect in the context of novel technologies seems to be especially complicated (Langer et al., 2018). Therefore, it is up to designers of technologically advanced tools for HRM to make these tools as controllable, social, and transparent as possible. In addition, it is up to organizations to promote fair and valid HRM procedures. Lastly, researchers also need to examine which aspects of novel technologies are perceived especially negative and how to improve these negative impressions.

7.6.3 Future research

Research could examine how people feel when they interact with novel HRM procedures in real life. In addition, what organizations think of these procedures is still an unanswered question; for instance, whether there are advantages in efficiency and thus attractiveness of the procedure (cf., Blacksmith et al., 2016; Stone et al., 2015). Compared to the participants' reactions in the current study, this could result in completely different evaluations of such novel technologies for HRM. Furthermore, the rapid evolution of technology offers various possibilities of constructing technologically advanced procedures in HRM. For instance, different kind of sensors can be used to examine participants behavior (cf., Nguyen et al., 2014); instead of computer screens, virtual reality could be used for training and personnel selection purposes. Consequently, future research could investigate how people react to these various combinations of technology. In addition, research should continue to evaluate the acceptance of such novel procedures. In the future and with ongoing technological development, people might become familiar with these novel procedures – and this could lead to entirely different reactions compared to the ones found in the current study.

7.6.4 Conclusion

Applicant reaction research on novel procedures in HRM is still in its infancy. The present study is one of the first studies examining acceptance of algorithm-based procedures for HRM. Our findings caution organizations to apply such procedures with care. Moreover, we hope that the current study motivates further research to investigate perceptions but also the validity of novel technologies used for HRM contexts in order to improve understanding and design of these technologies.

7.7 Footnotes

1. To support the call for open science, this study was pre-registered (Open Science Collaboration, 2015). In the pre-registration we included efficiency as an additional dependent variable and an exploratory moderated-mediation model. Our measure for efficiency was not adequately reliable and was thus excluded. The results of the moderated-mediation did not change the conclusions of this study qualitatively, so this analysis was excluded for the paper.
2. In the pre-registration, we proposed to include information known and computer self-efficacy as covariates. These analyses were conducted, however they did not change the results qualitatively so they were not included in the paper (they can be made available on request).
3. This statement is supported by an additional mediation analysis showing that high-stake evaluations mediate the negative effect of personnel selection situations on attractiveness of the procedure. This analysis was pre-registered but not reported to increase readability. Results can be made available on request.

7.8 References

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7.9 Tables and Figures

Table 7-1

Correlations and Cronbach's Alpha for the Study Variables.

	Scale	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.	Social Presence	*.87*											
2.	Interpersonal Treatment	.57**	*.90*										
3.	Perceived Self-Efficacy	.22*	.17	*.79*									
4.	Perceived Controllability	.35**	.37**	.50**	*.65*								
5.	Consistency	-.10	.11	.03	.01	*.81*							
6.	Emotional Creepiness	.37**	-.42**	-.41**	-.41**	.01	*.88*						
7.	Creepy Ambiguity	.30**	-.30**	-.35**	-.39**	.11	.75**	*.85*					
8.	Privacy Concerns	-.25**	-.05	-.12	-.05	-.20*	.13	.12	*.81*				
9.	Fairness	.39**	-.49**	-.38**	.54**	.36**	-.42**	.28**	-.16	*.92*			
10.	High-Stake	.09	-.07	-.05	-.04	.01	.18*	.25**	.13	-.02	*.86*		
11.	Attractiveness	.57**	.47**	.46**	.54**	.11	-.56**	-.46**	-.24**	.61**	-.19*	*.90*	
12.	Context	-.08	-.01	.07	.05	.16	-.09	-.09	-.07	.25**	-.28**	.21*	-
13.	Interaction Type	.16	.02	.26**	.30**	.04	-.16	-.24**	-.19*	.15	.06	.18*	-.04

Note. Coding of context: -1 = personnel selection, 1 = training. Coding of interaction type: -1 = algorithm-based interaction, 1 = video conferencing interaction. $N = 123$. Numbers in the diagonal represent Cronbach's alpha of the scales.

$^{*}p < .05$, $^{**}p < .01$.

Table 7-2

Means, Standard Deviations, Single ANOVA Results (including partial η²) and Hypotheses for the Dependent Variables.

	Condition				ANOVA						
	VC-TR	VC-PS	AB-TR	AB-PS	AB vs. VC		PS vs. TR		Interaction		
Variable	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*(1,119)	η^2_p	*F*(1,119)	η^2_p	*F*(1,119)	η^2_p	Hypothesis
Social Presence	4.07 (1.18)	4.39 (1.11)	3.85 (1.12)	3.87 (1.33)	3.00	.03	0.65	.01	0.47	.00	1a not supported
Interpersonal Treatment	3.88 (0.70)	3.99 (0.71)	3.95 (0.73)	3.86 (0.77)	0.07	.00	0.01	.00	0.54	.00	1b not supported
Perceived Self-Efficacy	5.04 (0.89)	4.94 (1.02)	4.51 (1.17)	4.25 (1.37)	9.02**	.07	0.81	.00	0.14	.00	1c supported
Perceived Controllability	4.63 (0.85)	4.89 (0.93)	4.41 (0.94)	3.92 (0.94)	12.99**	.10	0.53	.00	5.31*	.04	1c supported
Consistency	3.37 (0.63)	3.15 (0.91)	3.40 (0.83)	3.08 (0.96)	0.01	.00	3.11	.03	0.10	.00	1d not supported
Emotional Creepiness	3.19 (1.17)	3.19 (1.28)	3.35 (1.48)	3.89 (1.41)	3.19	.03	1.24	.01	1.24	.01	1e, 4a not supported
Creepy Ambiguity	3.44 (1.15)	3.21 (1.26)	3.57 (1.23)	4.31 (1.21)	7.89**	.06	1.34	.01	4.94*	.04	1e, 4a partially supported
Privacy Concerns	4.61 (0.85)	4.80 (0.97)	5.03 (1.08)	5.15 (1.04)	4.69*	.04	0.78	.01	0.04	.00	1f supported 3a, 4b not supported
Fairness	3.50 (0.74)	3.45 (0.94)	3.63 (0.77)	2.71 (1.02)	3.88	.03	9.35**	.07	7.62**	.06	1g not supported
High-Stake	5.42 (0.88)	5.58 (0.90)	4.91 (1.19)	5.72 (1.00)	0.30	.00	10.36*	.08	1.78	.02	3b supported
Attractiveness	-0.09 (1.00)	-0.22 (1.14)	-0.17 (0.98)	-0.99 (1.12)	4.82*	.04	6.22*	.05	3.31	.03	3c supported 4c not supported

Note. VC = video conferencing interaction group, AB = algorithm-based interaction group, TR = training context group, PS = personnel selection context group. $n_{VC\text{-}TR} = 30$, $n_{VC\text{-}PA} = 32$, $n_{AB\text{-}TR} = 32$, $n_{AB\text{-}PS} = 29$.
$^{*}p < .05$, $^{**}p < .01$.

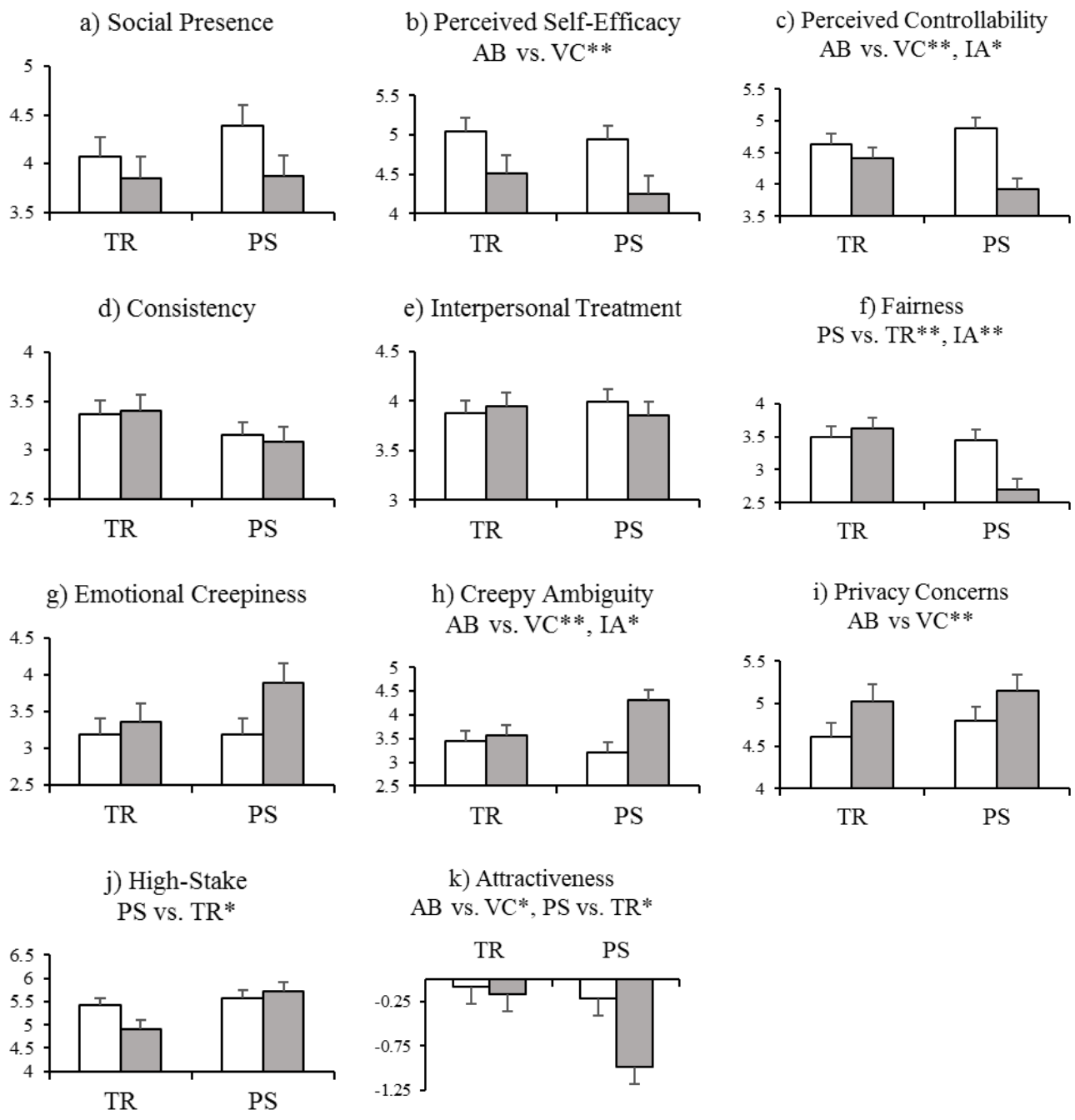

Figure 7-1. Results of the experimental groups for single variables. TR = training, PS = personnel selection, AB vs. VC = there is a main effect between video conferencing interaction and algorithm-based interaction, PS vs. TR = there is a main effect between the the training context and the personnel selection context, IA = there is an interaction effect between the two independent variables. □ = video conferencing interaction, ▒ = algorithm-based interaction.

$^{*}p < .05$, $^{**}p < .01$.

Table 7-3

Regression Results for the Mediation of the Hypothesized Mediators between Algorithm-Based vs. Video Conferencing Interactions and Attractiveness of the Procedure

Model	R^2	Coefficient	*SE*	*p*	95% Confidence Interval
Model complete	.61	-	-	<.01	-
Social Presence → Attractiveness		0.28	0.08	<.01	[0.13, 0.43]
Interpersonal Treatment → Attractiveness		-0.01	0.13	.93	[-0.26, 0.24]
Perceived Self-Efficacy → Attractiveness		0.12	0.07	.08	[-0.02, 0.26]
Perceived Controllability → Attractiveness		0.16	0.09	.09	[-0.03, 0.34]
Consistency → Attractiveness		0.05	0.09	.59	[-0.13, 0.23]
Emotional Creepiness → Attractiveness		-0.13	0.08	.11	[-0.30, 0.03]
Creepy Ambiguity → Attractiveness		-0.07	0.08	.41	[-0.23, 0.10]
Privacy Concerns → Attractiveness		-0.08	0.07	.28	[-0.22, 0.07]
Fairness → Attractiveness		0.32	0.10	<.01	[0.12, 0.52]
AB vs. VC → Attractiveness		-0.05	0.07	.53	[-0.19, 0.10]

Note. AB = algorithm-based interaction, VC = video conferencing interaction. Coding of the variable AB vs. VC: -1 = algorithm-based interaction, 1 = video conferencing interaction. The 95% confidence interval for the effects is obtained by the bias-corrected bootstrap with 50,000 resamples.

Table 7-4

Results for the Indirect Effects of Algorithm-Based vs. Video Conferencing Interaction over the Hypothesized Mediators on Attractiveness of the Procedure

Model	IE_{med}	SE_{Boot}	95% Confidence Interval
Complete indirect effect	.22	0.07	[0.09, 0.36]
AB vs. VC → Social Presence → Attractiveness	.05	0.03	[0.001, 0.12]
AB vs. VC → Interpersonal Treatment → Attractiveness	.00	0.01	[-0.02, 0.02]
AB vs. VC → Perceived Self-Efficacy → Attractiveness	.03	0.02	[-0.002, 0.09]
AB vs. VC → Perceived Controllability → Attractiveness	.04	0.03	[-0.01, 0.12]
AB vs. VC → Consistency → Attractiveness	.00	0.01	[-0.01, 0.02]
AB vs. VC → Emotional Creepiness → Attractiveness	.03	0.02	[-0.01, 0.09]
AB vs. VC → Creepy Ambiguity → Attractiveness	.02	0.03	[-0.03, 0.08]
AB vs. VC → Privacy Concerns → Attractiveness	.01	0.02	[-0.01, 0.05]
AB vs. VC → Fairness → Attractiveness	.04	0.03	[0.001, 0.12]

Note. AB = algorithm-based interaction, VC = video conferencing interaction. Coding of the variable AB vs. VC: -1 = algorithm-based interaction, 1 = video conferencing interaction. The 95% confidence interval for the effects is obtained by the bias-corrected bootstrap with 50,000 resamples. IE_{med} = completely standardized indirect effect of the mediation. SE_{Boot} = standard error of the bootstrapped effect sizes.

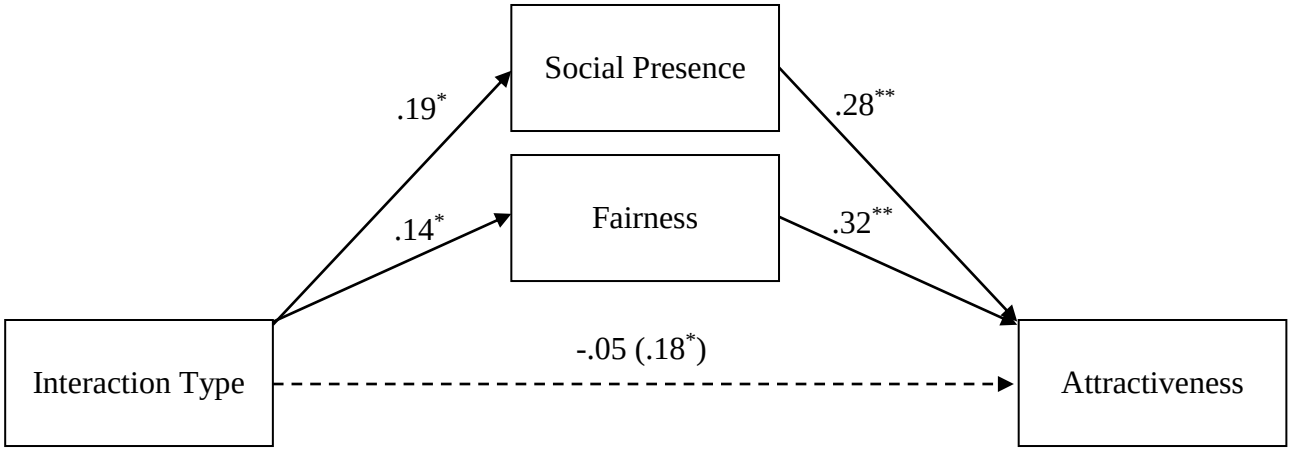

Figure 7-2. Mediation of social presence and fairness between algorithm-based interactions vs. video conferencing interactions and attractiveness of the procedure. The number in brackets indicates the zero-order correlation between interaction type and attractiveness. Coding of interaction type: -1 = algorithm-based interaction, 1 = video conferencing interaction.
$^{*}p < .05$, $^{**}p < .01$.

8 Study 4: Information as a double-edged sword: The role of computer experience and information on applicant reactions towards novel technologies for personnel selection

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8.1 Abstract

Technologically advanced selection procedures are entering the market at exponential rates. The current study tested two previously held assumptions: (a) providing applicants with procedural information (i.e., making the procedure more transparent and justifying the use of this procedure) on novel technologies for personnel selection would positively impact applicant reactions, and (b) technologically advanced procedures might differentially affect applicants with different levels of computer experience. In a 2 (computer science students, other students) × 2 (low information, high information) design, 120 participants watched a video showing a technologically advanced selection procedure (i.e., an interview with a virtual character responding and adapting to applicants' nonverbal behavior). Results showed that computer experience did not affect applicant reactions. Information had a positive indirect effect on overall organizational attractiveness via open treatment and information known. This positive indirect effect was counterbalanced by a direct negative effect of information on overall organizational attractiveness. This study suggests that computer experience does not affect applicant reactions to novel technologies for personnel selection, and that organizations should be cautious about providing applicants with information when using technologically advanced procedures as information can be a double-edged sword.

Keywords: Information; computer experience; personnel selection; applicant reactions; human-computer-interaction

8.2 Introduction

The use of technology has become more and more common as people are constantly being exposed to novel technologies and unfamiliar technologically-enhanced situations. It comes as no surprise that the area of personnel selection is no exception. With the objective of screening the best possible applicants, applicants might soon undergo employment interviews with virtual characters (Langer, König, Gebhard, & André, 2016). Compared to more classical technology-mediated selection interview procedures like videoconference interviews, these novel technologies would lack any interpersonal interaction in the interview. However, former research implies that applicant reactions (i.e., how do applicants react to a personnel selection situation) can be detrimentally affected by novel technologies (e.g., Blacksmith, Willford, & Behrend, 2016). Consequentially, some applicants might self-select out of the application process if they experience distinct negative feelings towards technologically advanced selection procedures (cf., Uggerslev, Fassina, & Kraichy, 2012). In particular, less computer-experienced applicants might be more prone to negative reactions towards novel technologies for personnel selection (e.g., Bauer et al., 2006).

According to previous research, negative applicant reactions can be mitigated by providing information (Lahuis, Perreault, & Ferguson, 2003; McCarthy et al., 2017; Truxillo, Bodner, Bertolino, Bauer, & Yonce, 2009). Information provided could include diverse topics, but applicants are generally given information focused on uncertainty reduction, guarantees of respectful treatment, increasing transparency, and pronouncing job validity of the selection procedure (McCarthy et al., 2017; Truxillo et al., 2009).

The first goal of this study was therefore to examine the relationship between computer experience and applicant reactions to novel technologies for personnel selection. The second goal was to test if procedural information (i.e., information about what is

happening during the procedure and justifying the use of this procedure) improves applicant reactions in the context of novel technologies for personnel selection.

The section background and hypotheses development is structured as follows: We start by introducing the evolution of the use of technology in personnel selection and by providing an overview of research about the relation of technology and applicant reactions. Following, we describe the importance of the variables computer experience and information and their interplay in the context of novel technologies for personnel selection. We then develop hypotheses regarding applicant reaction variables (i.e. job relatedness, information known, open treatment, transparency, consistency, interpersonal treatment, opportunity to perform, fairness, creepiness and privacy concerns) that are likely affected by our independent variables and propose that these variables will mediate the relationship of computer experience and information on organizational attractiveness.

8.3 Background and Hypotheses Development

8.3.1 Technology in personnel selection

The most extensively studied area of technology in personnel selection are technologically-mediated forms of the employment interview. For instance, Bauer, Truxillo, Paronto, Campion and Weekley (2004) used interactive voice response technologies such that applicants called a hotline and answered automatically administered questions by pressing the keypad. Other studies have used telephone and videoconference interviews and investigated their effects on the interview and on applicants (Chapman, Uggerslev, & Webster, 2003; Sears, Zhang, Wiesner, Hackett, & Yuan, 2013).

Recent research has shown that technology offers more sophisticated possibilities for personnel selection processes. For example, instead of pressing the keypad of a telephone, applicants in so-called digital interviews record themselves answering interview questions

using their webcam and submit these videos to the hiring organization (Brenner, Ortner, & Fay, 2016). There is even more to come as enhancements in machine learning and sensor technologies (e.g., cameras) allow automated recognition, analysis, and interpretation of social behavior (Schmid Mast, Gatica-Perez, Frauendorfer, Nguyen, & Choudhury, 2015). For instance, a study by Schmid Mast, Frauendorfer, Gatica-Perez, Choudhury, and Odobez (2017) showed that novel technologies can be used to automatically recognize nonverbal behavior (e.g., voice pitch) and to predict job performance for a sales job. This suggests that a virtual interviewer combined with sensing technologies could be used to automatically interview and screen applicants.

It is important to note that some of the discussed technological possibilities are already being used in personnel selection procedures. The biggest companies offering automatic interview solutions are HireVue (HireVue, 2017) in the American market and Precire (Precire, 2017) in the German market. Although there is no company offering interviews with a virtual interviewer, the use of virtual interviewers is one small step in comparison to the aforementioned job interview solutions (cf., Langer et al., 2016)

These technologies are attractive for organizations because of their efficiency and flexibility (no need for interview scheduling). They could also potentially reduce the impact of bias, and provide more analytical possibilities during the automatic evaluation (e.g., dedicated focus on many aspects of nonverbal behavior and verbal behavior) (cf., Chamorro-Premuzic, Winsborough, Sherman, & Hogan, 2016). However, there is only scarce research showing how applicants react to such procedures.

8.3.2 Applicant reactions towards technology in personnel selection

Applicant reaction research has generated much research over the last decades (Anderson, Salgado, & Hülsheger, 2010). Two theories (by Gilliland, 1993, and Schuler, 1993) are particularly relevant to understand the aspects that impact applicant reactions to

selection procedures. First, Gilliland (1993) presents three distributive justice rules (describing the fairness of selection outcomes, e.g., equality), and ten procedural justice rules (covering the fairness of selection processes, e.g., job relatedness, selection information, honesty) that relate to the overall fairness of selection results and processes. Gilliland (1993) states that these factors should impact important organizational outcomes like organizational attractiveness. Second, in his social validity approach, Schuler (1993) assumes that information about a selection procedure, transparency of the procedure, and applicants' perceived controllability of a procedure are especially impactful in forming positive applicant reactions.

These models are similar in that they point to the importance of fairness and justice in selection processes (Stone, Lukaszewski, Stone-Romero, & Johnson, 2013). If applicants react negatively to selection procedures, then fairness perceptions (Bauer et al., 2001; Gilliland, 1993) and organizational outcomes (e.g., organizational attractiveness, job performance) are likely to suffer (Highhouse, Lievens, & Sinar, 2003; Truxillo & Bauer, 2011). These theories also present key factors with which organizations can improve fairness of selection procedures (e.g., providing information, increasing transparency, showing job validity). Therefore, they might be especially helpful to overcome the extensively debated negative effects of technology on applicant reactions (Blacksmith et al., 2016).

Studies on perceptions of technology in personnel selection and job interviews emerged in the early 2000's when face-to-face interviews were compared to telephone interviews and videoconference interviews (Bauer et al., 2004; Chapman et al., 2003), and this research was recently meta-analytically summarized (Blacksmith et al., 2016). According to this meta-analysis, applicants react more favorably toward face-to-face interviews rather than toward technology-mediated job interviews (Blacksmith et al., 2016).

It is difficult to determine if more advanced technology (compared to technology-mediated interviews) evokes similar detrimental effects on applicant reactions since research on applicant reactions has not yet caught up to the recent technological developments (Blacksmith et al., 2016). However, if applicants are unfamiliar with a technology, they might have trouble using it or may not understand how or why it is used for personnel selection (Blacksmith et al., 2016; Stone et al., 2013; Wiechmann & Ryan, 2003). Therefore it is conceivable that more advanced technology could also elicit more negative reactions towards the selection situation.

8.3.3 Computer experience and applicant reactions

In contrast, the use of technology in selection might be more strategic for jobs that require computer skill. Previous research proposed that technology in personnel selection can attract people with high computer experience (Bauer et al., 2006; Stone, Deadrick, Lukaszewski, & Johnson, 2015; Wiechmann & Ryan, 2003). In fact, people with distinct computer experience (e.g., computer science students) are less anxious when interacting with computers (Beckers & Schmidt, 2003; Potosky & Bobko, 1998). Although most people use technology and have computers at home or at work, being exposed to technology and computers does not automatically imply that people understand how these technologies work, potentially leading to negative reactions towards the technology (Tene & Polonetsky, 2015).

On average, computer science students should possess more pronounced technological skills and computer experience. These students enter into this field of study because they are interested in computer technology (Beaubouef & Mason, 2005). Throughout their studies, they learn how to code, how websites and databases work, and how to apply sensor devices. Moreover, computer science students are provided with up-to-date information on novel developments and opportunities for applying their knowledge to various real-world problems (Werner, Hanks, & McDowell, 2004).

In the field of applicant reactions, Wiechmann and Ryan (2003) showed that computer experience is related to more positive perceptions of a computerized selection test, and Bauer and colleagues (2006) found that people with high computer experience had more favorable reactions to the selecting organizations. People with computer experience may be more adept at computer and technology-mediated selection scenarios and thus react more positively (Wiechmann & Ryan, 2003), but technologically advanced selection scenarios could also be more transparent for computer-experienced people than for people with low computer experience (cf., Tene & Polonetsky, 2015).

8.3.4 Information and perceptions towards the selection procedure

Information and transparency of the selection process are central points in the selection justice model by Gilliland (1993), and in the social validity approach by Schuler (1993). Indeed, information seems to be a useful way of enhancing applicant reactions: In their meta-analysis, Truxillo and colleagues (2009) found that the provision of information had a positive effect on applicant reactions towards the selection procedure and the organization. In addition, researchers have suggested that organizations should be influencing applicant reactions in the early stages of the selection process because early information about the organization and its selection procedures would help to prevent negative reactions, and instead evoke positive ones (McCarthy et al., 2017).

It is understandable that information is commonly used because (a) it is very easy to generate and to apply during selection procedures, (b) it can focus on a variety of the fairness rules in Gilliland's (1993) model and on transparency in Schuler's (1993) model, and (c) it improves applicant reactions (McCarthy et al., 2017; Truxillo et al., 2009). Therefore, providing information on technologically advanced personnel selection procedures may improve perceptions towards it, thus buffering potential negative applicant reactions (cf., McCarthy et al., 2017). For instance, applicants' feelings of controllability of the situation

may increase as they would comprehend to a greater extent what is happening during the selection situation (cf., Truxillo et al., 2009). Additionally, applicants will feel more informed and the selection procedure will become more transparent (McCarthy et al., 2017). Furthermore, with adequate information, applicants might understand why exactly this selection procedure was used, and concerns over the appropriateness of the selection procedure might be reduced.

8.3.5 Information × computer experience

Combining assumptions of former research on computer experience and information in the context of personnel selection leads to the idea that information on advanced technology in personnel selection could differentially affect people with different level of computer experience (Bauer et al., 2006). Describing what is happening during a novel personnel selection procedure might be trivial for computer science students as they would already be familiar with the techniques behind such procedures (e.g., that it is possible to automatically recognize nonverbal behaviour such as smiling and nodding). For non-computer science students, every piece of information might be useful to enhance the transparency of the selection procedure. Following the assumptions of Gilliland (1993) and Schuler (1993), a result of this could be that providing information is especially beneficial for applicants with less computer experience.

8.3.6 Variables potentially affected by computer experience and information

The current study answers calls for research to modernize the field of research on technology for personnel selection (e.g., Blacksmith et al., 2016; Stone & Deadrick, 2015). It is the first study to examine the influence of information on novel technologies for personnel selection. Therefore, we investigate a broad range of variables related to applicant reactions that may be affected by computer experience and the level of information.

Based on the importance of procedural justice and social validity for personnel selection (Gilliland, 1993; Schuler, 1993), we examine procedural justice of the selection procedure. Specifically, we will measure perceived job relatedness, information known, open treatment, transparency, consistency of the selection procedure, interpersonal treatment, opportunity to perform, and general fairness perceptions (Bauer et al., 2001). These variables are of crucial importance because they are incorporated in the applicant reaction models by Gilliland (1993) and Schuler (1993), reflect a wide range of applicant reactions (Bauer et al., 2001), are related to organizational attractiveness (Highhouse et al., 2003; Uggerslev et al., 2012), and are most likely influenced by computer experience and the level of information.

First, participants provided with the information that the procedure is job related (i.e., it can validly predict applicants' future job performance) will be more likely to perceive the situation as more job related. In the case of computer science students, they might already know that novel technologies can detect nonverbal and verbal behavior and that they can be useful to automatically predict job performance.

Second, provision of information will likely increase information known (i.e., the feeling of being informed about the procedure), open treatment (i.e., the feeling of being treated honestly), and transparency (i.e., perceiving that the procedure is transparent) of a selection process (e.g., Gilliland, 1993; McCarthy et al., 2017; Schuler, 1993; Truxillo et al., 2009). For computer science students, the impact of information on these variables will be less pronounced because they might already perceive the selection procedure as more transparent than non-computer science students.

Third, computer science students and applicants provided with information might perceive the selection procedure as being more consistent (i.e., no differences in the procedure's administration for different applicants) and therefore more objective because they have an idea about what the selection procedure is able to do (Bauer et al., 2006;

Wiechmann & Ryan, 2003). In the case of non-computer science students and low information, however, applicants might speculate about what is happening during the selection procedure, potentially leading to wrong conclusions about how the procedure is administered and thoughts of lower consistency of the procedure (cf., Bauer et al., 2006).

Fourth, perceived interpersonal treatment (i.e., applicants' feeling of being treated with warmth and respect) could be higher for applicants provided with information because being provided with information signals more respect from the selecting organization (Truxillo et al., 2009). The relation between computer science students and interpersonal treatment is more speculative. It is possible that computer science students could feel they are treated with more respect because they might be more used to interacting with novel technologies such as virtual agents as interviewers compared to non-computer science students.

Fifth, applicants' perception of opportunity to perform (i.e., applicants' belief that the procedure allowed them showing their abilities) during the selection procedure is likely higher for computer science students and for informed applicants as both groups might understand to a greater extent that the technologically advanced selection procedure offers applicants enough opportunity to show their skills (cf., Truxillo et al., 2009). More opportunity to perform might also positively impact applicants' control perceptions (cf., Bauer et al., 2001). In contrast, non-computer science students and uninformed applicants might question their ability to showcase their abilities during such a novel selection procedure and consequently be doubtful as whether they are able to control the situation.

Sixth, applicants' justice expectations might include being informed about the selection situation (Ployhart & Ryan, 1998). Therefore providing applicants with information likely generates higher feelings of fairness. For computer science students, higher fairness perceptions might be triggered by the general feeling of knowing what is going on during a

technologically advanced selection process (cf., Beaubouef & Mason, 2005; Beckers & Schmidt, 2003).

It is important to consider that procedural justice perceptions are just one component that forms applicant reactions to novel technologies for personnel selection. It is equally important to capture affective reactions toward the selection procedure. Accordingly, we apply the concept of creepiness (Langer et al., 2017; McAndrew & Koehnke, 2016; Mori, 1970; Mori, MacDorman, & Kageki, 2012; Tene & Polonetsky, 2015) to a technologically advanced selection process. Creepiness can be defined as potentially negative emotional impressions paired with feelings of ambiguity towards a person or a situation (Langer & König, 2017). Novel technologies can also evoke creepiness especially if they are not transparent and if they are perceived to be uncontrollable (cf., Tene & Polonetsky, 2015). In our study, participants experience a job interview with a virtual character, and their nonverbal and paraverbal behavior is evaluated automatically. In this situation, novel technologies are applied to a common situation (i.e., a job interview), and following assumptions of previous studies, this combination likely induces feelings of creepiness (Mori, 1970; Mori et al., 2012; Tene & Polonetsky, 2015). However, providing information can lead to less uncertainty (cf., Truxillo et al., 2009), potentially leading to less creepiness. The argument is similar for computer science students, because they already possess knowledge about the technologies used during the selection procedure (Beaubouef & Mason, 2005), and they thus likely report less creepiness.

Lastly, in selection procedures in which applicants are exposed to novel technologies, it is possible that they cannot control which kind of private information is gathered and that they are concerned about what is happening to their private data – a phenomenon that is known as privacy concerns (Malhotra, Kim, & Agarwal, 2004; Shin, 2010). Importantly, privacy concerns can lead to lower perceived organizational attractiveness and are therefore a

facet of applicant reactions that needs to be addressed when exploring novel technologies (Bauer et al., 2006). Providing applicants with information about the selection procedure could help to mitigate privacy concerns, because when selection procedures are more transparent, issues around privacy are reduced (Stone-Romero, Stone, & Hyatt, 2003). In the case of computer science students, they could be less concerned about their private data as they might be more privy to what data the procedure can collect and what can be inferred by these data (Beaubouef & Mason, 2005; Cooper, Dann, & Pausch, 2003).

To summarize, computer science students and applicants provided with more information should be able to see through the selection procedure (expressed in more information known, open treatment, and transparency) and they should have higher feelings of controllability (implicitly covered by the opportunity to perform, feelings of creepiness, and privacy concerns). Additionally, the information may alter applicant reactions such that computer science students and applicants provided with more information might hold more favorable assumptions about perceived job relatedness, consistency, interpersonal treatment, and fairness. Moreover, we expect the influences of information on the aforementioned variables are more pronounced for non-computer science students.

Hypothesis 1: Compared to non-computer science students, computer science students will show more favorable perceptions of a technologically advanced personnel selection method as assessed by increased perceptions of job relatedness, information known, open treatment, transparency, consistency, interpersonal treatment, opportunities to perform, fairness, and reduced levels of creepiness and privacy concerns.

Hypothesis 2: Participants who are provided with more detailed information will show more favorable perceptions of a technologically advanced personnel selection method as assessed by increased perceptions of job relatedness, open treatment, transparency,

consistency, interpersonal treatment, opportunities to perform, fairness, and reduced levels of creepiness and privacy concerns.

Hypothesis 3: There will be an interaction between the level of information and participants' field of study on perceptions towards a technologically advanced personnel selection method such that the effects of information on perceptions of a technologically advanced selection situation will be less pronounced for computer science students.

8.3.7 Effects on overall organizational attractiveness[1]

Overall organizational attractiveness is an important outcome of applicant reactions to a selection method (Gilliland, 1993; Highhouse et al., 2003). Overall organizational attractiveness encompasses the four facets general attraction towards an organization, application intentions (e.g., intention to accept a job offer), recommendation intentions (i.e., recommend the organization to peers), and prestige evaluations of the organization (Highhouse et al., 2003; Warszta, 2012). Previous research proposes that whenever applicants take part in a selection procedure they form perceptions about the organizations through their perception of the selection procedure (Rynes, Bretz, & Gerhart, 1991). Thus, if applicants react positively towards a selection procedure they also generate positive attitudes towards the organization (Bauer et al., 2006).

As shown before, we expect a positive relation between studying computer science and perceptions towards technologically advanced selection methods as well as a positive relation between information and perceptions towards technologically advanced selection methods. Accordingly, these more favorable perceptions could also evoke better evaluations of the organizations' overall attractiveness.

Hypothesis 4: The effects proposed in Hypothesis 1 will mediate the positive relation between studying computer science and overall organizational attractiveness.

Hypothesis 5: The effects proposed in Hypothesis 2 will mediate the positive relation between information and overall organizational attractiveness.

8.4 Method

8.4.1 Overview

We used a 2 × 2 (computer science vs. non-computer science students; information vs. low information) study design to test our hypotheses. After immersing into an application situation, participants received information corresponding to their information condition and then watched a video where an applicant was interviewed by a virtual character.

8.4.2 Sample

G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) was used to predict the required sample size to detect an interaction effect in a MANOVA. For a moderate effect size of Willk's $\lambda = .92$ and a power of $1-\beta = .80$, a sample of $N = 124$ is necessary. Students in the computer science group were recruited from computer science, bioinformatics, business informatics, and media informatics courses as well as via social network platforms. Non-computer science students were recruited from psychology, economics, education courses, and via social network platforms.

Because of common problems with online studies (e.g., participants taking pauses during the experiment, technical difficulties) we continued to collect data until our sample consisted of $N = 136$ participants. We excluded 13 participants who did not watch the video for the entire duration and three more participants who paused the experiment for more than one hour between the situation description and the questionnaire. The final sample consisted of $N = 120$ German participants. Fifty-seven participants (28% female) with a mean age of 24.23 years ($SD = 3.39$) and a mean study experience of 5.51 semesters ($SD = 4.17$) were assigned to the computer science group because they studied computer science or related fields of study (bioinformatics, computational linguistics, visual computing, computer science

for media, business informatics). Of the 63 participants (76% female) in the non-computer science group with a mean age of 23.19 years (*SD* = 4.46) and a mean study experience of 3.86 semesters (*SD* = 3.22), 41% of participants studied psychology, 13% studied economics and 46% came from other fields of study (e.g., chemistry, language, law, pharmaceutics, philosophy, literature). Participants received either course credit or a small amount of money which could be donated to welfare organizations.

8.4.3 Procedure and information manipulation

Participants received a link that provided them access to the experiment. At the beginning of the experiment, participants were asked to specify their field of study. Afterwards, they were randomly assigned to either the information or low information condition. Participants were then introduced into the context with the following information:

You applied for a job. Your application seems to be well received by the company, because you receive the following letter: "Thank you for your application. Your qualifications, which we gathered from your resume and cover letter, are well suited for the position. As such, we would like to invite you to interview for the position…"

Participants were then immersed into an application situation. They were told that they had to think about common interview questions and they should take time to think about how to present themselves, about where they see themselves in five years, and about their strengths and weaknesses. Following, participants received further information depending on which group they were assigned to (see Table 8-1).Afterwards, all participants watched a video where a female virtual character was shown interacting with a female applicant (see Figure 8-1).

The female applicant was present only through voice and through a body analysis skeleton on the left side of the screen. During the interaction, the interviewer asked the applicant two questions and responded to answers given by the applicant. To ensure

participants perceived the capabilities the interview program offers (e.g., sensing of nonverbal signals and emotions), the applicant displayed signs of nervousness in the second question and was thus unable to respond to the question. The interviewer then said it recognized some nervousness. The interviewer emphasized that nervousness was completely understandable and acted in very friendly manner to calm the applicant. The applicant recovered and was then able to answer the question. Participants were not given any information on the outcome of the interview.

In the end, participants completed a questionnaire containing all measures.

8.4.4 Measures

Dependent and mediator variables

The items used for this study are presented in Appendix A. All scales were measured with items that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*), except for privacy concerns and creepiness which were measured on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

Items for **job relatedness, information known, consistency, open treatment, interpersonal treatment, and opportunity to perform** were taken from a German version of the Selection Procedural Justice Scale and adapted for the purposes of this study (Bauer et al., 2001; Warszta, 2012). **Transparency** items were developed by the authors. **Fairness** items were taken from Warszta (2012) and adapted to our study. **Creepiness** items with the two facets emotional creepiness and creepy ambiguity were taken from Langer and König, (2017). One of the items for **privacy concerns** was taken from Smith, Milberg, and Burke (1996), two items were taken from Malhotra, Kim, and Agarwal (2004) and one items was developed by the authors. Twelve of the **overall organizational attractiveness** items were taken from Highhouse and colleagues (2003) and translated, and three more items were taken from Warszta (2012).

Manipulation check measures

Computer experience and the **information manipulation** were measured with items that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Four of the computer experience items were taken from Potosky and Bobko, (1998), and three more items as well as the one item for information manipulation were developed by the authors.

8.4.5 Data analysis

For Hypotheses 1-3 we used a multivariate analysis of variance (MANOVA) for a simultaneous overall evaluation of main and interaction effects (see Spector, 1977). This MANOVA included all dependent variables stated in Hypotheses 1, 2 and 3 (i.e., job relatedness, information known, open treatment, transparency, consistency, interpersonal treatment, opportunity to perform, fairness, creepiness and privacy concerns). Furthermore, we followed Spector's recommendations for these dependent variables and for organizational attractiveness and conducted analyses of variance (ANOVAs) to evaluate which dependent variables were especially affected by the experimental manipulations.

For the mediation Hypotheses 4 and 5, we used the PROCESS macro for SPSS (Hayes, 2013). We only included measures showing a significant difference between the independent variables because this is a precondition for a significant mediation effect (Baron & Kenny, 1986); the outcome variable of the mediation was overall organizational attractiveness. PROCESS offers a step-wise evaluation of mediation effects (for a detailed introduction see Hayes, 2013). First, it offers outputs for the effect of the independent variable onto the mediator variables. Second, its outputs indicate whether the mediating variables impacts the outcome significantly if the independent variable is also included in the regression model. Simultaneously, PROCESS evaluates whether the independent variable influences the outcome if the mediating variables are included in the regression model. Third, PROCESS provides bias-corrected bootstrapped estimates of the confidence intervals for the

overall indirect effect, and if these do not include zero, this indicates a significant indirect effect of the independent variable on the outcome variable mediated by the respective mediator. Fourth, PROCESS offers calculating effect sizes for the mediation effect (for an introduction to effect sizes for mediation models see Preacher & Kelley, 2011).

8.5 Results

8.5.1 Manipulation checks

Regarding the manipulation check items for computer experience, participants in the computer science group had more computer experience than participants in the non-computer science group, $t(106.98) = 13.36$, $p < .01$, $d = 2.42$. Furthermore, regarding the manipulation check item for the information manipulation, participants in the high information group stated that they received more information about what the online interview is capable in comparison to the low information group, $t(118) = 14.12$, $p < .01$, $d = 2.59$.

8.5.2 Testing the hypotheses

Table 8-2 provides correlations and reliabilities for the study variables, and Table 8-3 presents descriptive statistics and results for the single ANOVAs.

Hypothesis 1 stated that computer science students will have more favorable perceptions towards a technologically advanced selection procedure than non-computer science students. Overall, the MANOVA showed no difference between computer science and non-computer science students, $F(11, 106) = 1.24$, $p = .27$, *Wilk's* $\lambda = .89$. Regarding single ANOVAs (see Table 8-3), no differences between computer science and non-computer science students were found for any of the variables, hence Hypothesis 1 was not supported.

Hypothesis 2 proposed that participants who are provided with high level of information will show more favorable perceptions towards a technologically advanced personnel selection method than participants who are provided with low level of information.

Overall, there was a significant difference between the high information and the low information condition, $F(11, 106) = 5.35$, $p < .01$, *Wilk's* $\lambda = .64$. Regarding single ANOVAs (see Table 8-3), significant differences were found for information known, open treatment, and transparency which were all more positive for participants in the high information group. Thus Hypothesis 2 was partially supported.

Hypothesis 3 posited that there will be an interaction between information and participants' field of study on perceptions towards a technologically advanced personnel selection method. Overall there was no interaction between information and students' field of study $F(11, 106) = 1.04$, $p = .42$, *Wilk's* $\lambda = .90$. Regarding single ANOVAs (see Table 8-3), a significant effect was found for information known, where in contrast to the expected direction, computer science students showed a more pronounced positive effect of information on information known. Hence Hypothesis 3 was not supported..

Hypothesis 4 stated that perceptions towards technologically advanced selection methods will mediate the positive relation between studying computer science and overall organizational attractiveness. Results from Hypothesis 1 showed no influence of the field of study on perceptions towards technologically advanced selection procedures, consequently Hypothesis 4 was not supported.

Hypothesis 5 posited that perceptions towards technologically advanced selection methods will mediate the positive relation between information and overall organizational attractiveness. Mediation results are shown in Tables 8-4 and 8-5. These results indicate that there was a significant positive effect of information on overall organizational attractiveness mediated by more positive perceptions of open treatment, and information known towards the technologically advanced selection procedure (see Table 8-4 and 8-5). However, there was also a direct negative effect of information on overall organizational attractiveness counterbalancing the positive effect of the positive perceptions towards the selection

procedure on overall organizational attractiveness (see Table 8-4). Thus, Hypothesis 5 was partially supported. This suggests that information worked as a suppressor and it solves the contradictory result that high information was positively related to perceptions of the selection procedure and that positive perceptions towards the selection procedure correlated positively with overall organizational attractiveness but that there was no zero-order positive relation between information and overall organizational attractiveness. The resulting model is displayed in Figure 8-2.

8.6 Discussion

The present study responded to the call for research on novel technologies for personnel selection (e.g., Blacksmith et al., 2016; Stone & Deadrick, 2015). It represents one of the first studies shedding light on applicant reactions towards technologically advanced selection procedures regarding the influences of computer experience and information. The results point to three main findings. First, applicants high on computer experience (i.e. computer science students) were similar to those with lower computer experience in their reactions to a technologically advanced selection procedure and to the organization using these procedures. Second, providing applicants with information on technologically advanced personnel selection situations can improve applicant reactions and organizational attractiveness. Third, these information, however, can be a double-edged sword as the positive indirect effect of information on organizational attractiveness was counterbalanced by a negative direct effect of information on organizational attractiveness.

Our finding that computer science students do not differ from non-computer science students contradicts previous research findings that had proposed that computer-experienced applicants will perceive technology in selection differently than other applicants (Bauer et al., 2006; Wiechmann & Ryan, 2003). Possibly, computer science students have a better idea

about current technologies and might therefore have been less convinced that the presented (technologically advanced) interview would really be an alternative for a classical selection interview. This explanation is in line with previous research in the area of technology acceptance, where the technology acceptance model (TAM, Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003) implies that users will accept a technology less if they doubt its usefulness and ease of use. Maybe applicants with much computer science knowledge appreciate a selection procedure only if they perceive that it is near to technological perfection, but if they realize that some technical components (e.g., voice of the virtual character, analytical algorithms) are not working perfectly, they will doubt its usefulness and as a result, the selection procedure does not convince them.[2]

In addition, it was expected that people with more computer experience would benefit less from information. We found contrary evidence such that computer science students who received information had stronger reactions to information than non-computer science students. This suggests that computer science students are particularly appreciative when they are provided with information. However, it could also be that computer science students were more capable of absorbing and understanding the information given to them. Clearly, this counter-intuitive finding raises the need for further research.

The second main finding of the current study was that providing more information was beneficial for applicants' evaluation of transparency, open treatment, and information known, thus supporting assumptions of Gilliland's (1993) and Schuler's (1993) models that indicate that information, honesty, transparency, and increased controllability through information influence applicant reactions positively. As suggested by previous research (Gilliland, 1993; McCarthy et al., 2017; Schuler, 1993; Truxillo et al., 2009), information provided to applicants in the current study focused on informational fairness – specifically honesty, selection information, and job relatedness, which should have impacted various

facets of applicant reactions. However, we found that the information predominantly affected applicant perceptions of the selection procedure that are conceptually related to an honest treatment during the selection procedure. It might not be surprising that providing information leads to higher feelings of honesty, transparency and to feelings of being treated more openly. In hindsight, it is also less surprising that the information variation did not influence feelings of interpersonal treatment, because the level of interpersonal treatment was equal for all participants. However, it is striking that the provided information did not influence perceptions of job relatedness and opportunity to perform. A reason for this could be that participants were skeptical about the validity of this selection procedure despite receiving information regarding its validity. This is an important finding that adds to previous research on information in the context of personnel selection (e.g., McCarthy et al., 2017; Truxillo et al., 2009), as it suggests that applicants may not believe everything that is told to them. Indeed, applicants can still be skeptical about the job relatedness of a selection procedure and about their chance to show their skills during selection procedures.

It should also be noted that the provision of information did not affect feelings of creepiness nor privacy concerns. This is in contrast to former research which had postulated that creepiness and privacy concerns would be influenced by information (Malhotra et al., 2004; Stone-Romero et al., 2003; Tene & Polonetsky, 2015). As we have pointed out, creepiness, privacy concerns, and opportunity to perform are related to the concept of controllability (Bauer et al., 2001; Malhotra et al., 2004; Shin, 2010; Smith, Dinev, & Xu, 2011; Tene & Polonetsky, 2015). Therefore, the results of this study suggest that information provided to participants was not able to increase feelings of controllability. As such, there are other pieces of information that might be more impactful regarding controllability. For instance, future research may want to explore whether information focusing on reassurance (e.g., explaining to applicants that even though this is a novel selection procedure, it is not

really different from other common procedures, cf. McCarthy et al., 2017) may increase feelings of controllability.

The most important contribution of this study is that it provided insight into the equivocal effects that information can have on applicant reactions towards technologically advanced selection procedures and the selecting organization. Our results suggest that information can be a double-edged sword considering reactions towards the selecting organization. Although there was a positive indirect effect of information on overall organizational attractiveness through open treatment and information known which is in line with former research (McCarthy et al., 2017; Truxillo et al., 2009), this positive effect was diminished by a direct negative effect of information on overall organizational attractiveness. These two opposing effects of information on overall organizational attractiveness indicate that applicants are on the one hand thankful that they are being treated honestly, but on the other hand perceive the organization more negatively. A cause for this might be that applicants are somehow intimidated by being informed about technological aspects of the selection procedure. In addition, the low information group had less reason to be skeptical as they had no information about what is happening during the procedure, whereas the high information group had enough information to start questioning the selection procedure (e.g., they might have wondered whether it is really possible to infer job performance through analyzing speech). Consequently, specific pieces of information such as providing applicants with information including technical details can diminish applicants' reactions and their intentions to apply and recommend the organization.

However, it might also be possible that there is a specific amount and composition of information that negatively affects acceptance. Information provided in the current study was rather detailed, offering the possibility that this particular amount of information was detrimental[2] because it was enough to make participants skeptical about the selection

procedure and the organization, but not enough to explain the procedure and the reasons why the organization was using this procedure. For instance, if we had provided even more information about the selection procedure (e.g., benchmark information that other companies also use this procedure), participants might have less reason to react negatively.

In conclusion, *what* information and *how* much information is being given to applicants seems critical when designing information on technologically advanced selection procedures. As research on technologically advanced selection procedures is still in its infancy, more research is needed to more fully understand the effect of information.

8.6.1 Limitations

Four main limitations of this study need to be discussed. First, a quasi-experimental design was used when computer science students were used as a proxy for computer experience; albeit as the manipulation check implies, this proxy worked quiet well as we found a large difference in computer experience between the two studied student groups.

Second, since one of the groups consisted entirely of computer science students (who were predominantly male) and the other group mostly of human science students (who were predominantly female) this resulted in an unequal gender distribution between these groups. However, we reran our analyses with gender as a covariate. Results indicate that gender was not a significant covariate and there were only slight changes of *p*-values that would not have impacted conclusions of the current study. In addition, we reran the analyses with age as a covariate, which was not a significant covariate either and did not impact the results and conclusions of this study.

Third, participants only watched a video showing a technologically advanced selection procedure. Thus, findings may have differed had applicants experienced a real selection situation. Nonetheless, research has suggested that laboratory and field research converge better than typically assumed (Mitchell, 2012). However, future studies might

investigate whether participants who experience comparable selection procedures in real life experience more pronounced effects (e.g., more severe privacy concerns, cf., Smith et al., 2011).

Fourth, participants were introduced to a mock selection situation only. Indeed, it would be highly interesting to apply the current design to a real application situation. However, such a study would evoke ethical concerns because real applicants would be provided with different levels of information, potentially negatively affecting an organization's reputation.

8.6.2 Main practical implications

First, if an organization decides to use a technologically advanced selection procedure, it might not have to be concerned about scaring off specific applicants. However, it can neither hope to attract computer-experienced applicants.

Second, organizations using novel technologies for their selection procedures and hoping to improve applicant reactions through information should be think twice about which kind of information they provide because of information being a double-edged sword. On the one hand, applicants might appreciate being informed about the selection procedure as it would elicit feelings of being treated more openly. On the other hand, applicants view the organization as less attractive which could be detrimental for the organization. For instance, applicants might advise their peers against applying to an organization because of its use of strange selection procedures (cf., Van Hoye & Lievens, 2009).

8.6.3 Future research

Future studies could continue to investigate the role of computer experience when applicants undergo selection procedures similar to the one used in this study. Even if the current study did not find that computer experience impacted applicant reactions, it could still be an important variable if applicants have to interact directly with novel technologies (cf.,

Smith et al., 2011). For instance, less computer-experienced applicants might be affected differently by usability aspects of technologically advanced selection procedures compared to computer-experienced applicants, as they might know better how to handle technologically challenging situation (cf., Bauer et al., 2006; Davis, 1989; Venkatesh et al., 2003). Additionally, different kind of novel technologies could differentially impact applicants with varying computer experience. For instance, digital interviews could be compared to interviews with virtual characters and to automatically evaluated telephone interviews.

Another direction for future research could be to delve deeper into the role of information. For example, it may be possible to separate pieces of information which could positively affect applicants. In the current study, participants were given information pertaining to the process as well as a justification for using that process. In the process information part, participants were informed in-depth about what will be happening during the interview (e.g., that applicants voice and gestures are being analyzed), whereas in the process justification part, participants received information about why exactly the online interview will be used for selecting applicants (e.g. because it is job relevant and personality can be inferred). Accordingly, future studies could specifically look at the influence of these different pieces of information.

Furthermore, the current study raises questions about the role of information in situations where humans interact with technology. Information may detrimentally affect reactions towards technology in situations other than personnel selection. The effects this study revealed could also apply to conceptually related fields like personnel development in organizations, where automated training methods with virtual characters are used (e.g., Langer et al., 2016), but also for less closely related fields, for example health care robots for elderly people (Broadbent, Stafford, & MacDonald, 2009). In the latter case, providing people who are interacting with the robot with information about what the robot is able to do,

which sensors the robot uses to interact with people, and why this robot is used might provoke feelings of transparency and usefulness, but at the same time the information might evoke concern.

8.6.4 Conclusion

The effects of computer experience and information in the context of technologically advanced are more complex than expected. The current study showed that just because persons are enthusiastic about computers and technology does not mean that they are in favor of being selected by novel technologies. Moreover, informing people about a selection procedure does not necessarily lead to positive applicant reactions to this procedure.

8.7 Footnotes

1. This study was pre-registered (Open Science Collaboration, 2015), and there we included a mediation model where computer experience should have mediated the relation between the field of study and the perceptions of technologically advanced selection methods; after the experiment we realized that computer experience is rather a manipulation check than a mediator.
2. We thank an anonymous reviewer for this suggestion.

8.8 References

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8.9 Tables and Figures

Table 8-1

Information Presented to the Participants in the Different Information Conditions

Condition	Information
Low information	The company wrote: … To offer you the opportunity to introduce yourself, we would like to invite you to an online interview. This will be the next stage of the selection process. The online interview will be conducted by a virtual character.
High Information	*(In addition to the information from the low information group)* The program can …analyze your facial expressions by recognizing eye-movement, eye-contact and facial movement (e.g. smiling). Through eye-contact and facial expressions the computer tries to recognize if an applicant is nervous. If this applies, the computer tries to calm the applicant by treating the applicant positively. …analyze your gestures by recognizing hand, body, and head movement (e.g., nodding and crossing arms). …analyze your speech and voice for example pitch, volume, speech pauses because such signals can be used to infer personality traits like extraversion and openness. This can be useful to assess job fit of the candidate. …interpret your behavior as social and emotional signals for example nodding can be understood as approval; through this the computer can recognize when candidates have finished their answer and it can generate appropriate follow-up questions. …adapt to your individual behavior and try to react adequately to your behavior. If you use many gestures the character will also use more gestures, thus mirroring your behavior, just like real humans would do. …express human communication aspects through the virtual character, by letting the character smile, cross arms, nod… because in several studies it was shown that a virtual character with human communication aspects is perceived more likable than a “cold” computer character.

Note. Information translated from German.

Figure 8-1. Screenshot of the video presented to the participants. The female virtual interviewer was in the center of the screenshot, on the right side there were lights to provide feedback on applicant's nonverbal behavior, on the left side there was the applicant's skeleton, and below there was a continuous smile analysis.

Table 8-2

Correlations and Cronbach's Alpha for the Study Variables

	Scale	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1.	Computer Experience[a]	*.90*													
2.	Privacy Concerns	.11	*.72*												
3.	Emotional Creepiness	-.08	.32**	*.83*											
4.	Creepy Ambiguity	-.02	.24**	.64**	*.76*										
5.	Job Relatedness	-.07	-.04	-.32**	-.23*	*.80*									
6.	Information Known	.02	-.07	-.15	-.32**	.23*	*.87*								
7.	Opportunity to Perform	-.11	-.04	-.19*	-.15	.60**	.33**	*.88*							
8.	Objectivity	-.04	-.08	-.06	-.13	.07	.15	.14	*.67*						
9.	Interpersonal Treatment	.02	-.22*	-.31**	-.19*	.22*	.07	.23*	.16	*.88*					
10.	Open Treatment[a]	-.12	-.25**	-.32**	-.25**	.11	.27**	.15	.21*	.67**	*.78*				
11.	Fairness	.02	-.23*	-.40**	-.30**	.36*	.27**	.37**	.27*	.54**	.58**	*.82*			
12.	Transparency	.01	-.12	-.11	-.29**	.10	.28**	.14	.15	.31**	.32**	.33**	*.77*		
13.	Overall Attractiveness	.04	-.19*	-.30**	-.15	.44**	.25**	.39**	.18*	.48**	.43**	.55**	.15	*.93*	
14.	Field of Study	.77**	.16	-.09	.01	-.02	.04	.03	-.02	.01	-.09	.07	.04	.05	-
15.	Information Level	.02	-.06	.01	-.09	-.08	.49**	.06	-.04	.05	.22*	.17	.30**	-.02	-.05

Note. Coding of Field of Study: -1 = non-computer science students, 1 = computer science students. Coding of Information Level: -1 = low level of information, 1 = high level of information. Numbers in the diagonal represent Cronbach's alpha of the scales. $N = 120$.

[a] = one item of these scales was excluded because of impairing the reliability of the respective scale; in the case of computer experience two items were excluded.

$^{*}p < .05$, $^{**}p < .01$.

Table 8-3

Descriptives and Results for the Single ANOVAS (Including Partial η² for the Dependent Variables)

	Condition				ANOVA					
	HI-CS	HI-OS	LI-CS	LI-OS	Main Effect (HI vs. LI)		Main Effect (CS vs. OS)		Interaction	
Variable	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*(1,116)	η^2_p	*F*(1,116)	η^2_p	*F*(1,116)	η^2_p
Privacy Concerns	5.34 (1.17)	5.04 (1.03)	5.50 (1.26)	5.09 (0.85)	0.28	.00	3.10	.03	0.08	.00
Emotional Creepiness	3.58 (1.03)	3.84 (1.10)	3.62 (1.49)	3.76 (1.12)	0.00	.00	1.91	.02	0.48	.00
Creepy Ambiguity	4.04 (1.10)	4.01 (1.05)	4.22 (1.00)	4.20 (1.24)	0.86	.01	0.01	.00	0.00	.00
Job Relatedness	2.24 (0.99)	2.27 (0.67)	2.35 (0.66)	2.41 (0.72)	0.76	.01	0.09	.00	0.01	.00
Information Known	3.35 (0.72)	2.91 (0.81)	2.07 (0.80)	2.26 (0.99)	39.41**	.25	0.60	.01	4.21*	.04
Opportunity to Perform	2.02 (1.14)	2.00 (0.60)	1.95 (0.75)	1.87 (0.65)	0.45	.00	0.13	.00	0.04	.00
Objectivity	3.46 (1.01)	3.31 (1.07)	3.33 (0.82)	3.57 (0.72)	0.13	.00	0.07	.00	1.39	.01
Interpersonal Treatment	3.74 (0.89)	3.91 (0.56)	3.87 (0.70)	3.64 (0.72)	0.25	.00	0.05	.00	2.36	.02
Open Treatment	3.45 (0.96)	3.74 (0.80)	3.24 (0.87)	3.21 (0.75)	5.62*	.05	0.68	.01	1.09	.01
Fairness	3.05 (0.89)	3.07 (0.74)	2.92 (0.95)	2.63 (0.75)	3.43	.03	0.76	.01	1.02	.01
Transparency	3.20 (0.91)	3.09 (0.83)	2.64 (1.01)	2.57 (0.75)	11.26**	.09	0.30	.00	0.01	.00
Overall Attractiveness	2.78 (0.69)	2.81 (0.48)	2.88 (0.73)	2.73 (0.69)	0.01	.00	0.27	.00	0.54	.01

Note: HI = high level of information, LI = low level of information, CS = computer science students, OS = non-computer science students. $n_{HI\text{-}CS}$ = 28, $n_{HI\text{-}OS}$ = 34, $n_{LI\text{-}CS}$ = 29, $n_{LI\text{-}OS}$ = 29.
*p < .05, **p < .01.

Table 8-4

Regression Results for the Mediation of Perceived Information Known, Open Treatment, and Transparency between Information Level and Overall Organizational Attractiveness

Model	R^2	Coefficient	*SE*	*p*	95% CI
Single effects					
HI vs. LI → Perceived Information Known	.24	0.47	0.08	<.01	[0.31, 0.62]
HI vs. LI → Open Treatment	.05	0.19	0.08	<.05	[0.04, 0.34]
HI vs. LI → Transparency	.09	0.27	0.08	<.01	[0.11, 0.42]
HI vs. LI → Overall Organizational Attractiveness	.00	-0.01	0.06	.92	[-0.12, 0.11]
Model complete	.24	-	-	<.01	-
Perceived Information Known → Overall Organizational Attractiveness		0.17	0.06	<.01	[0.04, 0.29]
Open Treatment → Overall Organizational Attractiveness		0.30	0.07	<.01	[0.17, 0.43]
Transparency → Overall Organizational Attractiveness		0.01	0.06	.80	[-0.11, 0.14]
HI vs. LI → Overall Organizational Attractiveness		-0.15	0.06	<.05	[-0.27, -0.03]

Note. The 95% confidence interval for the effects was obtained by the bias-corrected bootstrap with 10,000 resamples. Coding of the variable HI vs. LI: -1 = low information, 1 = high information. CI = confidence interval, HI = high level of information, LI = low level of information. n_{HI} = 62, n_{LI} = 58.

Table 8-5

Results for the Indirect Effects of Level of Information over Perceived Information Known, Open Treatment, and Transparency on Overall Organizational Attractiveness

Model	IE_{med}	SE_{Boot}	95% CI
Total indirect effect	.22	0.07	[0.09, 0.37]
HI vs. LI → Perceived Information Known → Overall Organizational Attractiveness	.12	0.06	[0.03, 0.26]
HI vs. LI → Open Treatment → Overall Organizational Attractiveness	.09	0.04	[0.02, 0.19]
HI vs. LI → Transparency → Overall Organizational Attractiveness	.01	0.03	[-0.06, 0.07]

Note. The 95% confidence interval for the effects was obtained by the bias-corrected bootstrap with 10,000 resamples. Coding of the variable HI vs. LI: -1 = low information, 1 = high information. IE_{med} = completely standardized indirect effect of the mediation. SE_{Boot} = standard error of the bootstrapped effect sizes, CI = confidence interval, HI = high level of information, LI = low level of information. n_{HI} = 62, n_{LI} = 58.

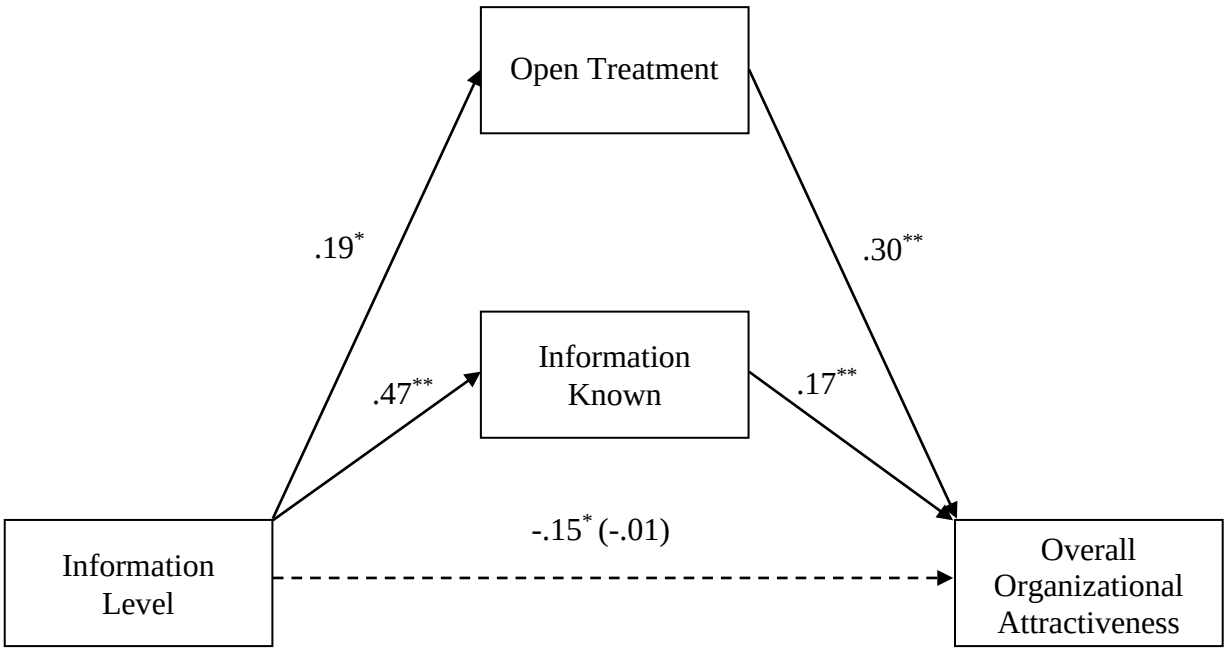

Figure 8-2. Suppressor model. The number in brackets displays the zero-order correlation of information level and overall organizational attractiveness.

8.10 Appendix

Table 8-6

Items Used in the Current Study

Scale	Item
Job relatedness	Doing well on this interview means that a person can do the job well.
	A good performance at this online interview will give information if a person is a good candidate for the advertised job.
	A person who did well in this interview will become a good employee.
	This personnel selection procedure can distinguish between good and poor employees.
Information known	I knew what to expect in the online interview.
	I understood in advance what the interview process would be like.
	I had ample information about what the format of the interview would be.
Consistency	The interview is administered to all applicants in the same way.
	There were no differences in the way the interview is administered to different applicants.
Open treatment	During the online interview there were no intentions to hide anything from me.
	Applicants are treated honestly and openly during the online interview.
	Procedural questions were answered in a straightforward and sincere manner.
Interpersonal treatment	During the online interview applicants were treated politely.
	During the online interview applicants were treated with respect.
	I was satisfied with the treatment of the applicant during the online interview.
Opportunity to perform	The applicant could really show her skills and abilities through the interview.
	This interview allows applicants to show what their job skills are.
	This interview gives applicants the opportunity to show what they can really do.
Transparency	The online interview was transparent.
	It is obvious what the online interview is measuring.
Fairness	All things considered this selection procedure was fair.
	I think this interview is a fair procedure to select people for the job.
	I think the interview itself was fair.
Creepiness	During this situation, I had a queasy feeling.
	I had a feeling that there was something shady about this situation.
	I did not know how to judge this situation.
	I felt uneasy during this situation.
	I had an indefinable fear during this situation.
	During this situation, I did not know exactly what was happening to me.
	This situation somehow felt threatening.
	During this situation, things were going on that I did not understand.

Scale	Item
	I did not know exactly how to behave in this situation.
	I did not know exactly what to expect of this situation.
Privacy Concerns	I am concerned that companies are collecting too much personal information about me.
	I am concerned about my privacy.
	To me it is important to keep my privacy intact.
	Novel technologies are threatening privacy increasingly.
Overall organizational attractiveness	For me, this company would be a good place to work.
	This company is attractive to me as a place for employment.
	I am interested in learning more about this company.
	A job at this company would be very appealing to me.
	If this company invited me for a job interview, I would go.
	I would accept a job offer from this company.
	I would make this company one of my first choices as an employer.
	I would like to work for this company.
	I would recommend this company to friends.
	I have friends who would be interested in this company.
	I would recommend others to apply at this company.
	Employees are probably proud to say they work at this company.
	This company probably has a reputation as being an excellent employer.
	There are probably many who would like to work at this company.
	This is a reputable company to work for.
Computer experience	I know how to write computer software.
	I frequently read computer magazines or other sources of information that describe new computer technology.
	I know how to recover deleted or “lost data” on a computer or PC.
	I am computer literate.
	I use the computer for communication via email or for social networks.
	I use the computer for videoconferences (e.g., Skype).
	I know what CSS and LaTeX in the computer context mean.
Information manipulation	Information I received before the online interview explained to me what the program is capable of.

Note. Items translated from German.

9 Study 5: Spare me the details: The impact of the type of information about novel technologies in personnel selection on applicant reactions

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9.1 Abstract

Providing information is a powerful way to influence the acceptance of technologies, for instance when organizations use technology in personnel selection procedures. However, there is initial evidence that information can also have negative side effects. It would therefore be beneficial to know which kind of information brings negative side effects and which potentially improves opinions towards technology-enhanced personnel selection. In a 2 (no process information vs. process information) × 2 (no process justification vs. process justification) experimental design, participants were assigned to different information conditions where they watched a video showing a virtual job interview. Results from 124 participants indicated that process information led to detrimental effects for applicant reactions, whereas process justification led to more fairness increasing organizational attractiveness compared to the process information condition. Contrary to expectation, information did not increase organizational attractiveness compared to the condition receiving neither process information nor process justification. These results indicate that the influence of information in technology-enhanced selection settings is highly complex and that organizations should cautiously select what information applicants receive when using technologically advanced procedures. If in doubt, organizations might be better off not providing any information.

Keywords: information; personnel selection; applicant reactions; human-computer-interaction

9.2 Introduction

Researchers and practitioners usually agree that providing users with information can be an impactful way to increase acceptance of products and systems (Venkatesh, Morris, Davis, & Davis, 2003). For instance, producers of new gimmicks typically also ship user manuals as a way of improving users' understanding, acceptance, and enjoyment (Etezadi-Amoli & Farhoomand, 1996). This is also true in the area of personnel selection, due to the increasing number of studies, Truxillo, Bodner, Bertolino, Bauer, and Yonce (2009) were able to meta-analytically summarize the effect of information on applicant reactions. They found that telling applicants about what will be happening during a personnel selection approach or why exactly this approach is used helps to improve applicant reactions. This is especially important for practitioners who would like to maintain the interest of viable candidates (McCarthy et al., 2017).

The positive effect of providing information (Truxillo et al, 2009) is especially interesting for those who want to use novel technology for personnel selection (e.g., videoconference interviews, digital interviews, interviews with virtual characters as interviewer) because using technology-enhanced personnel selection procedures has negative effects on applicant reactions (Blacksmith, Willford, & Behrend, 2016; Langer, König, & Krause, 2017; Langer, König, & Papathanasiou, 2017; Sears, Zhang, Wiesner, Hackett, & Yuan, 2013). Consequently, some researchers tried to buffer these negative effects by providing information (Langer, König, & Fitili, 2018; McCarthy et al., 2017). However, previous research (Lahuis, Perreault, & Ferguson, 2003; Langer et al., 2018) has suggested that the relation between information and beneficial outcomes (e.g., user acceptance, applicant reactions) is not ubiquitous, as often assumed. For example, in the Langer et al. study, providing applicants with information in technologically advanced selection settings led to improved applicant reactions, yet this positive effect was suppressed by a simultaneous

negative effect of information. They explained this suppressor effect by proposing that certain pieces of information might be beneficial for applicant reactions, whereas other information might jeopardize these positive effects, but the authors were unable to test this assumption.

The aim of the current study is therefore to expand the findings of Langer and colleagues (2018) and to clarify which pieces of information are beneficial and which ones potentially diminish applicant reactions. To achieve this goal, we closely followed the methodological approach by Langer and colleagues (2018), but separated information into four information conditions. We propose that the information that they used (process information and process justification) consisted of parts with positive and negative influence on applicant reactions. Doing so makes it possible to decipher which part of the information is most fruitful to improve applicant reactions and which is potentially detrimental.

In the following sections, we first briefly summarize the influence of technology on personnel selection. Afterwards, we introduce the realm of applicant reaction towards technology in personnel selection. Then we discuss the role of information on applicant reactions, followed by how different pieces of information can have a positive or negative impact on applicant reaction measures (i.e., transparency, fairness, creepiness, and privacy concerns) and on organizational attractiveness.

9.3 Theory and Hypotheses Development

9.3.1 The influence of technology on personnel selection

Researchers and practitioners in the area of technology for personnel selection have become very interested in technology-mediated forms of the employment interview (Blacksmith et al., 2016). For instance, they now use interactive voice response technologies (i.e., applicants answer to interview questions by pressing the keypad; Bauer, Truxillo,

Paronto, Weekley, & Campion, 2004), telephone interviews (Chapman, Uggerslev, & Webster, 2003), videoconference interviews (Sears et al., 2013), or digital interviews (i.e., applicants receive interview questions online via text and submit videos to the hiring organization in which they answer to the interview questions; Brenner, Ortner, & Fay, 2016, and Langer et al., 2017). Recently, companies like HireVue and Precire have expanded the use of technology in the job interview. They use machine learning approaches to automatically screen through applicants' digital interview recordings and evaluate their interview performance based on applicants' nonverbal (e.g., smiling) (HireVue, 2017) or verbal behavior (e.g., which words they used) (Precire, 2017). It is important to note that this kind of job interview assessment seems to bear a lot of potential, as research shows that nonverbal and verbal behavior can predict interview performance (Naim, Tanveer, Gildea, & Hoque, 2015), and even more importantly, job performance (Schmid Mast, Frauendorfer, Gatica-Perez, Choudhury, & Odobez, 2017). A potential next step of technology in the job interview is the use of virtual agents as interviewers. For example, Langer, König, Gebhard, and André (2016) used a virtual job interview program incorporating a virtual character and automatic feedback for interviewees' vocal (e.g., voice loudness) and nonverbal behavior (e.g., nodding) to train job interviews. Software like this could also be used for personnel selection purposes such that a virtual interviewer asks applicants a structured set of interview questions and evaluates their answers and their behavior (see also Langer et al., 2018).

Using all of the aforementioned technologies is attractive for organizations because it can boost the efficiency (i.e., less time needed for scheduling) and flexibility (i.e., applicants can conduct the interview whenever they want) of the job interview process. In addition, novel interview approaches like automatically evaluated interviews could improve perceived and actual fairness of job interviews. For instance, as the evaluation of the interviews progresses without the influence of human raters, there might be less bias in performance

evaluations (e.g., less racial biases, cf., Purkiss, Perrewé, Gillespie, Mayes, & Ferris, 2006), although the hope that algorithm-based solutions automatically lead to fair solutions might be overly optimistic (cf., Caliskan, Bryson, & Narayanan, 2017).

Despite the efficiency and flexibility arguments, organizations need to be aware that the effects of technology on applicant reactions are predominantly negative (Blacksmith et al., 2016). Summarizing nearly two decades of technology-mediated job interview research, Blacksmith and colleagues (2016) found that applicants react negatively to technology-mediated forms of the job interview. Additionally, Langer and colleagues (2017) provide initial evidence showing that applicant reactions might suffer to an even larger extent in cases involving more advanced technology (i.e., digital interviews). Langer et al. argue that it is the impersonality and unfamiliarity of novel technology for job interviews that can negatively affect applicant reactions. This argument implies that applicant reactions are also negatively impacted in a job interview with a virtual interviewer, which applicants likely also perceive as unfamiliar and impersonal.

9.3.2 Information and its impact on the selection procedure

There are several reasons indicating that the provision of information could improve applicant reactions to technology-based personnel selection procedures. First, the two main applicant reaction theories proposed by Gilliland (1993) and Schuler (1993) suggest that information and transparency bear the potential to positively impact applicant reactions. Second, this assumption was tested many times and has received meta-analytical support (Truxillo et al. 2009). Third, it is easy to develop information that focuses on information about the fairness aspects suggested by Schuler (1993) or Gilliland (1993) (e.g., job relatedness, transparency, honesty). Fourth, applicants can receive information in advance to the selection procedure which is meant to buffer potential negative reactions better than post-hoc interventions (McCarthy et al., 2017).

However, there are two studies that question the positive impact of information and that highlight the importance of what kind of information is presented. Lahuis and colleagues (2003) found that general information (short, justifying information that a cognitive ability selection test is job relevant) evoked higher fairness perceptions than specific information (detailed information explaining the process of determining that the test is job relevant). Langer and colleagues (2018) found that in a technologically advanced job interview setting (a virtual job interviewer interviews participants, and the virtual interviewer reacts to participants behavior based on sensors capturing participants behavior) information can simultaneously have a positive and a negative effect: Although information increased applicant reactions, which positively impacted organizational attractiveness, information also negatively affected organizational attractiveness, counterbalancing the aforementioned positive effect.

The design of the study of Langer et al. (2018) did unfortunately not allow for distinguishing between different kinds of information that might have produced different effects because their participants either received only nearly no information about a novel selection procedure or very detailed information. The latter included (a) information about what the virtual interview program is capable of (e.g., analyzing voice and nonverbal behavior), describing the process of the virtual interview as is. In the remainder of this article we call this kind of information process information. And it included (b) information about why the capabilities of the interview program should be valuable for the selection procedure (e.g., because the analysis of applicants' voice enables the organization to infer the personality of applicants). This information justifies the use of the interview program with information about job relevance or empirical findings that the interview program is suitable for the selection process (e.g., it can adapt to applicants). In the remainder of this article we call this kind of information process justification.

Comparing process information and justification leads to the conclusion that process information is a neutral description of technical details, whereas process justification ignores technical backgrounds and just provides a rationale for the use of the procedure. Obviously, process justification can be combined with process information as it justifies the technical specifications explaining how they are useful for the selection process. This combination led to simultaneously positive and negative effects in Langer and colleagues' (2018) study. This suggests that process information and process justification might have different effects on applicant reactions, as we will describe in the next section. Consequently, the current study experimentally segregates the information condition used by Langer et al. (2018) into process justification and process information and examines their influence on four different applicant reaction variables (transparency, fairness, creepiness, and privacy concerns).

9.3.3 Possible effects of different kinds of information on applicant reactions

Langer and colleagues (2018) focused on a wide range of applicant reaction variables, covering procedural justice, affective reactions, and privacy concerns variables. Procedural justice is one of the most important preconditions of applicants' positive evaluation of the selection process (cf., Gilliland, 1993; Schuler, 1993) and it should ultimately lead to increased organizational attractiveness (Gilliland, 1993). Affective reactions provide additional information about applicants' possible negative emotions during selection procedures above and beyond procedural justice perceptions. Privacy concerns are of special importance within technologically advanced selection procedures as they might cause applicants to self-select out of the selection process (cf., Bauer et al., 2006). These three perspectives are also examined by the current study.

Procedural justice. Applicants perceive selection processes as transparent if they perceive that they can see through a selection procedure (e.g., Gilliland, 1993; McCarthy et al., 2017; Schuler, 1993; Truxillo et al., 2009). Most commonly the relation between

information and transparency is assumed to be linear – the more information the more transparent the situation (cf., Langer et al., 2018; Truxillo et al., 2009). If applicants receive process information, the selection procedure should become more transparent as they have knowledge about what is happening within the virtual interview program. Similarly, if there are information justifying the process, transparency should increase as applicants will be able to understand why this selection procedure is used.

Applicants perceive a selection situation as fair if their justice expectations are met (cf., Colquitt et al., 2013). Justice expectations within job interviews cover a wide range of concepts. For instance, applicants expect to be treated with dignity and respect, and applicants might also expect to be informed about what awaits them during a personnel selection situation (Ployhart & Ryan, 1998). Additionally, they may wish to understand why an organization chose a specific selection approach to screen applicants. Consequently, it appears likely that process information and process justification will both help to bolster fairness perceptions. However, based on the findings of Lahuis and colleagues (2003), applicants might not expect to be overwhelmed with too specific information. If this argument is true, it would be detrimental to provide applicants with overly detailed information about what happens during the selection situation as applicants perceive their justice expectations (e.g., “tell me why we are doing this but spare me the details”) are violated. Furthermore, by providing very detailed information, applicants might be less likely to trust this information (Lahuis et al., 2003) and they might question some of the information. For example, telling applicants that the interview program recognizes voice and that it infers personality traits from vocal features could lead to applicants thinking about whether it is really possible to infer personality from voice. If they arrive at the conclusion that it cannot, fairness perceptions will likely suffer. In a case where information just explains that the program can infer personality traits, applicants might not challenge this statement.

This would imply that process information detrimentally affect applicant reactions, whereas process justification positively impacts applicant reactions. In sum, we propose the following four interaction hypotheses:

Hypothesis 1a: Participants who receive neither process information nor process justification will perceive the selection situation as less transparent than participants in the other groups.

Hypothesis 1b: Participants who receive both, process information and process justification will perceive the selection situation as more transparent than participants in the other groups.

Hypothesis 1c: Participants who receive neither process information nor process justification will perceive the selection situation as less fair than participants in the other groups.

Hypothesis 1d: Participants who receive process justification will perceive the selection situation as fairer than participants in both the process information and in the combined process information and process justification group.

Affective reactions. To capture affective reactions towards a technologically advanced selection situation, Langer and colleagues (2018) studied the concept of creepiness, which is a potentially negative emotional reaction paired with feelings of ambiguity towards a situation (Langer & König, 2017; McAndrew & Koehnke, 2016; Mori, 1970; Mori, MacDorman, & Kageki, 2012; Tene & Polonetsky, 2015). Creepiness seems to be an important concept to explain people's reaction to unfamiliar situations or to novel technologies (e.g., an interview with a virtual character, Tene & Polonetsky, 2015). Key factors increasing creepiness seem to be uncertainty and unpredictability (cf., McAndrew & Koehnke, 2016; Shklovski, Mainwaring, Skúladóttir, & Borgthorsson, 2014; Tene & Polonetsky, 2015). Providing information might attenuate these factors. For instance,

providing process information should make the situation more predictable as applicants receive information about what will be happening in the following selection situation before the selection procedure starts. Similarly, providing process justification should help to decrease uncertainty as it should help applicants why the organization is using a specific selection procedure. Therefore, we propose:

Hypothesis 1e: Participants in the group that receives neither process information nor process justification will perceive the selection situation as creepier (more emotional creepiness and more creepy ambiguity) than participants in the other groups.

Hypothesis 1f: Participants in the combined process information and process justification group will perceive the selection situation as less creepy than participants in the other groups.

Privacy concerns. Finally, technologically advanced selection procedures can lead to concerns about the controllability of the flow of private data to the organization and about what will happen to this data. Previous research has called these concerns privacy concerns (Malhotra, Kim, & Agarwal, 2004; Shin, 2010). Bauer and colleagues (2006) highlighted the importance of privacy concerns in personnel selection situation as they showed that privacy concerns can detrimentally affect applicants' reactions to selection procedures. Providing information on the procedure can be beneficial if the information relays to participants why exactly these data are gathered and why it makes sense to use these data (i.e., process justification). However, privacy concerns might not be alleviated if the information given is merely a description of what will take place (i.e., process information such as the recording of voice) because applicants would still not see the usefulness of the gathered data (e.g., that voice data can be used to predict job performance). Adding justification information should therefore be essential in decreasing privacy concerns. As such, we propose:

Hypothesis 1g: Participants in the process justification group and in the combined process information and process justification group will perceive the selection situation as less privacy concerning than participants in the process information and the group that receives neither process information nor process justification.

9.3.4 Effects on organizational attractiveness

According to the general logic of Hypotheses 1a-g, providing information should improve applicant reactions. Gilliland (1993) proposed that better applicant reactions should result in higher organizational attractiveness (i.e., form a positive image about the organization) – a proposal that has been empirically established in various studies (e.g., Bauer et al., 2001; Chapman, Uggerslev, Carroll, Piasentin, & Jones, 2005; Macan, Avedon, Paese, & Smith, 1994; Ployhart, Ryan, & Bennett, 1999). It is worth mentioning that organizational attractiveness is a highly relevant outcome variable for organization because it also encompasses applicants' willingness to accept a job offer (Chapman et al., 2005). If we combine these two arguments, it follows that providing information should improve organizational attractiveness and this effect is mediated by creepiness, privacy concerns, transparency, and fairness. In contrast to Langer and colleagues (2018), the current study uses four information conditions. In order to detect mediation effects, it is necessary to compare the low information condition to the three conditions that receive information. Accordingly, we propose:

Hypothesis 2a: There will be a positive indirect effect of the information conditions compared to the low information condition on organizational attractiveness via creepiness, privacy concerns, transparency, and fairness.

It is important to note that Hypotheses 2a would replicate findings by Langer and colleagues (2017) who also found a positive effect of information on organizational attractiveness as mediated by certain applicant reactions. However, they also found that

information counterbalanced this positive effect through a direct negative effect on organizational attractiveness. They argue that participants started to think critically about the information they received, however this was not possible in the case where they did not receive any information. It is therefore possible that the information participants receive in the current study could evoke similar negative reactions. More precisely, all the information conditions could negatively affect organizational attractiveness relative to the low information condition.

Hypothesis 2b: There will be a direct negative effect of the information conditions on organizational attractiveness compared to the low information condition

To conclude, Hypotheses 1a-g extend beyond Langer and colleagues' (2018) findings as the hypotheses provide additional insight into the effects of different kind of information on applicant reactions, whereas Hypotheses 2a and 2b would replicate their findings.

9.4 Method

9.4.1 Overview

We used a 2 × 2 (no process information vs. process information, no process justification vs. process justification) experimental design to test our hypotheses. After immersing participants into an application situation, they received information corresponding to their information condition, then watched a video where an applicant was interviewed by a virtual character, and in the end responded to all of the measures.

9.4.2 Sample

We used G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) to predict the required sample size. Truxillo and colleagues (2009) as well as Langer and colleagues (2018) found moderate effects for information on applicant reaction variables; therefore we decided to assume comparable effect sizes within the current study. For a moderate effect size of the

interaction effect within a multivariate analysis of variance (MANOVA) of Wilk's $\lambda = .90$ and a power of $1-\beta = 0.80$, a sample of $N = 125$ was necessary. Due to common problems with online studies (e.g., participants' pausing for long times, participants not reading the information carefully, and technical problems) we continued to collect data until our sample consisted of $N = 142$ participants. At the end of the experiment, participants were asked if the researchers should use their responses or if they had carelessly been responding to the survey (following the suggestion of Meade & Craig, 2012). As a result, three participants were excluded because they indicated that their data should not be used. We excluded two additional participants because they paused the experiment for more than an hour. Furthermore, eight participants who read the information for less than ten seconds in the information conditions were excluded because it is not possible to read all the information in less than ten seconds (except for the condition receiving neither process information nor justification). We also excluded five participants due to technical problems. The final sample consisted of $N = 124$ German students (75% female) with a mean age of 23.36 years ($SD = 14.40$) of whom 70 studied psychology, 8 were business majors, and the rest were in a range of diverse majors (e.g., medicine, arts, chemistry, communication). Regarding job interview experience, 16% had undergone six to ten interviews, 43% had experienced three to five interviews, 18% had undergone two interviews, 12% had experienced one interview, 6% of the participants had not experienced a job interview before, and the rest of participants had taken part in more than 10 interviews.

9.4.3 Procedure and information manipulation

For the entire process of the experiment we closely followed the process of Langer and colleagues (2018) to build upon their results. The experiment was conducted via an online survey platform. Students received course credit for participating in the study. Participants accessed the experiment through a link, and at the beginning they were randomly

assigned to one of the four conditions (neither process information nor justification, process information, process justification, combined process information and justification). Participants then received the following information that we took from Langer and colleagues (2018):

You applied for a job. Your application seems to be well received by the company, because you receive the following letter: "Thank you for your application. Your qualifications, which we gathered from your resume and cover letter, are well suited for the position. As such, we would like to invite you to interview for the position…"

Following, participants had to imagine being in a personnel selection situation. Following Langer and colleagues' (2018) procedure, participants had to think about typical questions in a job interview. They were also instructed to think about how to sell themselves to an interviewer, about their plans for the next five years, and about their strengths and weaknesses. Following, participants received further information depending on the experimental group they were assigned to (see Table 9-1).

Afterwards, participants received information that they will watch a video in which a female virtual character interviews a female applicant (see Figure 9-1). We used the same video as Langer and colleagues (2018).

Participants were able to hear the female applicant's responses to the virtual interviewer's interview questions. However, participants did not see the applicant (only indirectly through the skeleton on the left side of the screen). Altogether, the interviewer asked two questions and reacted to answers provided by the applicant. Within the interaction, the applicant showed signs of nervousness in response to the second interview question. As a result, she was unable to answer the question. The virtual interviewer reacted by telling the applicant that it sensed some nervousness but it also told the applicant that nervousness in a job interview is a normal reaction and it managed to calm the applicant. This procedure was

used to display the capabilities of this interview program (e.g., sensing of social signals like nonverbal behavior as well as adaptation to applicants' behavior). In the end, the video faded out without any further information about the results of the interview and participants were directed to a questionnaire containing all measures.

9.4.4 Measures

Dependent and mediator variables

Appendix A presents all the items that we used for this study. Transparency, fairness and organizational attractiveness were measured with items that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Privacy concerns and creepiness were measured on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

The two items for **transparency** were taken from Langer and colleagues' (2018) study. We used three **fairness** items developed by Warszta (2012) and adapted them to our study. The ten c**reepiness** items with the two subdimensions emotional creepiness and creepy ambiguity were taken from Langer and colleagues 2018's study. Of the six items for **privacy concerns**, one was taken from Smith, Milberg, and Burke (1996), another from Langer and colleagues (2018), two items were taken from Malhotra, Kim, and Agarwal (2004), and two more items were taken from Langer and colleagues (2017). Twelve of the **organizational attractiveness** items were taken from Highhouse, Lievens, and Sinar (2003) and translated, and three more items were taken from Warszta (2012).

Manipulation check measure

To assess the manipulation of the process information condition, the following item was used: "Information I received before the interview explained WHAT is being analyzed by the computer program (e.g., eye-contact)".

To assess the manipulation of the process justification condition, the following item was used: “Information I received before the interview explained WHY this computer program is used (e.g., because it can evaluate personality)”.

9.4.5 Data analysis

To analyze Hypotheses 1a-g we used a MANOVA for a simultaneous overall evaluation of main and interaction effects (see Spector, 1977). This MANOVA covered all dependent variables from Hypotheses 1a-g (i.e., transparency, fairness, creepiness, privacy concerns). We did not include organizational attractiveness in the overall MANOVA as this variable was the outcome of the mediation analysis.

To evaluate the single effects of the information conditions on the dependent variables, we followed Spector’s (1977) recommendations and conducted analyses of variance (ANOVAs) for all dependent variables regarding main effects and interactions of the information conditions.

For the mediation hypotheses (i.e., Hypotheses 2a and 2b), we used PROCESS for SPSS (Hayes, 2013). For Hypotheses 1a-g we proposed a 2×2 design with the two independent variables, process information and process justification. We did this so that it would be possible to distinguish the effects of process information and justification as well as their potential interactions. For Hypotheses 2a and 2b we used a different approach as it is also possible to assume that the information conditions can be considered as four categories of a single independent variable called “information”. For instance, within Hypotheses 2a we wanted to compare the participants who received neither process information nor justification with the other three information conditions. To test this hypothesis, we used PROCESS with a multicategorical independent variable with four conditions (for an introduction to multicategorical mediation analysis see Hayes & Preacher, 2014). To test hypotheses with a multicategorical independent variable, it is necessary to assign codes for the comparisons of

interest. For instance, it is possible to apply contrast coding to analyze our hypotheses in a way that the first contrast (C1) codes the comparison of the group that neither received process information nor justification against the other three information conditions; the second contrast (C2) would then code the comparison of the process information against the process justification and the combined process information and justification group, and the third contrast (C3) would compare the process justification with the combined process information and justification group. As such, it is possible to analyze direct and indirect effects of categories within the independent variable relative to other categories (e.g., analyzing the indirect effect of the group that received neither process information nor justification over the applicant reaction variables on organizational attractiveness relative to the indirect effect of the other groups).

We included all applicant reaction variables (transparency, fairness, creepiness with its both subdimensions emotional creepiness and creepy ambiguity, and privacy concerns) as mediator variables as suggested by Hayes (2013); the outcome variable of the mediation was overall organizational attractiveness. PROCESS provides a step-wise evaluation of multicategorical mediation effects (Hayes, 2013). First, it reveals the effects of the contrast variables C1-C3 onto the mediator variables. Second, it provides an overall output in which all mediating variables are included together with the contrast variables indicating whether the mediating variables impact the outcome significantly, if the contrast variables are also included in the model and vice versa. Third, PROCESS can calculate bias-corrected bootstrapped estimates of the overall indirect effects coded by C1-C3 and corresponding confidence intervals; if these intervals do not include zero this indicates a significant indirect effect of the respective contrast on the outcome mediated by the significant mediator variables. This significant indirect effect can then be interpreted based on the respective contrast (e.g., if C1 is significant, this means there is a positive indirect effect of the other

three information conditions compared to the condition that neither received process information nor justification).

9.5 Results

9.5.1 Manipulation checks

For the manipulation checks, we used contrast tests between the groups.

Participants who received neither process information nor justification stated that they received less information about "what" was happening during the selection procedure than the other three information conditions, $t(120) = 7.83$, $p < .01$, $d = 1.55$, and that they received less information about "why" this selection procedure was used, $t(120) = 4.29$, $p < .01$, $d = 0.86$.

Furthermore, participants who received neither process information nor justification and participants who received process information stated that they received less information on "why" the selection procedure was used than participants in the process justification and the combined process information and justification condition, $t(120) = 4.29$, $p < .01$, $d = 1.57$.

Lastly, participants who received neither process information nor justification and participants who received process justification stated that they received less information on "what" is being analyzed during the selection procedure than participants in the process information and the combined process information and justification condition, $t(120) = 7.81$, $p < .01$, $d = 1.41$.

9.5.2 Testing the hypotheses

Table 9-2 provides correlations and reliabilities of all study variables. Table 9-3 shows means and standard deviations of the information conditions.

To test Hypotheses 1a-g, we used MANOVA and single ANOVAs. The overall MANOVA indicated that the overall effect for process justification was not significant,

$F(5, 116) = 1.93$, $p = .09$, Wilk's $\lambda = .92$., but that there was an overall effect of the independent variable process information $F(5, 116) = 2.33$, $p < .01$, Wilk's $\lambda = .84$.

Hypotheses 1a and 1b proposed an interaction between the independent variables for transparency. According to Table 9-3, the interaction effect for transparency was not significant (exact significance $p = .07$), thus Hypotheses 1a and 1b were not supported.

In Hypotheses 1c and 1d we expected an interaction of the independent variables on fairness. These hypotheses were not supported (see Table 9-1). However, we found that process justification positively impacted fairness.

Hypotheses 1e and f predicted that there is an interaction effect of the independent variables on creepiness (emotional creepiness and creepy ambiguity). There was no interaction effect, therefore these hypotheses were not supported. However, we did find that process information lead to higher levels of emotional creepiness.

Hypothesis 1g proposed that process justification leads to less privacy concerns, but the data did not support this claim, and thus they also did not support Hypothesis 1g. Instead, we found that adding process information led to more privacy concerns.

In order to analyze Hypotheses 2a and 2b, it was necessary to conduct a multicategorical mediation analysis (see Hayes and Preacher, 2014). Tables 9-4 and 9-5 present the results of the multicategorical mediation analysis and all the results can be interpreted as relative effects compared to the reference group(s). We chose contrast coding where Contrast 1 (C1) compares the control condition (i.e. the condition which did neither receive process information nor justification) to the other three conditions, Contrast 2 (C2) compares the process information condition to the process justification and the full information condition (i.e., the combined process information and justification condition), and Contrast 3 (C3) compares the process justification and full information condition.

Hypothesis 2a suggested that there will be a positive indirect effect of the information conditions compared to the condition where participants did not receive process information or justification on organizational attractiveness as mediated by transparency, fairness, creepiness, and privacy concerns. Results of Contrast 1 indicate that there was no positive relative indirect effect of the information conditions compared to the control condition (see Table 9-4), as this contrast did not show an effect on any of the applicant reaction variables (i.e., the confidence intervals all included zero). Thus, Hypothesis 2a was not supported.

Hypothesis 2b proposed that there will be a direct negative effect of the information conditions on organizational attractiveness compared to the control condition. This hypothesis was not supported as there was no relative direct effect of Contrast 1 on organizational attractiveness (see Table 9-4).[1]

However, there are additional significant results that are noteworthy (see Tables 9-4 and 9-5). In particular, C2 for emotional creepiness indicates that process information evoked higher emotional creepiness compared to the process justification and full information group (see Table 9-4). Additionally, C3 for emotional creepiness implies that the combined process information and justification group evoked higher emotional creepiness than the process justification group but there was no indirect effect of emotional creepiness on organizational attractiveness (see Table 9-5). However, we found a significant positive indirect effect for fairness. More precisely, there was a positive indirect effect of the process justification and the full information group relative to the process information group (C2 for fairness) on organizational attractiveness. First, there was a positive effect of the full information as well as the process justification group on fairness relative to the process information group (see Table 9-4). Second, in the complete model (all mediators and contrasts included), fairness was the only significant variable positively influencing organizational attractiveness (see Table 9-4). Third, the relative indirect effect of the combined process information and

justification as well as the process justification group on fairness relative to the process information group was significant (see Table 9-5). In other words, there was a mediation effect such that the process justification and the combined process information and justification group were perceived as fairer than the process information group which positively impacted organizational attractiveness.

9.6 Discussion

The aim of this study was to shed light on the effects of different pieces of information on applicant reactions towards a technologically advanced selection procedure and the hiring organization. The current study provides three main findings: (a) process information may induce negative emotional reactions and (b) increase privacy concerns, whereas (c) fairness can increase when justification information is added to process information, which has the potential to impact organizational attractiveness positively. Additionally, there were two surprising findings: (d) Providing limited information may not be detrimental, and (e) when information is presented, transparency does not necessarily increase.

The first main result indicates that information including process information induces negative emotional feelings of creepiness towards technologically advanced selection methods. When using such a selection procedure, process information about what exactly will be happening during the procedure might not be a good idea, even if justification about why this procedure is being used is also presented. On the one hand, this is in line with the Lahuis and colleagues' (2003) findings who found that providing very specific information was not beneficial for applicant reactions. In the current study, specific pieces of information, including technical details about what is happening during the selection procedure, led to impaired feelings and intentions towards the organization. On the other hand, the findings of

the current study contradict results of other research that proposed that honest information about what is happening during a selection procedure increases acceptance of the respective procedure (Truxillo et al., 2009). One explanation is that the process information provided participants with technical details they would have otherwise not been concerned with. In providing that information, it evoked feelings of emotional creepiness. For example, participants were informed about the fact that nonverbal behavior and speech is analyzed, and that the program infers personality through these variables. This seem to have evoked more emotional creepiness than just telling participants that the program infers personality because such personality inferences can help to determine candidates' job fit. It seems that if applicants are provided with too detailed information, this can make them skeptical. This result partly explains the findings of Langer and colleagues (2018) as it indicates that process information negatively affected applicant reactions.

The second main finding of the current study indicates that the provision of process information can increase privacy concerns. Presumably, participants who were not informed did not even think about potential privacy invasions. This is an important finding as previous research indicated that privacy concerns negatively impact organizational attractiveness and test taking motivation (Bauer et al., 2006). Our findings indicate that organizations should be careful about what type of information they offer. "Wrong" information might lead to stronger concerns about privacy related issues.

The third main finding shows that fairness perceptions, one of the most important variables when examining acceptance of technological systems (Töniges, Ötting, Wrede, Maier, & Sagerer, 2016), were impaired when applicants received information about what awaits them in a technologically advanced selection procedure. Finally, this resulted in negative attitudes towards the organization which further clarifies that providing process information can lead to negative consequences which may ultimately reduce important

organizational outcomes like organizational attractiveness. However, this was only the case if the information did not contain justification about why the procedure was used. Justifying the usefulness of a chosen selection procedure counterbalanced the negative effect of process information regarding general fairness perceptions and organizational attractiveness. This result suggests that explaining *and* justifying why a selection procedure is used, positively influences acceptance of a selection procedure compared to only providing process information (Lahuis et al., 2003; Truxillo et al., 2009). It is worth mentioning that this conclusion was only possible through the explicit comparison of all information conditions using the method of multicategorical mediation analysis.

Rather surprisingly, the results of our study also indicated that providing applicants with nearly no information might not have any negative side effects when comparing it to offering detailed information to applicants. This means that under certain circumstances (e.g., in technologically advanced selection situations), providing information to applicants might bring more risks than benefits, a result that partly contradicts previous research findings (Truxillo et al., 2009). A reason for this result might be that past research used classical selection methods, where providing applicants with general information about the job relatedness and predictive validity of the selection method was more straightforward. For instance, there might be less reason to be skeptical about information describing a classical face-to-face job interviews procedure. Although it is still possible to be skeptical about the validity of classical interviews, there are more reasons to be skeptical in the case of technologically advanced selection methods. This might be the case because providing applicants with information means telling them about many more technological components (e.g., algorithms in the background, virtual characters as interviewers), and these components might be particularly unfamiliar in the area of personnel selection (cf., Tene & Polonetsky, 2015). However, if applicants are not provided with any information about why these

technological components are used, they might just trust these components work as intended and serve a certain purpose (e.g., selecting the best applicant) – otherwise organizations would not use them. However, when applicants receive process information and know exactly what is happening and how, for example, personality is inferred during the selection procedure, this might evoke doubts and negative feelings about the selection procedure and thus impair fairness impressions.

Another surprising result of the current study was the lack of support for the rather straightforward hypothesis that information should affect transparency. This is especially astonishing because the lack of support conflicts with the results of Langer and colleagues (2018) who found differences in transparency between their information conditions. Differences might have been expectable at least for the comparison between the group with the lowest amount of information and the other groups. However, a closer look at the results regarding transparency indicates that there were differences in transparency perceptions that were trending towards significance (p = .07 for the interaction effect; so it should be interpreted cautiously). In contrast to all the rather negative effects of process information regarding the other applicant reaction variables, providing process information was viewed as raising transparency, but when process justification was added, transparency dropped to the lowest mean score for all conditions. Perhaps participants in the full information condition felt overwhelmed by the amount of information they received. This would indicate that not only is there a beneficial kind of information, but also a detrimental amount of information.

9.6.1 Limitations

Two main limitations of the current study need to be discussed. First, participants were all sitting at home, reading the information and watching a video displaying a technologically advanced selection procedure. This means they might have been fully immersed in the situation. One could assume that the results will be different if participants

experience the situation first-hand, in a real selection situation. Despite this assumption, it is also important to note that laboratory and field research seem to point to more similar results than typically assumed (Mitchell, 2012; Vanhove & Harms, 2015). Still, future studies could examine if the results from the current study transfer to real selection situations (which might be hard to achieve because ethical concerns arise if applicants are provided with different levels of information), or at least to situations in which participants really interact within a technologically advanced selection situation.

Second, Cronbach's alpha for transparency was relatively low. This could result from the fact that we only used two items for this measure. It could also be that participants were rather uncertain about what exactly they should evaluate regarding transparency – the situation in the video, the information they received or the entire situation. This indicates that future studies should either use more items to capture transparency or they should be more explicit about what to evaluate with these items.

9.6.2 Main implications

First and foremost, the current study implies that if organizations choose to provide applicants with information about technologically advanced selection situations, they should focus on justification about why this selection procedure is used. Therefore, emphasizing job relatedness and validity in screening the best applicants are viable pieces of information that can be provided to applicants.

Furthermore, our results indicate that it is hard to develop information intervention that is beneficial for applicant reactions. In fact, our results show that it is more likely to negatively impact applicant reactions through information than to buffer negative reactions and positively impact them. An (potentially controversial) implication of the current study is therefore to limit the amount of information when using technologically advanced selection approaches. This implication is especially controversial as previous research on applicant

reactions on technology-enhanced selection approaches indicated that these approaches themselves already negatively affect applicant reactions (Blacksmith et al., 2016). Our findings warn organizations that by trying to diminish these negative reactions through information, they could actually worsen them.

Additionally, we see implications for the field of explainable artificial intelligence in which researchers are concerned about making artificial intelligence systems comprehensible for humans (Miller, Howe, & Sonenberg, 2017). The results of the current study imply that it might be not enough (or even detrimental) to increase understanding of a process underlying such a system. Instead, justification about the potential usefulness of the system may be necessary in order to improve acceptance and comprehensibility.

9.6.3 Future research

One aim of the current study was to detect which kind of information would have the potential to improve applicant reactions in technologically advanced selection situations. We found that process justification can be positive, but their positive effect is restricted to some applicant reaction variables. More research is needed to determine if there are any other kinds of information that can boost applicant reactions in technologically advanced selection situations. Future studies could try different kind of information that may focus on reducing the fear of novel technologies (e.g., telling people that this selection situation is just like any other selection situation that is more familiar, cf., Langer et al., 2018). Another option would be to use other approaches to improve applicant reactions, for instance showing a video testimonial in which other applicants explain their experience with the selection situation (cf., Walker, Feild, Giles, Armenakis, & Bernerth, 2009) or providing online tutorials in which applicants can familiarize themselves with novel selection procedures.

Furthermore, future research should try to reveal what kind of cognitive processes are initiated through the provision of different kind of information. It is not clear why

participants evaluated the condition with process information as more emotional creepy and privacy concerning; as such researchers could apply the think-aloud technique (Van Someren, Barnard, & Sandberg, 1994). Perhaps this technique could disclose why people are more concerned with a technologically advanced selection situation when they are informed about what is happening during this situation.

Additionally, we see a need for studies that explore the negative effect of providing information (found in this study and in Langer et al., 2018) in other contexts. For example, research could study information that accompany the use of robots in the workplace. Robots will likely concern their human colleagues as such, organizations might want to prevent this by informing people about their new fellow workers (cf., Töniges et al., 2016). Another example would be self-driving cars. Providing information could improve acceptance of this technology, but if people react negatively to information detailing the process that is used to make the car able to be self-driving, there might be better ways to improve acceptance of the technology.

9.6.4 Conclusion

Typically, most people would agree that they want to be treated in an honest way and not have things kept from them. Quite the contrary was found in the current study. Instead, it is necessary to tailor the amount and type of information provided. In doubt, it may even be better to withhold some information instead of providing too much information that might provide insights evoking skepticism and negative reactions.

9.7 Footnotes

1. In the pre-registration (Open Science Collaboration, 2015) we stated in an exploratory hypothesis that there might be a direct negative effect for the comparison of the process information condition and the full information condition to the process justification and low information condition, this was not supported; results can be accessed upon request.

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9.9 Tables and Figures

Table 9-1

Information Presented to the Participants in the Different Information Conditions

Condition	Information
No process information, no justification	In addition, the company wrote: … To offer you the opportunity to introduce yourself, we would like to invite you to an online interview. This will be the next stage of the selection process. The online interview will be conducted by a virtual character.
Process information, no justification	*(In addition to the information from the low information group)* The virtual character is run by a computer program. The program can: …analyze your facial expressions by recognizing eye-movement, eye-contact, and facial movement (e.g. smiling). …analyze your gestures by recognizing hand, body and head movement (e.g., nodding and crossing arms). …analyze your speech and voice for example pitch, volume, speech pauses. …interpret your behavior such as social and emotional signals. …display human conversational gestures such as smiling, crossing arms, nodding etc. …react to different facial expressions, gestures, voice characteristics, and behavior of the applicant.
No process information, justification	*(In addition to the information from the low information group)* The virtual character is run by a computer program. The program …tries to calm the applicant by treating the applicant positively. …can infer personality traits like extraversion and openness. This can be useful to assess the candidate's job fit. …can recognize if a person is listening, is agreeing with the virtual character's statements, and it recognizes when the candidates has completed their response. This can help to generate appropriate follow-up questions to answers given by the applicant. …uses a virtual character to communicate with applicants, because studies suggest that applicants prefer to talk to a virtual character in an automated online interview. …can adapt to your individual behavior and try to react adequately.
Process information, justification	*(In addition to the information from the low information group)* The virtual character is run by a computer program. The program …can analyze your facial expressions by recognizing eye-movement, eye-contact, and facial movement (e.g. smiling). …can analyze your gestures by recognizing hand, body and head movement (e.g., nodding and crossing arms). …is able to recognize if an applicant is nervous through eye-movement, facial expressions, eye-contact, and gestures. If the applicant is nervous, the computer tries to calm the applicant by treating the applicant positively. …can analyze your speech and voice for example pitch, volume, speech pauses because such speech signals can be helpful to infer personality traits like extraversion and openness. This can be useful to assess the candidate's job fit. …can interpret your behavior such as social and emotional signals, if a person for example is listening, is agreeing with the virtual character's statements, and it recognizes when candidates have completed their response. This can help to generate appropriate follow-up questions to answers given by the applicant. …can display human conversational gestures such as smiling, crossing arms, nodding… because studies suggest that applicants prefer to talk to a virtual character in an automated online interview …can react to different facial expressions, gestures, voice characteristics, and behavior of the applicant through the virtual character. It can adapt to your individual behavior and try to react adequately.

Note. Translated from German.

Figure 9-1. Screenshot of the experimental video when the interviewer greeted the applicant. The virtual interviewer was present in the center of the screen for the entire video. On the right side, signal lights provided feedback on the applicant's nonverbal behavior (e.g., smile, see first signal light from the top). On the left side, the applicant's skeleton was visible, accompanied by a continuous smile analysis below.

Table 9-2

Correlations and Cronbach's Alpha for the Study Variables.

	Scale	1.	2.	3.	4.	5.	6.	7.
1.	Transparency	*.60*						
2.	Fairness	.20*	*.91*					
3.	Emotional Creepiness	-.17	-.35**	*.79*				
4.	Creepy Ambiguity	-.22*	-.29**	.64**	*.74*			
5.	Privacy Concerns	.03	.29**	.29**	.19*	*.87*		
6.	Organizational Attractiveness	.14	.60**	-.38**	-.34*	-.31**	*.93*	
7.	Process Information	-.01	-.16	.34**	.12	-.23*	-.16	-
8.	Process Justification	-.08	.21*	-.14	-.06	.02	.19*	.00

Note. $N = 124$. Numbers in the diagonal represent Cronbach's alpha of the scales (in italics).
$^{*}p < .05$, $^{**}p < .01$

Table 9-3

Descriptives and Results for the Single ANOVAS (Including Partial η² for the Dependent Variables)

	Condition				ANOVA					
	No PI, no PJ	PI, no PJ	No PI, PJ	PI, PJ	Main Effect No PI vs. PI		Main Effect No PJ vs. PJ		Interaction	
Variable	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*(1, 116)	η^2_p	*F*(1, 116)	η^2_p	*F*(1, 116)	η^2_p
Transparency	2.84 (0.86)	3.08 (0.73)	2.97 (0.72)	2.71 (0.73)	0.00	.00	0.78	.00	3.34	.03
Fairness	2.72 (0.95)	2.31 (0.79)	3.00 (0.91)	2.81 (0.98)	3.51	.03	5.64*	.05	0.44	.00
Emotional Creepiness	3.37 (1.23)	4.08 (0.96)	3.00 (0.93)	3.83 (1.14)	16.20**	.12	2.59	.02	0.09	.00
Creepy Ambiguity	4.16 (1.28)	4.32 (0.99)	3.93 (1.10)	4.30 (1.09)	1.78	.02	0.39	.00	0.28	.00
Privacy Concerns	4.38 (1.07)	5.07 (1.25)	4.49 (0.83)	4.85 (1.34)	6.61*	.05	0.07	.00	0.62	.01
Organizational Attractiveness	2.95 (0.54)	2.63 (0.49)	3.06 (0.60)	2.99 (0.75)	3.49	.03	4.78*	.04	1.37	.01

Note: PI = process information, PJ = process justification. $n_{\text{No PI, No PJ}} = 31$, $n_{\text{PI, No PJ}} = 31$, $n_{\text{No PI, PJ}} = 31$, $n_{\text{PI, PJ}} = 31$.

*$p < .05$, **$p < .01$.

Table 9-4

Regression Results for the Mediation of Emotional Creepiness and Fairness between Information Condition and Overall Organizational Attractiveness

Model	R^2	Coefficient	*SE*	*p*	95% CI
Single effects					
C1 Control condition VS. Other information → Transparency		0.08	0.16	.61	[-0.23, 0.39]
C2 Process information VS. Process justification + Full information → Transparency		-0.24	0.17	.15	[-0.57, 0.09]
C3 Process justification VS. Full information → Transparency		-0.26	0.19	.19	[-0.64, 0.13]
C1 Control condition VS. Other information → Fairness		-0.01	0.19	.94	[-0.39, 0.36]
C2 Process information VS. Process justification + Full information → Fairness		0.59	0.20	<.01	[0.20, 0.99]
C3 Process justification VS. Full information → Fairness		-0.19	0.23	.40	[-0.65,0.26]
C1 Control condition VS. Other information → Emotional creepiness		0.27	0.22	.22	[-0.17, 0.71]
C2 Process information VS. Process justification + Full information → Emotional creepiness		-0.67	0.24	<.01	[-1.13, -0.20]
C3 Process justification VS. Full information → Emotional creepiness		0.83	0.27	<.01	[0.29, 1.37]
C1 Control condition VS. Other information → Creepy Ambiguity		-0.02	0.23	.92	[-0.44, 0.48]
C2 Process information VS. Process justification + Full information → Creepy ambiguity		-0.21	0.25	.40	[-0.69, 0.28]
C3 Process justification VS. Full information → Creepy ambiguity		0.37	0.28	.19	[-0.19,0.94]
C1 Control condition VS. Other information → Privacy concerns		0.42	0.24	.08	[-0.05, 0.89]
C2 Process information VS. Process justification + Full information → Privacy concerns		-0.40	0.25	.12	[-0.90, 0.10
C3 Process justification VS. Full information → Privacy concerns		0.37	0.29	.21	[-0.21, 0.94]
Model complete	.42	-	-	-	-
Transparency → Organizational attractiveness		0.02	0.06	.76	[-0.10, 0.14]
Fairness → Organizational attractiveness		0.32	0.05	<.01	[0.21, 0.42]
Emotional creepiness → Organizational attractiveness		-0.05	0.06	.33	[-0.16, 0.06]
Creepy ambiguity → Organizational attractiveness		-0.06	0.05	.27	[-0.16, 0.05]
Privacy concerns → Organizational attractiveness		-0.06	0.04	.17	[-0.14, 0.02]
C1 Control condition VS. Other information → Organizational attractiveness		-0.02	0.10	.86	[-0.22; 0.18]
C2 Process information VS. Process justification + Full information → Organizational attractiveness		0.15	0.12	.21	[-0.08; 0.38]
C3 Process justification VS. Full information → Organizational attractiveness		0.08	0.13	.61	[-0.17; 0.34]

Note. The 95% confidence interval for the effects was obtained by the bias-corrected bootstrap with 10,000 resamples. CI = confidence interval, C1 = Contrast 1, C2 = Contrast 2, C3 = Contrast 3. *n* = 31 in all conditions.

Table 9-5

Results for the Relative Indirect Effects of Information Conditions over Emotional Creepiness and Fairness on Overall Organizational Attractiveness

Model	*RIE*	SE_{Boot}	95% CI
C1 Control condition VS. Other information → Transparency → Organizational attractiveness	.00	0.01	[-0.02, 0.05]
C2 Process information VS. Process justification + Full information → Transparency → Organizational attractiveness	-.01	0.02	[-0.06, 0.03]
C3 Process justification VS. Full information → Transparency → Organizational attractiveness	.01	0.02	[-0.07, 0.03]
C1 Control condition VS. Other information → Fairness → Organizational attractiveness	-.01	0.06	[-0.12; 0.12]
C2 Process information VS. Process justification + Full information → Fairness → Organizational attractiveness	.19	0.08	[0.07; 0.37]
C3 Process justification VS. Full information → Fairness → Organizational attractiveness	-.06	0.08	[-0.24; 0.08]
C1 Control condition VS. Other information → Emotional creepiness → Organizational attractiveness	-.02	0.03	[-0.11, 0.01]
C2 Process information VS. Process justification + Full information → Emotional creepiness → Organizational attractiveness	.04	0.04	[-0.02, 0.15]
C3 Process justification VS. Full information → Emotional creepiness → Organizational attractiveness	-.05	0.05	[-0.18, -0.03]
C1 Control condition VS. Other information → Creepy ambiguity → Organizational attractiveness	.00	0.02	[-0.05, 0.03]
C2 Process information VS. Process justification + Full information → Creepy ambiguity → Organizational attractiveness	.01	0.02	[-0.01, 0.08]
C3 Process justification VS. Full information → Creepy ambiguity → Organizational attractiveness	-.02	0.03	[-0.11, 0.01]
C1 Control condition VS. Other information → Privacy concerns → Organizational attractiveness	-.02	0.03	[-0.10, 0.01]
C2 Process information VS. Process justification + Full information → Privacy concerns → Organizational attractiveness	.02	0.03	[-0.01, 0.11]
C3 Process justification VS. Full information → Privacy concerns → Organizational attractiveness	-.02	0.03	[-0.13, 0.01]

Note. The 95% confidence interval for the effects was obtained by the bias-corrected bootstrap with 10,000 resamples. RIE_{med} = Relative indirect effect of the mediation. SE_{Boot} = Standard error of the bootstrapped effect sizes, CI = confidence interval, C1 = Contrast 1, C2 = Contrast 2, C3 = Contrast 3. n = 31 in all conditions.

9.10 Appendix

Table 9-6

Items Used in the Current Study

Creepiness	
Emotional Creepiness	During this situation, I had a queasy feeling.
	I had a feeling that there was something shady about this situation.
	I felt uneasy during this situation.
	I had an indefinable fear during this situation.
	This situation somehow felt threatening.
Creepy Ambiguity	I did not know how to judge this situation.
	During this situation, I did not know exactly what was happening to me.
	During this situation, things were going on that I did not understand.
	I did not know exactly how to behave in this situation.
	I did not know exactly what to expect of this situation.
Transparency	The online interview was transparent.
	It is obvious what the online interview is measuring.
Fairness	All things considered this selection procedure was fair.
	I think this interview is a fair procedure to select people for the job.
	I think the interview itself was fair.
Privacy Concerns	I am concerned if companies are collecting too much personal information about me.
	Novel technologies are threatening privacy increasingly.
	In situations like the one shown in the video it is important to me that my privacy is secure.
	In situations like the one shown in the video I am concerned about my privacy.
	Situations like the one shown in the video threaten participants' privacy.
	Private data that are provided in such situations could be misused.
Overall organizational attractiveness	For me, this company would be a good place to work.
	This company is attractive to me as a place for employment.
	I am interested in learning more about this company.
	A job at this company would be very appealing to me.
	If this company invited me for a job interview, I would go.
	I would accept a job offer from this company.
	I would make this company one of my first choices as an employer.
	I would like to work for this company.
	I would recommend this company to friends.
	I have friends who would be interested in this company.
	I would recommend others to apply at this company.
	Employees are probably proud to say they work at this company.
	This company probably has a reputation as being an excellent employer.
	There are probably many who would like to work at this company.
	This is a reputable company to work for.

Note. Items translated from German.

10 General Discussion

The aim of my dissertation was to modernize research regarding technology-based job interviews and to draw the research closer to the technological evolution and application. In summary, my dissertation (a) provided a new measure for reactions towards novel technologies, (b) demonstrated that digital interviews can evoke negative applicant reactions and that applicants receive better interview ratings compared to videoconference interviews, (c) indicated that algorithm-based job interviews with a virtual interviewer had a detrimental effect on applicant reactions, whereas the same procedure was better perceived as a training opportunity, (d) implied that computer experience had no effect on applicant reactions in a technologically advanced job interview setting, and e) showed that providing information before a technologically advanced selection situation can have equivocal effects on applicant reactions and that justification information led to better reactions than process information.

In the general theoretical background section, I introduced four questions that I wanted to address with this dissertation. The first question asked if there is a way to measure creepiness and addressed if creepiness plays an important role regarding applicant reactions during technology-based job interview approaches. In the first study, the CRoSS emerged as a new psychometric tool to capture insights into situations applying novel technologies. In Studies 2 through 5, the CRoSS was demonstrated as a useful tool for measuring applicant reactions in research. In all of these studies, its subscales showed significant relations to other applicant reaction variables, providing further support for the validity of the CRoSS and the importance of creepiness as a novel perspective for acceptance research. For instance, creepy ambiguity, and emotional creepiness correlated negatively with the respective overall outcome measures (i.e., organizational attractiveness or attractiveness of the procedure) in all of the studies. One could argue that this correlative findings are due to common method variance (cf., Lindell & Whitney, 2001), as participants self-reported their feelings of

creepiness and their attitude towards the procedure or the organization. However, creepiness was also sensitive to theory-based hypotheses and to the experimental comparison of different interview approaches. Furthermore, creepiness was related to the interview performance measures in Study 2 in such a way that higher creepiness correlated with lower interview performance. This advances research on creepiness, revealing that creepiness is not just a measure of acceptance but that it can also affect behavioral outcomes. Therefore, it could be interesting to investigate how exactly negative relationships between creepiness and behavioral outcomes evolve.

In addition to the results for creepiness, findings regarding privacy concerns in Studies 2 and 3 indicate that there is a need for including novel perspectives on applicant reactions in cases in which technology is involved in the personnel selection procedure. Previous research on technology-based job interviews (e.g., Chapman et al., 2003; Sears et al., 2013) did not include these measures which might have been adequate since they used traditional technology-mediated interview approaches. However, with the development of algorithm-based job interviews and with the use of virtual characters or robots as interviewers, it seems to be necessary to assess these novel perspectives on applicant reactions.

The second and third question I asked were related to the investigation of interviewer ratings within digital interviews as well as applicant reactions to digital interviews and to technologically advanced interview procedures. In corresponding Studies 2 and 3, the respective modern job interview approach detrimentally impacted applicant reactions. These studies indicate that the novelty of these interview approaches and their lack of transparency diminished acceptance which is supported by the fact that participants were confused about what was happening and concerned about their private data in such situations. However, in future and as a consequence of more exposure to these novel procedures, it is possible that

perceptions of novel interview approaches will change as applicants become more familiar with similar approaches and potentially have more knowledge of the underlying processes and technologies (cf., Tene & Polonetsky, 2015). On the one hand, it is possible that acceptance of these procedures will improve as familiarity increases. On the other hand, considering findings of Studies 4 and 5, increasing knowledge about underlying processes (i.e., applicants having more process information because of better technical education) might also lead to negative consequences. Researchers and organizations should therefore keep track of available job interview technologies but also on corresponding education in schools or universities in order to anticipate familiarity, applicants' knowledge about these procedures, and the potential impact on applicant reactions.

One main focus in Studies 2 and 3 were hypotheses focusing on differences in aspects of interpersonal justice (e.g., social presence, interpersonal treatment; Bauer et al., 2001) and these hypotheses drew a clear picture of more interpersonal justice for interview approaches involving a human interviewer. However, findings were not as clear in a way that participants perceived less interpersonal treatment during digital interviews compared to videoconference interviews, whereas this was not found for the comparison of algorithm-based interviews and videoconference interviews. This might imply that in the case of the algorithm-based interview there was a virtual conversation partner, whereas participants in digital interviews talked directly to the camera. Therefore, an idea could be to add a virtual conversation partner in order to increase interpersonal justice and acceptance of digital interviews (cf., Lee & Nass, 2003). However, as our results regarding algorithm-based interviews are based on a study in which participants only watched a video, it might be possible that in digital interviews using a virtual character, applicants still perceive lower interpersonal justice as they are more likely to realize and negatively evaluate the implications of this kind of interview. More precisely, in cases in which there is a virtual interviewer, applicants might

comprehend that there is no representative of the hiring organization conducting the interview.

Furthermore, results of Studies 2 and 3 differ in a way that in the case of digital interviews, participants were more convinced of their abilities to control the situation (e.g., using impression management). It might be possible that these differences are a consequence of participants perceiving more opportunity for impression management during digital interviews relative to algorithm-based interviews. This would indicate that people in digital interviews have the impression that they can apply their standard repertoire of impression management skills (e.g., slight image creation; Roulin & Bourdage, 2017). In the case of algorithm-based interviews, participants might have felt that it would not be possible to control the course of the interview through these standard tactics. However, it might be possible that interviewees in future are more able to see through algorithm-based selection procedures and apply algorithm-specific impression management behaviors in order to increase perceived controllability. In other words, they could try to apply impression management behavior intended to improve their algorithmically evaluated interview performance. For instance, if participants know that the algorithm-based tool attaches importance to nonverbal behavior or specific use of words (e.g., positive emotion words in order to assess extraversion; cf., Pennebaker & King, 1999) interviewees could train to adapt their behavior accordingly to please the algorithm. This seems to open fruitful directions for future research.

It is also worth mentioning that Studies 2 and 3 advance the understanding of the relationship between different technology-based job interview approaches by highlighting the importance of practically relevant comparison groups. To be clear, previous research (e.g., Chapman et al., 2013) always included face-to-face job interviews as the comparison group for technology-mediated interviews which was valuable for realizing that face-to-face

interviews are more accepted (cf., Blacksmith et al., 2016). In practice however, it is unlikely that face-to-face interviews will be substituted by technology-mediated interviews as the latter approaches are more likely to stay screening devices (Brenner et al., 2016). In this regard, it is much more important to understand how different technology-based interview approaches relate to each other. Studies 2 and 3 analyzed exactly this and point towards a continuum of declining acceptance from face-to-face interviews over videoconference interviews and digital interviews to algorithm-based interviews.

To elaborate this implication more deeply, especially Study 2 highlights that modern job interview approaches are not just variations of classic technology-mediated job interviews. Every novel job interview approach comes with its own set of challenges for research and practice. The algorithm-based job interview used for Studies 3-5 is one example and other algorithm-based job interviews might go without a virtual interviewer or with additional sensor devices gathering data about applicants (e.g., vital sensors tracking heart rate). Clearly, it is necessary to examine all aspects of these novel approaches (e.g., preparation time in digital interviews, use of different kind of sensor devices, use of virtual characters) in order to clarify what distinguishes different job interview approaches and what effects arise of these distinctions.

The fourth question that I proposed in the general theoretical background focused on detecting possibilities to alleviate negative applicant reactions to technologically advanced job interview approaches. Instead of endorsing the well-supported positive effects of information on applicant reactions (see McCarthy et al., 2017; Truxillo et al., 2009), however, Studies 4 and 5 led to novel insights about equivocal impacts of information when applied to inform about technologically advanced selection situations. These studies did not succeed in increasing applicant reactions through information indicating that there is an

urgent need for more research about ways to improve applicant reactions in order to effectively implement novel interview approaches.

Altogether, it appears that transparency is the one aspect that connects all of the studies of this dissertation and it seems to be highly relevant regarding applicant reaction research on technology-based job interviews (cf., Biran & Cotton, 2017). Indeed, applicant reactions regarding digital interviews as well as algorithm-based interviews suffered from the results of less transparency (e.g., more creepy ambiguity). Additionally, transparency led to equivocal effects in the context of information as its related constructs (e.g., open treatment) were beneficial for organizational attractiveness, whereas too much transparency regarding the processes underlying algorithm-based interviews resulted in detrimental outcomes. This calls for future research which explicitly investigates transparency of technology-based job interview procedures. First, it appears to be unclear which facets constitute transparency. For instance, one facet might cover transparency related to the idea if it is possible to follow the decision process within a job interview, whereas another facet might be a more technical transparency (i.e., which sensors are involved in the technology-based interview process). Second, using different versions of technology-based job interviews with various degrees of transparency might provide novel insights about the relationships among transparency, acceptance, and other behavioral outcomes (e.g., interview performance). Lastly, it seems necessary to develop novel ideas about how to influence different aspects of transparency. Indeed, information is the most popular but maybe not the most influential way of modifying perceptions of transparency.

10.1 Limitations

In addition to the limitations presented in the respective studies (i.e., mostly student samples, no longitudinal data) there are three broader limitations concerning this dissertation.

First, all of the studies (except interviewer ratings in Study 2) rely on self-report measures meaning the results of these studies need to be interpreted cautiously as there might be an issue with common-method variance increasing correlations between the dependent variables (Lindell & Whitney, 2001). Obviously, applicant reaction measures are predominantly self-report measures as applicants report their feelings about a selection situation. However, there might be other ways of measuring these reactions. For instance, future work could try to use sensor-based measures (e.g., vital sensors, cameras; cf., Langer, Schmid Mast, Meyer, Maass, & König, in press) to examine applicants' perceptions of a selection situation. It could be that negative applicant reactions correspond with negative facial expressions or with vital responses, such as changes in heart rate.

Second, findings of this dissertation might be less relevant for small to medium sized organizations as it examined personnel selection methods which appear to be mainly relevant when there is a large applicant pool (cf., Campion et al., 2016). More precisely developing algorithm-based personnel selection methods to automatically screen applicants might not be worth the effort if there are only three applicants applying for a job. To be clear, in such cases it is still important to keep the few applicants interested in a job, hence small and medium sized organizations should also ensure that applicant reactions to selection devices are positive (cf., Chapman et al., 2005). However, it is even more important to take advantage of selection procedures which provide more opportunity for recruitment in order to maintain and possibly increase the applicant pool. For instance, face-to-face interviews (Ferris, Berkson, & Harris, 2002) appear to be much better methods to present an organization to applicants or to offer applicants the possibility to ask questions about the job compared to asynchronous digital interviews where there is only one-way communication.

Third, this dissertation incorporated ideas from computer science in an attempt to modernize psychological research but its ideas, terminology, theoretical background, and

measures mainly stem from psychology. Therefore, implications and contributions are also mainly embedded in the field of psychology. This is not necessarily negative as computer scientists themselves recognize that psychological theory is useful to advance their field (e.g., Miller, Howe, & Sonenberg, 2017). However, computer scientists may not be very familiar with terms like "personnel selection" which are rather clear for psychologists and other terms like "acceptance" may have different connotations in psychology (e.g., acceptance of personnel selection procedures; Gilliland, 1993) and in computer science (e.g., technology acceptance; Venkatesh et al., 2003). In other words, there may be misunderstanding when computer scientists read work that is mainly influenced by psychology (like this dissertation) and vice versa. In order to achieve more interdisciplinary work, future research should try to work even more closely with the field of computer science. This way, it will be possible to include new data gathering options (e.g., web scraping), new analyses methods (e.g., machine learning approaches), and to frame implications in a way that addresses a broader audience consisting of psychologists and computer scientists (e.g., through using a common terminology or at least being aware of existing differences in terminology).

10.2 Future Research and Directions

Future studies regarding novel technologies for HRM should attempt to stay current with technological developments and broaden knowledge concerning the effects of novel tools for HR purposes. For instance, in cases in which applicants or hiring managers react negatively to modern personnel selection approaches, it is necessary to develop new ways of improving reactions. One common criticism regarding algorithm-based technologies is that they lack transparency which might reduce acceptance (Biran & Cotton, 2017) – a finding that is also supported by the current set of studies. The area of explainable artificial intelligence (Miller et al., 2017) offers some interesting new ideas about how to increase transparency and eventually trust in novel algorithm-based technologies. This area of

research has just recently started to receive renewed attention (Biran & Cotton, 2017) supporting the timeliness and value of the findings of this dissertation. One stream of researcher in this field advocates that decision-making processes within algorithms should be observable. For instance, this would mean building neural networks (one specific class of machine learning algorithms) in which every prediction would be traceable as every predictor within every layer of the neural network and its influence on the outcome would be transparent (Biran & Cotton, 2017). Another idea would be to develop algorithms that explain themselves and their decision-making process to humans (Brinton, 2017). In the end, such a system could appear similar to observing participants in experiments which apply the think-aloud method (Van Someren, Barnard, & Sandberg, 1994). For instance, the algorithm would open its black box and explain why it chose candidate A instead of candidate B. Future studies should combine ideas of the areas of explainable AI and psychology, for the purpose of developing an interdisciplinary field of research (see also Miller et al., 2017). The goal of this should be, to make algorithms more comprehensible for humans who will increasingly be affected by algorithm-based decisions.

Furthermore, important in the case of personnel selection, is the validation of algorithm-based personnel selection tools. Up to now, these tools were predominantly validated by computer scientists who may be less aware of goals other than individual job performance that organizations might want to achieve with their hiring strategies (e.g. increasing diversity; Ployhart, Schmitt, & Tippins, 2017). In other words, it is highly relevant to validate such tools in order to realize the effects they have on the future of an organization. For example, it may be possible that an algorithm-based personnel selection tool can validly predict individual job performance (cf., Schmid Mast et al., 2017), but if people are selected based on this information it might negatively affect diversity in the workforce or undermine organizational citizenship behavior. To be clear, this could be a result of the fact that the

algorithm was trained to predict individual job performance neglecting other outcomes which are equally important for organizational performance (e.g., organizational citizenship behavior; Ployhart et al., 2017). In sum, it is necessary to evaluate algorithms regarding their broader implications for organizations rather than focusing on a single criterion.

In addition to personnel selection, novel technologies will likely affect the future of other HR processes. For example, algorithm-based training approaches will likely increase possibilities for very specific feedback on trainees' behavior (e.g., about how to improve presentation skills; cf., Batrinca et al., 2013). In combination with novel sensor devices, literally every single step, heartbeat, and intonation of every word, could be used to provide trainees with insights about their behavior (Langer et al., in press). It would therefore be fruitful to examine which sensor information is useful for training. In addition, virtual reality devices can aid to develop novel training opportunities for employees. For instance, computer scientists have developed creative environments for virtual reality presentation training (e.g., Batrinca et al., 2013) in which it is possible to manipulate many different variables providing manifold opportunities for psychological research. In the case of a presentation training, it is for example possible to examine the influence of the size or the behavior of the audience (see Batrinca et al., 2013). More specifically, the great advantage for psychological research that lays within virtual reality environments is the possibility to manipulate variables in a strictly standardized way offering potentials for new research paradigms for psychology. This might not sound like a very innovative idea but psychology has not yet captured the full potential of virtual environments.

Finally, using technology for recruitment as another HR core process should also receive more attention. For instance, organizations nowadays invest in games for recruitment as they hope that they lead to a larger applicant pool because people enjoy the game instead of being aware that it is used as a recruitment device (Chamorro-Premuzic et al., 2017;

Collmus, Armstrong, & Landers, 2016). Within these games, potential applicants additionally produce a lot of behavioral data (e.g., reaction times; which person was the leader in a team task; Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012) and it might be possible to use these data in order to find suitable candidates for open positions. In contrast to the widespread idea of using games as recruiting and selection devices (Chamorro-Premuzic et al., 2017; Ployhart et al., 2017), empirical evidence is scarce. More precisely it is not yet clear if games actually are useful tools for recruitment and selection. Moreover, it is even less clear if there are people that are more likely to be attracted by games (cf., Landers, 2014), or if people with more gaming experience have an unfair advantage over other people in selection games (Orvis, Horn, & Belanich, 2008). Therefore, it seems to be worthwhile to invest in future research about recruitment and selection games.

10.3 General Conclusion

This dissertation is one small step in the direction to modernize psychological research on technology for HRM purposes. However, there will probably already be new technological developments driving the future of HRM when this dissertation is printed and published. In order to stay up-to date or to produce future-oriented research regarding novel technological developments, psychologists should closely follow research in domains like computer science and consider interdisciplinary collaborations. This way, psychological research will be able to not only reactively conduct research on novel technologies, but proactively shape future tools and modern applications.

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