ACCOUNTABILITY INCONGRUENCE AND ITS EFFECTS ON AI DEVELOPERS’ JOB SATISFACTION

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ACCOUNTABILITY INCONGRUENCE AND ITS EFFECTS ON AI DEVELOPERS’ JOB SATISFACTION

Research Paper

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Abstract

Developers of Artificial Intelligence (AI)-based systems are increasingly urged to assume accountability for their development decisions, referring to the degree to which they must justify underlying algorithms and their outcomes on demand. Thereby, AI developers often have to juxtapose how much accountability they self-attribute to them and how much accountability they perceive others attribute to them, creating intrapersonal perceptual accountability (in)congruence with unknown consequences for their job satisfaction. Building on perceptual congruence research and algorithmic accountability literature, we conducted an online survey of 87 AI developers about their experiences in AI-based systems development projects. Our results show that the lower the incongruence between self-attributed and others-attributed accountability, the higher the job satisfaction of AI developers. Moreover, we find that AI developers’ role ambiguity mediates this effect. Our study contributes to a more nuanced understanding of AI developers’ perceived accountability, with essential insights for defining job roles and understanding AI developers.

Keywords: AI-based Systems, Information Systems Development, Perceived Accountability, Perceptual Congruence.

1 Introduction

With the growing demand for information system (IS) employees (e.g., Bureau of Labor Statistics, 2022) and their involvement in more and more business areas (e.g., Deighton, 2022), it is more important than ever to pay attention to employees’ job satisfaction. This need is also pressing in light of the rising rate of IS employee resignations, which, for example, was 4.5% in 2021 than the previous year (Cook, 2021). To foster job satisfaction, an increasing number of companies are paying attention to their employee value proposition (e.g., Green, 2022; Bhardwaj et al., 2022), some explicitly concerning software developers (e.g., Irwin, 2019). Due to this relevance of job satisfaction, IS research has for some time been concerned with corresponding intangible factors in the relationship between companies and their employees (e.g., Rutner et al., 2008; Maier et al., 2021). In particular, due to the increasing complexity and volatility of IS development (ISD) projects and the resulting demands on software developers, IS research has recently focused more on software developers’ stress and satisfaction levels (e.g., Windeler et al., 2017; Mueller and Benlian, 2022; Benlian, 2022).

The complexity of ISD projects increases even further when they aim to develop AI-based systems (e.g., Adam et al., 2022; Jung et al., 2018), as such projects must also consider complex accountability issues.
related to the underlying algorithms of AI-based systems (Buhmann et al., 2020; Ågerfalk et al., 2021; Benlian et al., 2022). In this context, AI-based systems are understood as systems that employ algorithms to iteratively learn from data to solve tasks independently or only with minimal human intervention (Berente et al., 2021). Given the independence from human interventions, how such systems can be developed and used responsibly has sparked research interest under the umbrella term of algorithmic accountability (Wieringa, 2020). This contemporary scholarship adopts an understanding of accountability that focuses primarily on an actor’s obligation to explain and justify actions and outcomes to a forum upon request, with the forum potentially imposing consequences on the actor (Bovens, 2007; Lindberg, 2013). In the algorithmic context, the focus lies on an “accountability relationship where the topic of explanation and/or justification is an algorithmic system” (Wieringa, 2020, p. 2). Therefore, algorithmic accountability aims to discuss who can be expected to be able to justify and explain AI-based systems and their outcomes (e.g., assessments or predictions) and, therefore, can be held accountable (Wieringa, 2020). From a legal perspective, these issues remain unresolved despite initial initiatives (Floridi, 2021). To enable accountability nonetheless, IS research is increasingly focusing on developers of AI-based systems (e.g., Martin, 2019a; Benbya et al., 2021), for whom it is devising technology-oriented guidance (Jobin et al., 2019; Attard-Frost et al., 2022). However, it is still unknown how AI developers deal with these increasing attributions of accountability and their effects on them.

To assess questions about how attributed accountability is handled and its effects, it is important to consider the capabilities of the underlying AI-based systems: As AI-based systems are able to act autonomously, learn from new data, and become more and more inscrutable to humans (Baird and Maruping, 2021; Berente et al., 2021), it is becoming increasingly difficult for AI developers to explain the AI-based systems themselves or how their outcomes come about (Benbya et al., 2021; Buhmann et al., 2020). However, since these are precisely the explanations AI developers are expected to provide when held accountable (e.g., Martin, 2019b), they face increasingly unknown implications of the accountability attributed to them (Kacianka and Pretschner, 2021). As a result, they may be uncertain about the expectations placed on their role and may tend to neglect their accountability, instead holding others responsible for the appropriate deployment or use of AI-based systems. This dilemma presents an additional stressor in the context of AI-based systems development projects, which come at the expense of job satisfaction, as described at the outset.

Consequently, AI developers have to juxtapose two different perceptions in light of external attributions of accountability and the inscrutability of AI-based systems: First, the degree of accountability they attribute to themselves, and second, the degree of accountability they assume other AI stakeholders (e.g., managers, users) attribute to them. In the following sections, we will return to these two accountability perceptions more frequently when discussing AI developers’ accountability perceptions. While doing so, we refer to self-attributed accountability as the accountability AI developers attribute to themselves. By others-attributed accountability, we mean the accountability that AI developers perceive as being attributed to them by others. When these perceptions converge, that is, when AI developers attribute as much accountability to them as they perceive that others attribute to them, intrapersonal perceptual congruence emerges (White, 1985; Srull and Wyer, 1988). On the contrary, intrapersonal perceptual incongruence arises if these perceptions diverge (White, 1985; Srull and Wyer, 1988). As a result of intrapersonal perceptual incongruence regarding their accountability, AI developers should perceive ambiguity about how they can meet accountability obligations associated with their role (e.g., Van Sell et al., 1981). In other words, their responsibilities in developing AI-based systems remain unclear, for example, regarding their decision-making authority and relevant judgment standards imposed on them. Such lack of clarity is defined as role ambiguity (Kahn et al., 1964; Rizzo et al., 1970) and leads to, among others, reduced job satisfaction (e.g., Moore, 2000; Ruttner et al., 2008).

Calling upon IS research to understand the effects of accountability perceptions on AI developers, we encounter three essential issues. First, to the best of our knowledge, ISD research has not yet explored the accountability perceptions of individual ISD project participants such as AI developers. Second, previous algorithmic accountability research has focused mainly on technical approaches to address accountability issues of AI-based systems and their outcomes (Jobin et al., 2019; Attard-Frost et al., 2022) but has neglected the effects of attributed accountability on AI developers. Third, research on
perceptual (in)congruence in IS research is still limited. So far, respective studies have mainly focused on the effects of interpersonal perceptual (in)congruence between IS stakeholders instead of intrapersonal perceptual (in)congruence within an individual IS stakeholder (e.g., Benlian and Haffke, 2016; Huisman and Iivari, 2006).

Therefore, we want to investigate whether intrapersonal perceptual incongruence exists among AI developers regarding their accountability and how it affects AI developers’ job satisfaction through role ambiguity. Thus, we pose the following research questions:

RQ1: How do AI developers experience self-attributed accountability compared to others-attributed accountability?

RQ2: How do AI developers’ intrapersonal perceptual (in)congruence regarding accountability affect their perceptions of role ambiguity and job satisfaction?

To address these research questions, we drew on perceptual congruence research and algorithmic accountability literature. We conducted an online survey of 87 AI developers on their experience in recent AI-based system development projects. Our study extends ISD and algorithmic accountability research by revealing the relevance of intrapersonal perceptual (in)congruence among developers of AI-based systems regarding their accountability. Likewise, it provides business executives with new evidence contributing to the success of AI-based system development projects by demonstrating the importance of clear job role definitions and understandings. The relevance of clear job role definitions and understandings is particularly evident in emerging complex accountability issues, gaining importance for AI developers and business executives.

2 Theoretical Framework

2.1 Perceptual Congruence and Its Effects on ISD Projects

Perceptual congruence research holds that many different factors shape an individual’s perceptions and perceptual processes, forming an individual’s interests, values, and behaviors (Gibson and Earley, 2007). Those factors can be personal (e.g., one’s own experiences or personality type) or social (e.g., one’s assumptions of others’ perceptions) (Allport, 1955). When the perceptions of those factors converge, IS research speaks of perceptual congruence, while different perceptions are understood as perceptual incongruence (Srull and Wyer, 1988). Likewise, two different levels of analysis can be distinguished: First, intrapersonal perceptual (in)congruence refers solely to the (dis)agreement in an individual’s self-perception concerning the previously mentioned factors. Second, interpersonal perceptual (in)congruence examines the (dis)agreement in the perceptions of two individuals (Benlian, 2013). The effects of either inter- or intrapersonal perceptual (in)congruence can be explained by referring to cognitive dissonance theory (CDT). The underlying premise of CDT is that individuals strive for cognitive consistency. Any state of psychological discomfort stems from such consistency not being present in an individual’s beliefs, attitudes, and/or actions (Benlian, 2013). Such inconsistency results in mental conflict, especially when facing evidence that one’s beliefs or attitudes may be wrong (Festinger, 1957). Not least the degree of inconsistency determines the degree of psychological discomfort (Szajna and Scamell, 1993). A perceived higher inconsistency leads to a higher perceived psychological discomfort and thus to further negative consequences such as dissatisfaction (Benlian, 2013). In order to resolve such perceptions of psychological discomfort and thus bring about cognitive consistency, individuals tend to adjust their beliefs, attitudes, or behaviors (Festinger, 1957). Cognitive dissonance arises, among other things, from an individual’s expectations (Teas, 1994) or interactions with others (Moschis, 1976). Especially in interactions with others, individuals evaluate their own beliefs by comparing them with the perceived beliefs of others, using them as a standard of comparison that may be more or less congruent (Benlian, 2013), resulting in intrapersonal perceptual (in)congruence.

Additionally, intrapersonal perceptual incongruence often challenges an individual’s role perceptions through diverging role expectations (Windeler et al., 2017; Venkatesh et al., 2020). This is likely to increase role ambiguity, being the most pertinent role perception affected by diverging role expectations.
(Kahn et al., 1964; Rizzo et al., 1970). Role ambiguity can be understood as an employee’s lack of clarity regarding their decision-making authority, applying judgment standards or expectations placed on them (Fisher and Gitelson, 1983; Tubre and Collins, 2000; Ebbers and Wijnberg, 2017; Rizzo et al., 1970). Consequently, employees often do not know which tasks they have to tackle in which order, how their work will be evaluated, and how they should communicate with external stakeholders (e.g., Häusser et al., 2010; Swanson and Power, 2001; Windeler et al., 2017).

Previous ISD research, drawing on perceptual congruence literature, has shown that cooperation among IS stakeholders benefits from interpersonal perceptual congruence (e.g., Loske et al., 2014; Benlian, 2014; Benlian and Haffke, 2016) but has left the intrapersonal perspective mainly unaddressed. At the level of ISD projects, research suggests that the overall performance is enhanced by minimized differences (Basnet and Lane, 2005), mutual understanding (Jenkin et al., 2019), and shared values (Narayanaswamy et al., 2013; Maruping et al., 2019) between ISD project participants. Accordingly, in the context of ISD projects, pairs of two or more individuals are already well-researched regarding the effects of interpersonal perceptual (in)congruence. Concerning role ambiguity, previous IS research has shown that increased role ambiguity leads to reduced job satisfaction (e.g., Ply et al., 2012; Rutner et al., 2008; Moore, 2000) and indeed occurs in work environments where algorithms are pertinent (e.g., Tárafárdi et al., 2022). Nevertheless, to the best of our knowledge, IS research has not yet investigated AI developers’ perceptions regarding potential intrapersonal perceptual incongruences and their downstream effects on role ambiguity and job satisfaction.

2.2 Effects of Algorithmic Accountability on AI Developers

The research strand of algorithmic accountability addresses the question of to whom accountability for algorithms and their outcomes should be attributed (Wieringa, 2020; Martin, 2019a); in other words, who should be able to explain algorithms and their outcomes (Bovens, 2007; Lindberg, 2013). In AI-based system development projects, to bear accountability, one has to be able to explain the emergence of algorithms and outcomes (e.g., assessments or predictions) of autonomous, inscrutable, and learnable AI-based systems (Berente et al., 2021; Baird and Maruping, 2021). Since AI-based systems themselves have no sense of self or purpose (Braga and Logan, 2017), they cannot establish intentionality, which is a prerequisite for being held accountable (Floridi, 2008). Therefore, questions arise about who could and should be held accountable to resolve emerging accountability gaps (Mittelstadt et al., 2016; Martin, 2019b; Benbya et al., 2021). Most algorithmic accountability research has so far addressed these accountability gaps through proposed guidelines (Attard-Frost et al., 2022; Jobin et al., 2019), primarily suggested in the form of technical frameworks (e.g., Tóth et al., 2022), certification systems (e.g., Matus and Veale, 2022), or internal audit frameworks (e.g., Raji et al., 2020). In addition, initial legislative initiatives and regulations from both the U.S. Government (2022) and the European Commission (2021) aim to address these accountability gaps by clarifying responsibilities for the actions and outcomes of AI-based systems.

Nevertheless, technical answers to socio-relational accountability issues cannot be exhaustive. Mostly, this is because they seldom consider the complexity of the socio-technical interactions between involved AI stakeholders (i.e., developers, managers, and users) while developing, operating, and using an AI-based system (Raisch and Krakowski, 2021). These interactions are accompanied by organizational and societal effects that are impossible to predict (O’Neil, 2016), let alone controlled by a single human actor involved (Raisch and Krakowski, 2021). Due to those effects and further strategic and technical challenges of AI-based systems (Buhmann et al., 2020), all involved human actors have personal reasons to reject the attribution of accountability. Strategic accountability challenges arise because AI-based systems are proprietary entities, giving organizations operating such systems incentives to keep them a secret to protect functionality, competitiveness, or user data (Buhmann et al., 2020), thus avoiding accountability. In contrast, technical challenges arise because the inner workings of algorithms remain unclear, especially in AI-based systems that incorporate machine learning techniques (Buhmann et al., 2020), giving AI stakeholders reasons to reject being held accountable. Nevertheless, AI developers are increasingly held accountable for AI-based systems they develop and their outcomes (e.g., Martin,
2019a), which has implications for their development decisions (Benbya et al., 2021; Kacianka and Pretschner, 2021). AI developers face corresponding accountability questions already in new AI-based systems’ planning and design phases (e.g., Diakopoulos, 2016; Sjöström et al., 2022).

In such development situations, AI developers face the dilemma of perceiving that they are increasingly being held accountable by others while at the same time being well aware of the inscrutability of AI-based systems and their outcomes. They, therefore, have to reconcile the accountability they perceive as being attributed to them from others (i.e., others-attributed accountability) and the accountability they attribute to themselves (i.e., self-attributed accountability) facing the technical limitations of AI-based systems. As illustrated, these two perceptions could lead to intrapersonal perceptual incongruence among AI developers regarding their accountability.

The question arises regarding the effects of such potential intrapersonal perceptual incongruence regarding their accountability to AI developers. Previous IS research in this context has merely qualitatively compared AI developers’ perceptions of compliance with high-level accountability AI-based system development guidelines (Seguel and Vaast, 2021). The results primarily emphasized the plurality of different ways AI developers self-evaluate their accountability. To our knowledge, further qualitative or quantitative studies on the effects of accountability perceptions on AI developers do not yet exist. Therefore, it is reasonable to turn to related research areas, such as the control mechanisms of ISD projects, to assess the effects of accountability perceptions on AI developers. Often, rules and guidelines are specified to be followed during ISD projects (Merchant and Otley, 2007). While the majority of control mechanisms, such as performance evaluations and rewards (Choudhury and Sabherwal, 2003), positively affect the overall project performance (Gopal and Gosain, 2010; Keil et al., 2013), they can also lead to distrust and dissatisfaction among individuals (Spector, 1986; Piccoli and Ives, 2003). Additionally, control mechanisms further increase the complexity of ISD projects, which in turn causes developers to experience stress (Windeler et al., 2017).

Nonetheless, the specific effects of accountability perceptions and related potential intrapersonal perceptual incongruences remain unresolved. It could be shown that perceptions of accountability have inconsistent effects in general work contexts: For example, perceived accountability positively affects anxiety (Green et al., 2000), job tension (Hochwarter et al., 2005), emotional exhaustion (Hall et al., 2006) and, last but not least, reduces job satisfaction (Hall et al., 2006; Lanivich et al., 2010). However, when distinguishing between perceived accountability to colleagues and perceived accountability to management, positive effects on job satisfaction are observed due to accountability’s aspect of awareness (Thoms et al., 2002). This awareness can be understood as an employee’s perception that managers and co-workers know what employees are doing within the scope of their jobs and how well they perform (Thoms et al., 2002).

These positive effects of a differentiated view on accountability perceptions and of intrapersonal perceptual congruence can be drawn upon to investigate how different perceptions of accountability attributions and corresponding potential intrapersonal perceptual incongruence affect AI developers.

3 Research Model and Hypotheses Development

Drawing on CDT (Festinger, 1957), perceptual congruence research (e.g., Srull and Wyer, 1988; Benlian, 2013), and algorithmic accountability literature (e.g., Wieringa, 2020), we develop a research model, depicted in Figure 1, that examines self-attributed accountability and others-attributed accountability for the presence of intrapersonal perceptual incongruence among AI developers related to their accountability (H1). We then examine the effects of perceived accountability congruence, that is, a congruence of self-attributed accountability and others-attributed accountability, on AI developers’ job satisfaction (H2). Finally, we investigate whether this effect can be explained by a mediation effect of AI developers’ role ambiguity (H3).
Building on the increasing relevance of AI-based systems development projects for ISD research and the outlined different perceptions of accountability attributions for these systems, we draw on perceptual congruence research to answer our research questions. Previous perceptual congruence studies support the existence of interpersonal perceptual incongruence and the positive effects of interpersonal perceptual congruence (e.g., Benlian, 2013; Huisman and Iivari, 2006; Loske et al., 2014; Maruping et al., 2019). Accordingly, our study has two underlying premises: First, that intrapersonal perceptual incongruence is also prevalent among AI developers regarding their accountability. Second, AI developers who, in contrast, perceive intrapersonal perceptual congruence regarding their accountability should benefit from a higher psychological comfort in the form of higher job satisfaction due to lower role ambiguity.

We suspect that growing accountability issues (e.g., Ågerfalk et al., 2021; Benlian et al., 2022) and the increasing attribution of accountability for AI-based systems and their outcomes to AI developers (e.g., Martin, 2019a) should lead AI developers to perceive a high level of others-attributed accountability. In contrast, as AI developers should be aware of the inscrutability of algorithms underlying AI-based systems and their outcomes (Baird and Maruping, 2021; Berente et al., 2021), so they should consequently also be aware of their resulting inability to explain them (Buhmann et al., 2020). As a result, AI developers should attribute low accountability to themselves, resulting in low self-attributed accountability among AI developers. We expect the juxtaposition of both accountability perceptions to result in intrapersonal perceptual incongruence, giving rise to our first hypothesis:

H1: All else being equal, AI developers perceive others-attributed accountability as higher than their self-attributed accountability, resulting in intrapersonal perceptual incongruence regarding their accountability.

At the interpersonal level between two IS stakeholders, the opposite of perceptual incongruence, namely perceptual congruence, leads to positive effects (e.g., Benlian and Haffke, 2016; Maruping et al., 2019; Jenkin et al., 2019). Accordingly, intrapersonal perceptual congruence, as the opposite of intrapersonal perceptual incongruence, can also be expected to affect the individual level positively. Intrapersonal perceptual congruence occurs when AI developers’ self-attributed accountability matches their perceived others-attributed accountability. The assumption of positive effects of intrapersonal perceptual congruence is grounded in CDT: Intrapersonal perceptual congruence prevents psychological discomfort (Benlian, 2013; Szajna and Scamell, 1993) and, correspondingly, contributes to the fulfillment of an individual’s need for cognitive consistency (Festinger, 1957). The resulting cognitive consistency leads to higher perceived psychological comfort and thus to further positive effects such as job satisfaction (Benlian, 2013). In contrast, intrapersonal perceptual incongruence regarding accountability should decrease job satisfaction. In connection with the identified positive effects of accountability when considered in a differentiated manner (Thoms et al., 2002), our second hypothesis follows:
H2: Intrapersonal perceptual congruence regarding their accountability increases AI developers’ job satisfaction.

Assuming that both previous hypotheses are supported, it remains to be explored how the positive effects of intrapersonal perceptual congruence regarding their accountability on AI developers’ job satisfaction can be explained. Intrapersonal perceptual congruence regarding accountability can be understood as AI developers’ certainty about what they are accountable for, which arises when self-attributed accountability and others-attributed accountability match. In such a case, an AI developer avoids perceived uncertainty about what expectations should be met (Fisher and Gitelson, 1983; Tubre and Collins, 2000). Such avoided uncertainty gives the AI developer greater clarity regarding their decision-making authority and the applying judgment standards; in other words, it should reduce role ambiguity (Kahn et al., 1964; Rizzo et al., 1970). As role ambiguity is understood as one of the primary stressors in a work context (Jackson and Schuler, 1985; Kahn et al., 1964), its reduction should contribute to positive feelings and increased satisfaction of AI developers due to higher psychological comfort (Festinger, 1957). Conversely, intrapersonal perceptual incongruence leading to higher role ambiguity should reduce AI developers’ job satisfaction. This decrease should be explained by the fact that any aspect of uncertainty should decrease one’s job satisfaction due to psychological discomfort. IS research has often shown that a mediation effect of role ambiguity can explain effects on job satisfaction (e.g., Rutner et al., 2008; Moore, 2000; Ply et al., 2012). Accordingly, our third and final hypothesis links these results of previous IS research on role ambiguity to an intrapersonal perceptual congruence regarding their accountability and its effects on AI developers’ job satisfaction:

H3: AI developers’ perceived role ambiguity mediates the effects of an intrapersonal perceptual congruence of self-attributed accountability and others-attributed accountability on job satisfaction.

4 Research Methodology

4.1 Procedures and Survey Sample

To test our hypotheses, we chose an online survey research approach. To ensure that AI developers could understand the questions and instructions in our survey, we conducted two exploratory interviews before distributing the survey, focusing particularly on the comprehensibility of the different accountability perceptions. We collected responses for our survey implemented as an online questionnaire using the crowdsourcing platform Prolific (prolific.co). Previous research has shown that data collection through Prolific ensures high data quality and reliability (e.g., Palan and Schitter, 2018). To reach AI developers with prior professional experience in AI-based systems development projects, we applied appropriate filtering criteria to Prolific (i.e., prior employment experience in an IT context, US citizenship, fluency in English, and a minimum age of 25). We chose these filtering criteria to ensure appropriate professional experience in AI-based systems development projects and the ability to understand the survey instructions as well as to allow for comparable law and cultural environments. Also, we requested the participants to describe one of their last three AI-based systems development projects. We explained the survey’s purpose on the welcome page and asked for participation in exchange for monetary compensation while ensuring the confidentiality and anonymity of responses. In this way, we obtained an initial data sample of 119 surveys that we filtered to ensure high data quality. First, we filtered whether attention checks were passed. Second, we filtered for reasonable processing time, following the recommended Relative Speed Index (RSI) threshold of 2.0 (Leiner, 2019). Third, two authors independently reviewed the authenticity of participants’ reported AI-based systems development project summaries and job titles to ensure a high likelihood of regular AI-based system development tasks in the participants’ professional context.

The resulting dataset contains 87 survey entries, representing a 73.11% valid response rate. The mean age of participants was 35.63 years (standard deviation: 9.14), 80.46% were male, and 94.25% had a bachelor’s degree or higher. 75.86% stated working in an organization with at least 50 employees, and 65.52% reported their team size to be at least five employees.
4.2 Measurement of Variables

To measure self-attributed accountability and others-attributed accountability, we adapted the scale for perceived accountability in the work context from Hochwarter, Perrewé, Hall, and Ferris (2005) in two distinct versions: First, to measure self-attributed accountability, we adapted the items to match AI developers’ cognitive processes (e.g., “I thought that I often had to explain why I did certain things regarding AI development.”). Second, we queried others-attributed accountability through adaptations regarding the AI developers’ assumptions about the cognitive processes of others such as colleagues and business or IT managers (e.g., “I think others thought that I often had to explain why I did certain things regarding AI development.”). To measure AI developers’ job satisfaction perceptions, we adopted the McKnight (1997) scale, in line with previous IS studies (e.g., Rutner et al., 2008). Also, following previous IS research (e.g., Moore, 2000), we adapted the perceived role ambiguity scale of Rizzo et al. (1970) and queried it reversed, as intended. All constructs were queried with three items each, and all items were assessed with 7-point Likert-type scales, ranging from 1 (strongly disagree) to 7 (strongly agree). Furthermore, we included several control variables (i.e., age, gender, education, industry sector of employment, AI tenure, team size, and organization size). However, because both the inclusion and exclusion of our control variables led to substantially similar findings, we neglect them when reporting our statistical results in the subsequent sections (Field et al., 2012).

To determine intrapersonal perceptual congruence regarding accountability, we compared related responses values of self-attributed accountability and others-attributed accountability. Instead of calculating the absolute difference between two response values, we followed the approach of Acitelli et al. (1993) and Benlian and Haffke (2016). The numerical congruence scoring procedure (see Table 1) translates scores of related items, one for self-attributed accountability and one for others-attributed accountability, into congruence values between one and ten. Relatively lower congruence values were assigned when both responses were on opposite sides of the scale spectrum, and relatively higher congruence values were assigned when both were on the same side. Following this principle, for example, response values of five (somewhat agree) and seven (strongly agree) are more congruent than response values of five (somewhat agree) and three (somewhat disagree), even though both value pairs are precisely two points distant from each other.

<table>
<thead>
<tr>
<th>Self-Attributed Accountability</th>
<th>Others-Attributed Accountability</th>
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<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
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<td>3</td>
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<td>3</td>
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<td>6</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1. Perceptual Congruence Scoring Table

4.3 Measurement Model Tests and Common Method Bias

By evaluating the individual item loadings, internal consistency, convergent validity, and discriminant validity, we assessed the psychometric properties of our measurement model. Regarding convergence validity, we followed the recommended criteria of Fornell and Larcker (1981): While all measurement factor loadings are expected to be significantly above the threshold of 0.70 (Hair et al., 2019), construct reliabilities should exceed 0.70, and the average variance extracted (AVE) of each construct should exceed variance due to measurement error for that construct, meaning that AVE has to exceed the threshold of 0.50 (MacKenzie et al., 2011).

As shown in Table 2, all but two items of the constructs self-attributed accountability and others-attributed accountability exceeded the loading threshold of 0.7. However, it is recommended to remove
items with loadings between 0.4 and 0.7 only if the removal leads to an increase in internal consistency reliability or convergent validity above the suggested threshold values (Hair et al., 2021). Since our constructs already met these thresholds, we kept the corresponding items. Furthermore, all item loadings were significant (p < 0.001). Composite reliability and Cronbach’s alpha reached values between 0.72 and 0.95, while AVE values ranged from 0.64 to 0.93. Thus, all constructs met the internal consistency reliability and convergence validity criteria. Concerning discriminant validity, it is recommended that the square root of AVE of a single construct should be greater than the shared variance of that item with other constructs in the model in question (Fornell and Larcker, 1981). All square roots of AVE exceeded the respective interconstruct correlations, affirming discriminant validity. In summary, our measurement model consists of constructs representing theoretically and empirically distinguishable concepts.

<table>
<thead>
<tr>
<th># of Items</th>
<th>Range of Loadings</th>
<th>Cronbach’s alpha</th>
<th>Composite Reliability</th>
<th>AVE</th>
<th>SA</th>
<th>OA</th>
<th>RA</th>
<th>JS</th>
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<td>0.85</td>
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<td>0.80</td>
<td></td>
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<td>0.70</td>
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<td>0.39</td>
<td>0.22</td>
<td>0.81</td>
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<tr>
<td>JS</td>
<td>3</td>
<td>0.93 – 0.94</td>
<td>0.93</td>
<td>0.95</td>
<td>0.93</td>
<td>0.40</td>
<td>0.26</td>
<td>0.59</td>
</tr>
</tbody>
</table>

1 All factor loadings are significant at the p < 0.001 level

Note: Diagonal elements (bold) are the square root of AVE, and off-diagonal elements represent correlations (SA = Self-Attributed Accountability; OA = Others-Attributed Accountability; RA = Role Ambiguity; JS = Job Satisfaction)

Table 2. Assessment of Internal Consistency and Convergent Validity

Due to intrapersonal perceptual congruence regarding accountability to be determined across the measured constructs of self-attributed accountability and others-attributed accountability, we examined the corresponding items for their skewness and kurtosis values. In this way, we wanted to ensure that the conditions for the t-tests to be conducted later were met. Both items were within the suggested limits of an absolute skew value of less than 2 (self-attributed accountability 0.74; others-attributed accountability 0.53) and a kurtosis value of less than 7 (self-attributed accountability 3.05; others-attributed accountability 3.09), which means that no substantial deviations from normality have to be assumed (West et al., 1995). In addition, we performed a post-hoc power analysis using the statistical program G*Power. This revealed that our sample size of 87 AI developers achieved a power value of 0.82, which is above the limit of 0.80 conventionally considered appropriate (Ellis, 2010).

Performing Harman’s single-factor test with principal axis factoring and restricting factors to extract to one, we analyzed Common Method Bias (CMB) in our dataset. The results showed that a single factor accounted only for 21.38% and, therefore, well below the critical value of 50% (Podsakoff et al., 2003). To verify this result, we also used a correlational marker technique in which the factor analysis’ highest variable was considered an additional independent variable (Richardson et al., 2009). As this variable also did not significantly change the variance explained in our dependent variable (i.e., job satisfaction), it seems unlikely that CMB significantly affects our analysis results.

5 Results

We performed all analyses with the statistical software R, several extension libraries for R, and the PROCESS macro for R (Hayes, 2022).

To test H1, we first conducted a two-sided Wilcoxon signed-rank test for paired samples to test the mean values of self-attributed accountability and others-attributed accountability for possible equality of central tendencies (Wilcoxon, 1945), resulting in a p-value of 0.003. As this is well below the threshold of 0.05, the results suggest that AI developers indeed differentiate between self-attributed accountability and others-attributed accountability. To assess the effect size of this intrapersonal perceptual incongruence, we determined the effect size of the applied Wilcoxon signed-rank test (Rosenthal and Rubin, 2003). The resulting r-value of 0.387 suggested a medium effect regarding the difference
between self-attributed accountability and others-attributed accountability of AI developers (Cohen, 1988). However, as H1 states that AI developers perceive their others-attributed accountability to exceed their self-attributed accountability, we aimed to evaluate which of those two accountability perceptions is more pronounced. We conducted paired one-sided t-tests between means following previous perceptual congruence research in the IS field (e.g., Benlian and Haffke, 2016) and referring to proven acceptable results regarding comparing constructs in perceptual congruence models (e.g., White, 1985; Acitelli et al., 1993). The results presented an unexpected finding in our study: Not only did our data not support our hypothesis that others-attributed accountability exceeds self-attributed accountability ($p > 0.05$), but it actually suggested the reversal of H1. In fact, the results show that AI developers’ self-attributed accountability is higher than their others-attributed accountability (means of 5.25 and 4.98; $p < 0.01$).

H2 states that intrapersonal perceptual congruence regarding accountability increases AI developers’ job satisfaction. In addition, H3 states that role ambiguity mediates the effects of such intrapersonal perceptual congruence regarding accountability on AI developers’ job satisfaction. In order to be able to test H2 and H3, we performed a hierarchical multiple linear regression analysis with two stages, as shown in Table 3. In this analysis, we determined the intrapersonal perceptual congruence regarding accountability according to the numerical congruence scoring procedure presented in Table 1 and included it as an accountability congruence construct. Hence, accountability congruence represents the degree to which intrapersonal perceptual congruence regarding accountability exists.

Stage 1 examined the direct effects of accountability congruence on job satisfaction, and stage 2 investigated the effects of accountability congruence on role ambiguity. Consequently, stage 3 explored a mediation effect of role ambiguity on the relationship between accountability congruence and job satisfaction of AI developers (Baron and Kenny, 1986).

<table>
<thead>
<tr>
<th></th>
<th>Job Satisfaction</th>
<th>Role Ambiguity</th>
<th>Job Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stage 1</td>
<td>Stage 2</td>
<td>Stage 3</td>
</tr>
<tr>
<td>Intercept</td>
<td>4.58 (0.61)***</td>
<td>4.67 (0.66)***</td>
<td>6.97 (0.65)***</td>
</tr>
<tr>
<td>Accountability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congruence</td>
<td>0.16 (0.07)*</td>
<td>-0.24 (0.08)**</td>
<td>0.04 (0.06)</td>
</tr>
<tr>
<td>Role Ambiguity</td>
<td></td>
<td>-</td>
<td>-0.51 (0.09)***</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.06</td>
<td>0.10</td>
<td>0.34</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.05</td>
<td>0.09</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Note: $N = 87$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; () = standard error

Table 3. OLS Results

In support of H2, our results in stage 1 show a significant effect of accountability congruence on job satisfaction ($\beta = 0.16; p < 0.05$); accordingly, intrapersonal perceptual congruence regarding accountability leads to higher job satisfaction of an AI developer in question. Also, as shown in stage 2, accountability congruence significantly reduced role ambiguity ($\beta = -0.24; p < 0.01$). Therefore, accountability congruence can be expected to be associated with AI developers’ greater perceived clarity of the expectations of their role and decision-making authority, as these characteristics are constrained when role ambiguity is high. In addition, we find a significant mediation effect of role ambiguity on job satisfaction in stage 3. This provides initial support for our third hypothesis that role ambiguity mediates the effect of intrapersonal perceptual congruence regarding accountability on job satisfaction.

We relied on a PROCESS model 4 analysis to validate our mediation analysis (Hayes, 2022). PROCESS uses the least squares method to determine unstandardized path coefficients of the total, direct, and indirect effects. Relying on 5,000 bootstrapping iterations and heteroskedasticity-consistent standard errors (Davidson and MacKinnon, 1993), we calculated 95% confidence intervals and inferential statistics, which were considered significant when the confidence interval did not include zero.
The results fully support our third hypothesis and are presented in Table 4. They show that accountability congruence, that is, a high degree of congruence between self-attributed accountability and other-attributed accountability, is fully mediated by role ambiguity. Therefore, reduced role ambiguity can explain the positive effect of a high accountability congruence on job satisfaction. The indirect effect of the mediation is 0.12, and the 95% confidence interval ranges from 0.04 to 0.24.

Figure 2 summarizes our results according to the research model.

<table>
<thead>
<tr>
<th>Mediation (PROCESS Model 4)</th>
<th>Effect of Variable on Job Satisfaction</th>
<th>Total Effect</th>
<th>Direct Effect</th>
<th>Indirect Effect</th>
<th>Std. Error</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accountability Congruence</td>
<td>0.16</td>
<td>-</td>
<td>-</td>
<td>0.07</td>
<td>0.02</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Accountability Congruence</td>
<td>-</td>
<td>0.04</td>
<td>-</td>
<td>0.06</td>
<td>-0.09</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>Role Ambiguity</td>
<td>-</td>
<td>-</td>
<td>0.12</td>
<td>0.05</td>
<td>0.04</td>
<td>0.24</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Mediation Analysis Summary

Figure 2. The Effects of Accountability Congruence on Job Satisfaction via Role Ambiguity

6 Discussion and Conclusion

Drawing on CDT (Festinger, 1957), perceptual congruence research (e.g., Srull and Wyer, 1988; Benlian, 2013), and algorithmic accountability literature (e.g., Wieringa, 2020), this study examined the extent to which AI developers attribute accountability to themselves compared to the extent to which they perceive others attribute accountability to them. Subsequently, this study aimed to clarify how corresponding perceptual (in)congruence regarding these perceptions of accountability affects AI developers’ job satisfaction and whether, and if so, how role ambiguity mediates these effects.

Our study’s empirical results demonstrate that AI developers experience intrapersonal perceptual incongruence regarding their accountability for developed AI-based systems. Moreover, they provide evidence that, contrary to our initial hypothesis, AI developers attribute more accountability to themselves than they perceive others to attribute to them. Additionally, we show that when such intrapersonal perceptual incongruence is low, and thus intrapersonal perceptual congruence between self-attributed accountability and others-attributed accountability prevails, AI developers perceive higher job satisfaction during AI-based system development projects. Moreover, we show that the
positive effects of intrapersonal perceptual congruence regarding accountability on job satisfaction can be explained through reduced role ambiguity.

6.1 Contributions to Research and Practice

Our study extends IS research in three important ways. First, we advance previous work by increasing our understanding of how AI developers perceive attributed accountability and implications that follow. This is especially relevant when considering AI developers’ increasing relevance in AI-based system development projects. Previous research qualitatively examined AI developers’ perceptions of their accountability regarding high-level guidelines for developing AI-based systems (Seguel and Vaast, 2021). However, it has not been investigated how accountability perception and specifically related intrapersonal perceptual congruence affects AI developers’ job satisfaction. Through our findings, it becomes clear that it is crucial to consider these perceptions, as we show that AI developers already attribute more accountability to themselves than they assume others attribute to them. This finding is particularly important in light of ongoing discussions about who should be held accountable for AI-based systems and their outcomes, with AI developers increasingly coming into focus. Further, we show that fostering AI developers’ intrapersonal perceptual congruence regarding accountability can increase their job satisfaction. Therefore, our study contributes to understanding the effects of perceptual accountability (in)congruence on AI developers’ job satisfaction and helps to understand accountability’s partially contradictory effects on job satisfaction identified so far. This is important as it highlights the role of accountability as a job characteristic that crucially shapes job satisfaction in the context of ISD projects.

Second, through our distinction between self-attributed accountability and others-attributed accountability, we show that accountability cannot be understood as a uniquely assignable and perceived construct. Previous accountability research in the context of AI-based systems has been primarily concerned with who should be held accountable and why (e.g., Martin, 2019b) or how accountability assignments can be addressed with technically driven frameworks or guidelines (e.g., Raji et al., 2020; Tóth et al., 2022; Matus and Veale, 2022). How individuals perceive these attributions has received scant attention from IS research. We revealed that these perceptions are relevant in dealing with attributed accountability and have tangible effects on AI developers. Therefore, our findings underscore the relevance of considering perceptions and effects on individuals when proposing solutions to accountability issues rather than relying mainly on technical terms, as has been done in the past.

Our third and final contribution is to shed light on the importance of intrapersonal perceptual (in)congruence. Previous IS perceptual congruence has focused mainly on the effects of interpersonal perceptual (in)congruence of IS stakeholders (e.g., Benlian, 2014; Benlian and Haffke, 2016; Maruping et al., 2019). It was also shown that ISD projects benefit from intrapersonal perceptual congruence between ISD project participants (e.g., Narayanaswamy et al., 2013; Basnet and Lane, 2005; Jenkin et al., 2019). However, the effects of intrapersonal perceived (in)congruence on ISD project participants have remained unconsidered, although emerging social dilemmas have suggested their relevance (e.g., Strümke et al., 2022). By examining AI developers’ intrapersonal perceptual (in)congruence regarding their accountability in AI-based development projects, we show that such (in)congruences can affect their work attitudes, introducing another perspective that can contribute to the success of ISD projects.

In addition to our research contributions, our primary practical implication is to highlight the importance of intrapersonal perceptual congruence and the adverse effects of intrapersonal perceptual incongruence on IS employees’ job satisfaction. These results suggest that organizations developing and operating AI-based systems should enhance and harmonize their organizational communication regarding attributions of accountability to promote intrapersonal perceptual congruence. Even today, it remains one of the biggest challenges for companies to build, recruit or retain talent with AI skills (e.g., IBM Corporation, 2022). Accordingly, it is of utmost importance for companies to motivate their employees to stay, which can be promoted through increased job satisfaction of IS employees. Potential intrapersonal perceptual incongruences among AI developers regarding their accountability listed in our study are simultaneously juxtaposed with potential solutions: AI developers need to be sure of what they are accountable for. An
intrapersonal perceptual congruence generated in this way increases their job satisfaction by reducing their role ambiguity, giving them fewer reasons to search for other and potentially more satisfactory professional opportunities. Corresponding advancements will benefit not only individual AI-based system development projects but also the companies in which they are conducted.

6.2 Limitations and Directions for Future Research

Three limitations of the present study should be considered. First, our study only investigates AI developers’ intrapersonal perceptual (in)congruences. It does not contrast them with intrapersonal perceptual (in)congruences of other relevant AI stakeholders (i.e., managers and users) in the socio-technical context of AI-based systems. However, perceptual congruence models are not fully considered until both intrapersonal and interpersonal perceptual (in)congruences have been examined. Since our primary goal was to discuss intrapersonal perceptual (in)congruence regarding AI developers’ self-attributed accountability and others-attributed accountability and its effects, we did not survey dyadic pairs (e.g., developers and managers of AI-based system development projects). Therefore, this study only takes an essential first step in investigating potential perceptual (in)congruences of accountability in development projects of AI-based systems. Accordingly, research building on this study should conduct dyadic studies between at least two relevant stakeholders in AI-based system development projects. Similarly, follow-up studies could choose a qualitative approach to examine the drivers of the different accountability perceptions revealed in this study. In addition, it would be valuable to investigate potential strategies AI developers choose to overcome the corresponding intrapersonal perceptual incongruence regarding accountability and thus reduce their role ambiguity and ultimately induce psychological well-being.

Likewise, we have chosen a comparatively limited analysis tool based on linear regressions and the presented numerical scoring technique. Therefore, we reduced the two dimensions of self-attributed accountability and others-attributed accountability to one dimension, accountability congruence; thus, our final model was only two-dimensional instead of potentially more adequate three-dimensional models. For example, similar IS perceptual congruence research has already applied quadratic polynomial regressions and response surface methodologies (e.g., Benlian, 2013; Maruping et al., 2019). Analyses building on such methodologies lend themselves to be used to discuss fine-grained differences between the two accountability perceptions instrumentalized here and their respective effects.

Finally, the setting of AI-based system development projects is a setting that depends on many more factors than self-attributed accountability or others-attributed accountability of involved AI developers. Previous research suggested that even the choice of project management styles affects work attitudes, such as the constructs of role ambiguity or job satisfaction examined here (e.g., Hemon-Hildgen et al., 2020; Tripp et al., 2016). Comparable research in the IS field has also already shown that project success is positively related to overcoming multi-faceted problems, which is likely to affect AI developers’ job satisfaction (e.g., Nelson, 2007; Narayanaswamy et al., 2013). However, by carefully considering such respective ISD project trajectories and multi-faceted problems, it should be possible to find support for our results on software developers’ perceptual (in)congruence in the context of other ISD projects. In addition, follow-up studies could also explore other perceptions of AI developers in more depth and examine their effects on different work attitudes.

Acknowledgments

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European Commission (2021). Laying down harmonised rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain union legislative acts.


