2024

Transparency of Algorithmic Control Systems and Worker Judgments

Maximilian Kempf
TU Darmstadt, Germany, maximilian.kempf@stud.tu-darmstadt.de

Filip Simić
TU Darmstadt, Germany, filip.simic@stud.tu-darmstadt.de

Armin Alizadeh
TU Darmstadt, Germany, alizadeh@ise.tu-darmstadt.de

Alexander Benlian
TU Darmstadt, Germany, benlian@ise.tu-darmstadt.de

Transparency of Algorithmic Control Systems and Worker Judgments

Research Paper

Maximilian Kempf[1], Filip Simić[1], Armin Alizadeh[2], and Alexander Benlian[2]

[1] Technical University of Darmstadt, Darmstadt, Germany
{maximilian.kempf, filip.simic}@stud.tu-darmstadt.de
[2] Technical University of Darmstadt, Information Systems and Electronic Services, Darmstadt, Germany
{alizadeh, benlian}@ise.tu-darmstadt.de

Abstract. The use of algorithms to guide worker behavior, referred to as algorithmic control (AC), is increasingly prevalent in organizations. Despite its potential operational benefits, prior research indicates that workers often struggle with the opaque nature of such systems. Our research aims to explore how workers perceive, judge, and react to AC systems when exposed to two distinct facets of algorithmic transparency (AT): input and transformation AT. Through an experimental study with 121 participants, we provide empirical evidence that increased transparency about the algorithm's transformation process significantly enhances workers' perceived AT, which in turn positively impacts workers' judgments and, ultimately, their continuance intention and acceptance of an AC system. In doing so, we provide practical recommendations for organizations to mitigate the adverse effects associated with algorithmic control.
Keywords: Algorithmic control, algorithmic transparency, worker judgments

1 Introduction

The modern workplace is being transformed by the continuous collection of data through ubiquitous digital devices and the integration of artificial intelligence for decision making (Brynjolfsson & McAfee, 2014). This transformation has given rise to the concept of algorithmic control (AC), which refers to the use of these advanced technologies to guide worker activities in alignment with organizational goals (Wiener et al., 2023). While AC has been studied mainly within platform-based organizations (e.g., ride-hailing or food-delivery platforms), it has recently also spread into more conventional work settings (Benlian et al., 2022; Cameron et al., 2023). One particularly noteworthy example for AC in conventional work settings are employee management systems, such as Microsoft Viva. These systems utilize algorithms to monitor worker activity, such as calendar schedules, set productivity goals, and deliver feedback (John et al., 2023). As a result, these systems are automating managerial tasks that were traditionally performed by human managers (Kellogg et al., 2020; Möhlmann et al., 2021).

Although the use of AC promises significant benefits to organizations, including enhanced efficiency and scalability of control mechanisms (Kellogg et al., 2020), it comes

19th International Conference on Wirtschaftsinformatik
September 2024, Würzburg, Germany

with significant drawbacks. One core issue associated with AC is the opaque nature of these systems (Kellogg et al., 2020). Workers frequently report increased job-related uncertainties when subjected to AC systems due to a lack of transparency regarding the underlying algorithms and their decision-making processes (Möhlmann & Henfridsson, 2019). This obscurity can lead to feelings of alienation and decreased job satisfaction, as workers struggle to understand the rationale behind task assignments and performance evaluations (Lee et al., 2015). To mitigate these negative outcomes, scholars suggest that AC systems should be designed to provide more information about their inner workings to mitigate these negative aspects of AC (Benlian et al., 2022; Möhlmann et al., 2021; Ajunwa, 2020). However, despite these frequent recommendations, there is a notable lack of empirical research exploring the effects of increased transparency concerning AC systems on worker judgments of AC. Against this background, our study aims to answer the following research question:

How do varying levels of transparency in AC systems affect worker perceptions, judgments, and reactions toward AC?

To address our research question, we leveraged existing literature on algorithmic transparency (Bitzer, 2022) to describe two distinct forms of AT in AC systems: input and transformation AT. In an online experiment with 121 participants using a fictional employee management system, we found that transformation AT significantly increased perceived AT, unlike input AT, which had no significant effect. Perceived AT positively influenced workers' judgments of AC, which in turn positively correlated with their acceptance and continuance intention.

Our study makes two key contributions to AC research. First, while existing research often treats transparency in AC as an abstract requirement, we leverage AT literature to define two specific forms of transparency within AC systems: input and transformation AT as action. Second, we provide rare empirical evidence linking perceived AT to worker judgments in conventional work settings, demonstrating that not all forms of transparency positively affect workers' perceptions. Consequently, we recommend that future AC research adopts a more granular approach to transparency, in order to provide organizations with concrete recommendations for action.

2 Conceptual Background

Our study builds on recent advancements in research on AC and AT. Initially, we introduce the concept of AC and how it unfolds in different work settings. Subsequently, we review recent approaches to studying worker judgments of AC systems. Finally, we draw on an existing conceptualization of AT, detailing its relevance and application within the AC context, thereby laying the groundwork for our empirical investigation.

2.1 Opaqueness of Algorithmic Control and Worker Judgments

The notion of AC represents a new form of organizational control that leverages intelligent algorithms and advanced digital technologies to align worker activities with organizational goals (Wiener et al., 2023). Compared to previous forms of (human-

based) control, AC is considered to be a more comprehensive, interactive, instantaneous, and opaque form of control (Kellogg et al., 2020). AC is considered the backbone of platform-based organizations, such as Uber and Deliveroo, which guide millions of workers through their smartphone app (Cameron et al., 2023; Wiener et al., 2023). In more conventional work settings, AC becomes embedded within established power dynamics between managers and workers, redefining their roles, relationships, and information exchange, thereby resulting in a shift in power dynamics (Jarrahi et al., 2021). Therefore, in more conventional work settings, AC typically has a complementary character, replacing only some managerial functions and delivering control together with the human manager (Wiener et al., 2023; Jarrahi et al., 2021). A prominent example in this regard, which also builds the backdrop for our study, is employee management systems, such as Microsoft Viva, which provide individual-level recommendations to workers, such as "Stay connected with you collaborators - You don't have 1:1 meetings over next 2 weeks. Here are suggested times that work everyone." (John et al., 2023).

Research in the context of AC has identified both advantages and disadvantages for workers. On the positive side, AC can provide precise, real-time feedback, a capability beyond the scope of conventional human supervision (Parent-Rocheleau & Parker, 2022; Benlian et al., 2022; Kellogg et al., 2020). AC systems can analyze vast amounts of data from different data sources in real time to assess individual working behaviors and recommend specific actions tailored to each worker (Cram et al., 2022; Hirsch et al., 2023). However, the widespread adoption of AC also introduces significant challenges, including concerns over job autonomy, constant surveillance, and the potential erosion of trust within the workplace (Kinowska & Sienkiewicz, 2022; Möhlmann & Henfridsson, 2019; Göttel, 2021; Kellogg et al., 2020; Spiekermann et al., 2022).

Recently, a growing body of research has been investigating how specific design features of AC affect workers, aiming to amplify benefits and mitigate drawbacks of AC use (Wiener et al., 2023; Cram et al., 2022; Parent-Rocheleau & Parker, 2022). A principal design recommendation emerging from these studies is the need for greater transparency, as "algorithmic opaqueness can be very frustrating to the workers exposed to algorithmic instructions, causing them to experience uncertainties about [...] the accuracy and fairness of algorithmic instructions" (Benlian et al., 2022, p. 830). Surprisingly, empirical research on the relationship between increased transparency and worker perceptions is scant and yields mixed results. Göttel (2021) identified a positive correlation between the disclosure of information and workers' retention intentions within a ride-hailing platform context. Conversely, Cram et al. (2022) observed that perceived AT did not significantly affect workers' perceptions of technostress under AC and therefore suggest to examine how different elements of transparency impact worker perceptions of AC.

To examine how different AC designs affect workers, recent studies have employed a three-step model of AC perception, judgment, and reaction (Wiener et al., 2023). With this study, we apply this approach to assess how different levels of transparency impact workers' perceptions (i.e., perceived AT of an AC system), judgments, and reactions. We specifically focus on two reactions that are frequently discussed in the literature and have significant practical implications: acceptance of an algorithmic recommendation and the continuance intention to use the system (Wiener et al., 2023; Lee et al., 2015). Regarding judgments, our study concentrates on three key dimensions frequently highlighted in

AC research: autonomy, privacy, trust. Additionally, considering the specific context of this research, we have also included credibility as a critical judgment dimension. It is common research practice to focus on the most relevant dimensions, though it is acknowledged that the list of possible judgments can never be exhaustive (Wiener et al., 2023). Table 1 provides detailed definitions and illustrative examples for these dimensions.

Table 1. Dimensions of Worker Judgments

Dimension	Short description	Illustrative example in the traditional context	Reference
Privacy	Workers judge AC practices as appropriate, respecting their personal information during data collection, storage, and use.	A Microsoft viva user feels that the app-usage data collected by the company are relevant to her/his work and will contribute to better work outcomes.	Wiener et al. (2023)
Autonomy	Workers judge AC practices as empowering, while allowing them to act independently.	A Microsoft viva user values the flexibility of working when and where he or she chooses.	Wiener et al. (2023)
Trust	Workers judge AC practices as trustworthy.	A Microsoft viva user believes the application and recommendations are well-meaning and honest.	Bitzer et al. (2021)
Credibility	Workers judge AC practices as believable.	A Microsoft viva user views the information presented by the application as authentic and unbiased.	Shin et al. (2022)

2.2 Algorithmic Transparency

The notion of algorithmic transparency was first articulated by Diakopoulos & Koliska (2017). They conceptualized algorithmic transparency as "the disclosure of information about algorithms to enable monitoring, checking, criticism, or intervention by interested parties" (p. 811). This perspective assumes that there are at least two distinct roles within the transparency dynamic: the disclosing party (i.e., the AC system within the scope of our study), which shares information about the algorithms, and the receiving party (i.e., workers in our study), which interacts with this information (Bernstein, 2017; Bitzer et al., 2023).

Building on this definition, a recent literature review (Bitzer et al., 2023) conceptualized AT in terms of *AT as action* and *AT as perception*. AT as action involves the disclosing party providing information about an algorithm to its users. AT as perception focuses on how users observe and interpret this information. Although these concepts are related, not every facet and amount of information shared leads to a correspondent perception. Instead, this relationship is dependent on the specific context and recipient of the information (Bitzer et al., 2023). Additionally, Bitzer et al. (2023) conceptualize AT along the algorithmic process itself. The definition of an algorithm, “encoded procedures for transforming input data into a desired output based on specified calculations” (Gillespie et al., 2014, p. 167), stresses that algorithms can be seen as a process. Thus, algorithmic information can be provided for every step of an algorithm’s input, transformation, or output (Bitzer et al., 2023).

Recent research highlights that workers are also seeking insights into the inner workings of an AC system, particularly regarding what data is fed into the system (i.e., input transparency) and how the system processes this data to derive instructions (i.e., transformation transparency). For example, AC workers demand more transparency regarding the data collection and the processing of how tasks are assigned (Ajunwa,

2020; Möhlmann & Henfridsson, 2019). Therefore, these two forms are in the focus of this study. Table 2 provides an overview of the concepts, including illustrative examples of the two transparency forms.

Table 2. Two Forms of Algorithmic Transparency

Construct	Definition	Illustrative Example
IATA	Input algorithmic transparency as action	Information on why and how data is collected (e.g., calendar for schedule optimization)
TATA	Transformation algorithmic transparency as action	Information on the algorithm's logic (e.g., schedule is generated based on analyzed work patterns)

3 Hypothesis Development

3.1 AT as Action and Perceived AT

Looking at the impact of AC on workers, stakeholders frequently demand greater transparency with respect to their usage (Benlian et al., 2022). However, the degree of perceived AT of workers differs remarkably when they are provided with different types of information. Some details about algorithms may not even influence individuals' perceptions of AT (Bitzer et al., 2023). Nevertheless, despite the lack of direct investigation, the majority of studies implicitly suggest that greater AT as action is truly associated with increased AT as perception (Cramer et al., 2008; Lehmann et al., 2020; Wang & Benbasat, 2007; Wang & Benbasat, 2016; Salminen et al., 2020; Bitzer et al., 2023). In the context of this study, we scrutinize the disclosure of two different types of information. The first one is IATA. Workers demand a higher level of transparency regarding the data collection (Ajunwa, 2020), since often they are not even aware of the existence or purpose of such data collections (Kellogg et al., 2020). Providing workers with desired information about the input of algorithms may contribute to a higher perception of AT. Therefore, we propose the following hypothesis:

Hypothesis 1a: *IATA is positively related to workers' perceived AT.*

The second form is TATA. Scholars point out one main concern in human-algorithm interaction, which is the lack of perceived AT in regards to how the algorithms' output is generated (Tarafdar et al., 2023; Bernstein, 2017). Hence, individuals who receive information about the inner logic of algorithms may perceive greater AT when provided in a way that humans can understand (no machine code). We propose the following hypothesis:

Hypothesis 1b: *TATA is positively related to workers' perceived AT.*

3.2 Perceived AT and Worker Judgments

Numerous of the impeding beliefs and perceptions, lowering worker judgments, come from the aspect of uncertainty (Bitzer et al., 2021). One possible way to mitigate individuals' uncertainty is to disclose information, or, in other words, to increase their

perceived AT (Bernstein, 2017; Bitzer et al., 2021) and thereby positively influence their worker judgments. By increasing workers' perceived AT, they gain insights into the inner processes of AC systems and potentially drop their concerns about data misuse and incorrect calculations. In this study, we conceptualized worker judgments in terms of four dimensions (autonomy, privacy, trust, credibility), all of which appear to be affected by perceived AT. Regarding autonomy, Vaassen (2022) argues that more transparent algorithms enable individuals to gain insights into the explanations behind algorithmic recommendations. This increased understanding allows them to make well-informed decisions about whether to accept or decline such recommendations, leading to higher levels of autonomy. Transparency and privacy are closely related (Bernstein, 2017) and research has been called to examine the effect of perceived AT on privacy (Bitzer et al., 2023). Sharing information about why and how algorithms collect data might reduce users' privacy concerns and, thus, enhance their judgment about the privacy aspects of the underlying AC system. The relationship between AT and trust has shown contrasting findings when considering different contexts (Lehmann et al., 2020). Regarding the context of our study, we draw upon the following assumptions: Through higher perceived AT, workers understand that organizations have nothing to conceal concerning their algorithms and provide relevant information with positive intentions (Bitzer et al., 2021). Hence, we argue that enhanced perceived AT increases workers' trust judgments towards AC systems. When examining credibility, workers who view AC systems as transparent interpret the presented information as more authentic and recognize their output as unbiased (Shin et al., 2022). Therefore, we conclude that increased perceived AT is related to higher judgments of credibility. Thus, we propose the following hypothesis:

Hypothesis 2: *Perceived AT is positively related to worker judgments.*

3.3 Worker Judgments and Behavioral Reactions

In this study, we focus on two common behavioral reactions of workers resulting from their judgments about AC systems. First, we examine the extent to which workers accept algorithmic recommendations. This is of great importance, as it is the most common approach to direct workers to specific decisions or behaviors intended by their employers (Kellogg et al., 2020). The second reaction is the degree to which workers plan to continue working with a given AC system. Implementing AC systems in organizations requires substantial effort and investments (Christin, 2017). Therefore, it is crucial for organizations to achieve high adoption rates to make the investment worthwhile. In the following paragraphs, we investigate each behavioral reaction. Algorithmic recommending is widely spread for the purpose of affecting workers by suggesting they behave in a certain way or perform desired actions (Hirsch et al., 2023; Kellogg et al., 2020). However, the effectiveness of such an instrument heavily depends on workers' acceptance of these recommendations.

From an organizational perspective, the concept can be compared to an advice-taking and decision-making scenario. Existing research in this context suggests that autonomy is positively associated with following the recommendations of credible advisors (Koestner et al., 1999). Conversely, workers who judge the advisor as questionable are unlikely to accept recommendations. Apart from this, Koestner et al. (1999) further indicates

that individuals would decline recommendations to a greater extent if they suspected the advisors' goals not to be aligned with their own, which may result in a positive relationship between trust and advice-taking. We assume these considerations are transferable to the context of workers and AC systems. Following the line of arguments, workers who experience no restriction on their autonomy and judge the underlying AC system as trustworthy and credible are more likely to accept recommendations from AC systems. Formally, we state this hypothesis as follows:

Hypothesis 3: *Worker judgments are positively related to workers' acceptance of algorithmic recommendations.*

The integration of AC systems in conventional organizations is associated with high costs and the effort of aligning AC systems and human employees, leading to an uncertain return on investment (Christin, 2017; Burton et al., 2020). In addition, organizations that implement AC systems are also characterized by high turnover rates (Anderson, 2016; Bujold et al., 2022; Delfanti, 2021). As a consequence, organizations benefit from increasing workers' commitment to the organization and their AC system. Prior studies found that autonomy leads to less tension and higher job satisfaction (Deci & Ryan, 1987; Kinowska & Sienkiewicz, 2022), indicating that workers may stay longer in the organization's ecosystem, including their AC system. In terms of privacy, individuals are aware of the surveillance practices and utilization of personal data by organizations, yet their perceptions vary (Wiener et al., 2023). Perceived invasions of workers' privacy are likely to result in reduced organizational commitment and a higher turnover rate (Hodson et al., 1999; Smith & Tabak, 2009; Tabak & Smith, 2005). Another aspect to consider concerning continuance intention is trust, since it contributes to loyalty towards a specific system. Prior research analyzed this relationship in the context of the sharing economy (Jiang & Lau, 2021) as well as voice-controlled artificial intelligence (Hasan et al., 2021) and revealed significant positive effects. The effects of credibility have not yet been investigated in the AC literature. However, the credibility of online platforms has been found to positively impact the continuance intention of their users (Filieri et al., 2021). We suppose this relationship is also transferable to the context of AC systems. Following the above lines of arguments, we assume that AC workers with enhanced judgments intend to continue working with AC systems more often and hypothesize the following:

Hypothesis 4: *Worker judgments are positively related to workers' continuance intention.*

4 Experimental Study

4.1 Design and Procedure

In the particular case of this study, we implemented a 2x2 between-subjects design experiment consisting of four randomly assigned scenarios, followed by a survey. Past Information Systems research conducted similar approaches for their experiments (Göttel, 2021; Lee, 2018).

The subject of our experiment was a fictional application called “WorkFlowZen”, which simulated an employee management system, a prominent example of AC in conventional work settings. Such systems analyze employee data to provide managers with detailed insights into worker behaviors, activities, and performance, thereby offering recommendations to boost productivity (Jarrahi et al., 2021). WorkFlowZen offered the functionality of presenting personalized recommendations for weekly schedule optimizations.

The experiment started by asking the participants to imagine being in the following scenario: The attendees are employed in an office setting with flexible working hours. Their boss introduces them to an application called "WorkFlowZen". The participants are informed about the functions of the app, which include providing work and well-being improving analytics as well as recommendations tailored to their unique needs. They were instructed to carefully examine the application and decide whether they wanted to accept or decline the recommendation provided by WorkFlowZen.

The participants were then randomly assigned to one of four different experimental scenarios and directed to the initial page, imitating a first visit to the application. They were asked to provide access to their office suite usage data, screen time, and calendar. We varied the quantity of information considering IATA (low or high). Participants in the high information group received the following two pieces of information: **"This access enables us to personalize your tasks, track your activities, and enhance productivity while prioritizing your data privacy."**; **"The application discreetly captures your work hours at different times of the day, allowing it to evaluate data and offer personalized scheduling recommendations."** Participants in the low-information group received no additional information.

Next, participants were redirected to the second page of the experiment, where they were presented with analytical metrics and a personalized recommendation. Similarly, we manipulated the quantity of information associated with TATA (low or high). Participants in the high-information group received the following piece of information: **"This recommendation is based on our analysis of your work patterns using office suite usage data. We’ve observed that your peak productivity hours typically occur in the afternoon. Applying this recommendation, you can optimize your work schedule to align with your peak productivity, promoting overall well-being and efficiency."** Participants in the low-information group received no additional information.

After inspecting the page, participants decided whether they wanted to accept or decline the recommendation. Consequently, this resulted in a change in their fictional regular weekly schedule. After finalizing their decision, they were redirected to the survey.

4.2 Survey Instrument and Data Collection

In the first part of the questionnaire, all dependent and independent latent variables were measured reflectively on a 7-point Likert scale (1 = "strongly disagree" and 7 = "strongly agree"). We measured perceived AT by adapting existing scales to our specific context (Wang & Benbasat, 2016; Zhou et al., 2018). The construct served as the dependent variable for hypotheses H1a and H1b as well as the independent

variable for hypothesis H2. The four dimensions of worker judgments were assessed by implementing customized items from previous studies: privacy (Alge et al., 2006), autonomy (Goldbach et al., 2018), trust (Cyr et al., 2009), credibility (Thielsch & Hirschfeld, 2019). We combine these four variables into a reflective-formative second-order construct, following the notion of previous studies that view them as building parts of worker judgments (Wiener et al., 2023). Furthermore, this aggregation reduces the overall complexity of the measurement model (Hair et al., 2018; Polites et al., 2012). To capture workers' acceptance of recommendations and continuance intention, we applied constructs developed by Abraham et al. (2019) and Goldbach et al. (2018).

To check for potential confounded effects, we collected several control variables at the end of the questionnaire: general privacy concern (Martin et al., 2017), algorithmic literacy (Flynn & Goldsmith, 1999), technology use index at work and personally (Abraham et al., 2019), positive and negative attitude towards technology (Rosen et al., 2013). To ensure external validity, we implemented a reality check (Jones et al., 2006; Göttel, 2021), asking participants to assess the presented scenario regarding its authenticity on a 7-point scale from "not realistic" to "very realistic". The results demonstrate participants perceived the experiment as realistic (M = 4.73, SD = 1.62). In addition, the survey included two attention checks to reject straight-liners and inattentive participants.

Our study recruited participants through the crowd-sourcing platform Prolific, providing high-quality data (Peer et al., 2017; Palan & Schitter, 2018). The total sample size reached 121 after excluding incomplete responses and failed attention checks. The participants had a mean age of 28.5 (SD=8) years, and regarding gender, the sample was balanced, with 53.3% being male and 46.7% female.

4.3 Data Analysis

To test hypotheses H1a and H1b of our research model, we employed a two-way ANOVA. We evaluated the hypotheses H2, H3, and H4 of the research model through a structural equation model using SmartPLS 4 (Ringle et al., 2022). The partial least squares structural equation modeling (PLS-SEM) algorithm was the most suitable choice since it handles our reflective-formative second-order construct worker judgments (Hair et al., 2011; Ringle et al., 2012). Following the set standards, we then performed a bootstrapping algorithm with 5000 subsamples to evaluate the significance of the relationships (Hair et al., 2011). Due to the higher-order construct, the model was implemented using a two-step approach (Hair et al., 2018). First, we calculated latent variable scores for the lower-order constructs, including privacy, autonomy, trust, and credibility. Afterward, these scores were combined to measure the higher-order construct worker judgments. During the first step, we evaluated several metrics of our measurement model to ensure valid results. Starting with indicator reliability, we analyzed the outer loadings of each item and removed one autonomy, one privacy, and one perceived AT item. The remaining items all passed the benchmark of 0.708 proposed by Hair et al. (2017). Subsequently, we looked at the internal consistency reliability and chose the reliability coefficient rho_α, whereby all values are in the acceptable range (0.6–0.95). For measuring convergent validity, we selected the average variance extracted. All constructs passed the threshold of 0.5. To assess discriminant validity, this study applied the Fornell-Larcker criterion,

which all constructs passed. Concerning the second step, we recalculated our model with the assembled formative second-order construct and ensured the reliability and validity of the new model. However, the outer weight of the privacy item was above the significance level (β = 0.137, p = 0.071). Yet, all items' outer loadings are highly significant (autonomy: β = 0.613, p < 0.001; privacy: β = 0.651, p < 0.001; trust: β = 0.941, p < 0.001; credibility: β = 0.887, p < 0.001). Considering that formative indicators don't have to be excluded solely based on the statistical outcomes (Hair et al., 2017), we decided to keep privacy in the measurement model because of its conceptual importance for the research model (Bijlsma-Frankema & Costa, 2010; Wiener et al., 2023).

5 Results

5.1 Results of H1a & H1b

The results of the two-way ANOVA indicate no significance for hypothesis H1a (F(1, 117) = 0.615, p > 0.05). Participants who received information about why they should give access to their applications and how data is utilized did not show higher levels of perceived AT than participants who received no information about this criterion. However, hypothesis H1b is statistically significant (F(1, 117) = 12.868, p < 0.01). Participants who received information about why they got their personalized recommendation reported higher perceived AT compared to participants who received no information about this criterion. Regarding the descriptive statistics, the scenarios revealed the following characteristics: with IATA and TATA both low, the mean perceived AT is 4.208 (SD = 1.188, N = 39). With low IATA and high TATA, the mean is 4.946 (SD = 1.066, N = 21). High IATA and low TATA result in a mean of 4.423 (SD = 1.107, N = 26). Both high yield a mean of 5.029 (SD = 1.019, N = 35). The model explains 7.6% of the variance in perceived AT (R^2 = 0.099, adjusted R^2 = 0.076).

5.2 Results of H2 & H3 & H4

The results of the structural equation model suggest the following: The hypothesis H2 is statistically supported by the results (β = 0.535, p < 0.001). This indicates that workers who perceived the AC system as more transparent also showed greater judgments. Moreover, the results support hypothesis H3 (β = 0.712, p < 0.001), showing that workers with higher judgments tend to accept algorithmic recommendations more often. Likewise, hypothesis H4 is supported (β = 0.729, p < 0.001). Therefore, workers who express higher-level judgments are more likely to work with the AC system in the future. The control variables were not found to be significant. Figure 1 summarizes the results.

Lastly, the model was analyzed for any mediation effects of worker judgments. Therefore, we examined the effects of perceived AT on acceptance and continuance intention, respectively. To do so, we added direct connections to the existing research model, following the guidelines proposed by Hair et al. (2017). The outcomes reveal that both indirect effects (with worker judgments as mediators) are significant, while only perceived AT appears to influence acceptance through an immediate effect. As a consequence, the relationship between perceived AT and recommendation acceptance is

partially mediated by worker judgments, whereas the connection between perceived AT and continuance intention is *fully* mediated (see Table 3). Given the opposite signs of the direct and indirect effects between perceived AT and acceptance (negative direct effect), the relationship is characterized by a competitive mediation effect (Hair et al., 2018).

Table 3. Analysis of Mediation Effects.

	Direct effect		Indirect effects		
Path	Path coefficient	p-value	Path coefficient	p-value	Analysis results
PT → AC	**-0.217**	0.006	**0.441**	0.000	*Partial mediation*
PT → CI	0.025	0.753	**0.393**	0.000	Full mediation

Significant effects in bold.
PT = Perceived AT, AC = Acceptance of recommendations, CI = Continuance intention.

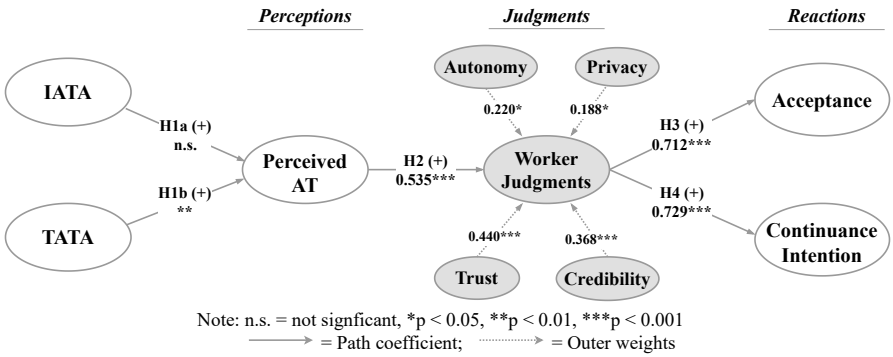

Figure 1. Visualization of the Research Model and Results

6 Discussion and Conclusion

The purpose of this research was to examine whether more and different information about the inner workings of AC systems affects how workers perceive, judge, and react to AC systems. Thereby, workers' perceived AT, worker judgments, and behavioral reactions, namely acceptance of recommendation and continuance intention, were analyzed. The empirical results of our experimental study show that providing information about the transformation process of algorithms increases workers' perceived AT, whereas information about the input of algorithms seems to have no significant effect. One possible explanation is that the provided information about the algorithm's input was not sufficient. Participants were asked an additional optional question: *In which area of the application do they want to see enhanced transparency?* Multiple high IATA group responses requested more detailed information about when exactly the application captures data, where and how long the data is stored (regarding third parties), and reasons for collecting each type of data. Another reason may be that worker information needs

vary greatly by context. We further observed the importance of worker judgments serving as a mediator in linking workers' perceived AT with their consequential reactions. Additionally, as an observation of our mediation analysis, we find a direct effect of perceived AT on acceptance of recommendations to be positively related, confirming prior studies (Cramer et al., 2008). This indicates that AC workers with enhanced perceived AT are more likely to accept AC recommendations.

6.1 Research Contributions

This research contributes to the existing research on AC in two ways: Conceptually, our study bridges the gap between recent AC and AT research. While calls for greater transparency within AC are a recurrent theme in the AC literature (Benlian et al., 2022; Cameron et al., 2023; Möhlmann & Henfridsson, 2019), these calls remained somewhat broad and often lacked specificity. This is why recent studies emphasized the need to examine different elements of transparency in more detail (Cram & Wiener, 2020). By leveraging the concepts of IATA and TATA, and distinguishing between AT as action and AT as perception (Bitzer et al., 2023), this research paves the way for future, more nuanced investigations into transparency in AC settings. Empirically, our study provides a rare insight into how workers' perceive, judge, and react to different levels of provided transparency in AC systems. Through experimental investigation, we observed a significant correlation between TATA and workers' perceived AT, while IATA showed no such relationship. These results may suggest that employees assign different importance to different types of information if they want to better understand the inner workings of the AC system. Additionally, we found a strong positive relationship between perceived AC, worker judgments, and reactions, aligning with prior assumptions in previous research (Parent-Rocheleau & Parker, 2022). However, it had not been demonstrated through an experimental setup.

6.2 Limitations and Future Research

Our paper acknowledges several limitations. First, our cross-sectional experimental design hinders the ability to establish cause-and-effect relationships (Spector, 2019). Therefore, the causal interpretations we provide are based on recent literature and logical reasoning. Additionally, the distribution of the participants across the four scenarios was not perfectly balanced. Future research should address these limitations by implementing a longitudinal study to confirm the results suggested by our experimental study (Cram et al., 2024). Second, as our research context, we focused on a prominent application of AC in conventional settings, namely employee management systems. While these systems represent a subtler form of AC, there exist more coercive applications of AC in traditional work environments, such as AC in warehouses (Delfanti, 2021). This variation in AC manifestations raises questions about the generalizability of our findings. Hence, we recommend investigating the relationships in other conventional work contexts like warehouses (Delfanti, 2021).

References

Abraham, M., Niessen, C., Schnabel, C., Lorek, K., Grimm, V., Möslein, K. & Wrede, M. (2019), 'Electronic monitoring at work: The role of attitudes, functions, and perceived control for the acceptance of tracking technologies', *Human Resource Management Journal* **29**(4), 657–675.

Ajunwa, I. (2020), 'The "black box" at work', *Big Data & Society* **7**(2), 205395172096618.

Alge, B. J., Ballinger, G. A., Tangirala, S. & Oakley, J. L. (2006), 'Information privacy in organizations: empowering creative and extrarole performance', *The Journal of applied psychology* **91**(1), 221–232.

Anderson, D. N. (2016), 'Wheels in the head: Ridesharing as monitored performance', *Surveillance & Society* **14**(2), 240–258.

Benlian, A., Wiener, M., Cram, W. A., Krasnova, H., Maedche, A., Möhlmann, M., Recker, J. & Remus, U. (2022), 'Algorithmic management', *Business & Information Systems Engineering* **64**(6), 825–839.

Bernstein, E. S. (2017), 'Making transparency transparent: The evolution of observation in management theory', *Academy of Management Annals* **11**(1), 217–266.

Bijlsma-Frankema, K. M. & Costa, A. C. (2010), Consequences and antecedents of managerial and employee legitimacy interpretations of control: a natural open system approach, *in* S. B. Sitkin, L. B. Cardinal, K. M. Bijlsma-Frankema & K. Bijlsma-Frankema, eds, 'Organizational control', Cambridge companions to management, Cambridge University Press, Cambridge and New York, pp. 396–433.

Bitzer, T. (2022), 'Algorithmic transparency in action: How and why do companies disclose information on algorithms?', *AMCIS 2022 Proceedings* .

Bitzer, T., Wiener, M. & Cram, W. A. (2023), 'Algorithmic transparency: Concepts, antecedents, and consequences – a review and research framework', *Communications of the Association for Information Systems* **52**.

Bitzer, T., Wiener, M. & Morana, S. (2021), 'The role of algorithmic transparency in contact-tracing app adoption', *ICIS 2021 Proceedings* .

Brynjolfsson, E. & McAfee, A. (2014), *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*, first edition edn, W.W.Norton & Company, New York, NY and London.

Bujold, A., Parent-Rocheleau, X. & Gaudet, M.-C. (2022), 'Opacity behind the wheel: The relationship between transparency of algorithmic management, justice perception, and intention to quit among truck drivers', *Computers in Human Behavior Reports* **8**, 100245.

Burton, J. W., Stein, M. & Jensen, T. B. (2020), 'A systematic review of algorithm aversion in augmented decision making', *Journal of Behavioral Decision Making* **33**(2), 220–239.

Cameron, L., Lamers, L., Leicht-Deobald, U., Lutz, C., Meijerink, J. & Möhlmann, M. (2023), 'Algorithmic management: Its implications for information systems research', *Communications of the Association for Information Systems* **52**(1), 518–537.

Christin, A. (2017), 'Algorithms in practice: Comparing web journalism and criminal justice', *Big Data & Society* **4**(2), 205395171771885.

Cram, W. A., D'Arcy, J. & Benlian, A. (2024), 'Time will tell: The case for an idiographic approach to behavioral cybersecurity research', *MIS Quarterly* **48**(1), 95–136.

Cram, W. A. & Wiener, M. (2020), 'Technology-mediated control: Case examples and research directions for the future of organizational control', *Communications of the Association for Information Systems* **46**(1), 70–91.

Cram, W. A., Wiener, M., Tarafdar, M. & Benlian, A. (2022), 'Examining the impact of algorithmic control on uber drivers' technostress', *Journal of Management Information Systems* **39**(2), 426–453.

Cramer, H., Evers, V., Ramlal, S., van Someren, M., Rutledge, L., Stash, N., Aroyo, L. & Wielinga, B. (2008), 'The effects of transparency on trust in and acceptance of a content-based art recommender', *User Modeling and User-Adapted Interaction* **18**(5), 455–496.

Cyr, Head, Larios & Pan (2009), 'Exploring human images in website design: A multi-method approach', *MIS Quarterly* **33**(3), 539.

Deci, E. L. & Ryan, R. M. (1987), 'The support of autonomy and the control of behavior', *Journal of personality and social psychology* **53**(6), 1024–1037.

Delfanti, A. (2021), *The Warehouse: Workers and Robots at Amazon*, 1st ed. edn, Pluto Press, London.

Diakopoulos, N. & Koliska, M. (2017), 'Algorithmic transparency in the news media', *Digital Journalism* **5**(7), 809–828.

Filieri, R., Acikgoz, F., Ndou, V. & Dwivedi, Y. (2021), 'Is tripadvisor still relevant? the influence of review credibility, review usefulness, and ease of use on consumers' continuance intention', *International Journal of Contemporary Hospitality Management* **33**(1), 199–223.

Flynn, L. R. & Goldsmith, R. E. (1999), 'A short, reliable measure of subjective knowledge', *Journal of Business Research* **46**(1), 57–66.

Gillespie, T., Boczkowski, P. J. & Foot, K. A. (2014), *The Relevance of Algorithms*, Media Technologies: Essays on Communication, Materiality, and Society, The MIT Press.

Goldbach, T., Benlian, A. & Buxmann, P. (2018), 'Differential effects of formal and self-control in mobile platform ecosystems: Multi-method findings on third-party developers' continuance intentions and application quality', *Information & Management* **55**(3), 271–284.

Göttel, V. (2021), 'Sharing algorithmic management information in the sharing economy – effects on workers' intention to stay with the organization', *ICIS 2021 Proceedings* .

Hair, J. F., Hult, G. T. M., Ringle, C. M. & Sarstedt, M. (2017), *A primer on partial least squares structural equation modeling (PLS-SEM)*, second edition edn, SAGE, Los Angeles and London and New Delhi and Singapore and Washington DC and Melbourne.

Hair, J. F., Ringle, C. M. & Sarstedt, M. (2011), 'Pls-sem: Indeed a silver bullet', *Journal of Marketing Theory and Practice* **19**(2), 139–152.

Hair, J. F., Sarstedt, M., Ringle, C. M. & Gudergan, S. (2018), *Advanced issues in partial least squares structural equation modeling*, SAGE, Los Angeles and London and New Delhi and Singapore and Washington DC and Melbourne.

Hasan, R., Shams, R. & Rahman, M. (2021), 'Consumer trust and perceived risk for voice-controlled artificial intelligence: The case of siri', *Journal of Business Research* **131**, 591–597.

Hirsch, F., Alizadeh, A., Wiener, M. & Cram, A. (2023), 'Algorithmic control in platform and traditional work settings: An updated conceptual framework', *ECIS 2023 Research Papers* .

Hodson, T. J., Englander, F. & Englander, V. (1999), 'Ethical, legal and economic aspects of employer monitoring of employee electronic mail', *Journal of Business Ethics* **19**(1), 99–108.

Jarrahi, M. H., Newlands, G., Lee, M. K., Wolf, C. T., Kinder, E. & Sutherland, W. (2021), 'Algorithmic management in a work context', *Big Data & Society* **8**(2), 205395172110203.

Jiang, Y. & Lau, A. K. (2021), 'Roles of consumer trust and risks on continuance intention in the sharing economy: An empirical investigation', *Electronic Commerce Research and Applications* **47**, 101050.

John, B., Alsamarra'i, Z. & Panteli, N. (2023), 'Enhancing employee experience in the era of hybrid work: The case of microsoft viva', *IEEE Software* **40**(2), 70–79.

Jones, D. A., Shultz, J. W. & Chapman, D. S. (2006), 'Recruiting through job advertisements: The effects of cognitive elaboration on decision making', *International Journal of Selection and Assessment* **14**(2), 167–179.

Kellogg, K. C., Valentine, M. A. & Christin, A. (2020), 'Algorithms at work: The new contested terrain of control', *Academy of Management Annals* **14**(1), 366–410.

Kinowska, H. & Sienkiewicz, Ł. J. (2022), 'Influence of algorithmic management practices on workplace well-being – evidence from european organisations', *Information Technology & People* **36**(8), 21–42.

Koestner, R., Gingras, I., Abutaa, R., Losier, G. F., DiDio, L. & Gagné, M. (1999), 'To follow expert advice when making a decision: An examination of reactive versus reflective autonomy', *Journal of Personality* **67**(5), 851–872.

Lee, M. K. (2018), 'Understanding perception of algorithmic decisions: Fairness, trust, and emotion in response to algorithmic management', *Big Data & Society* **5**(1), 205395171875668.

Lee, M. K., Kusbit, D., Metsky, E. & Dabbish, L. (2015), Working with machines, *in* B. Begole, J. Kim, K. Inkpen & W. Woo, eds, 'Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems', ACM, New York, NY, USA, pp. 1603–1612.

Lehmann, C., Haubitz, C., Fuegener, A. & Thonemann, U. (2020), 'Keep it mystic? – the effects of algorithm transparency on the use of advice', *ICIS 2020 Proceedings* .

Martin, K. D., Borah, A. & Palmatier, R. W. (2017), 'Data privacy: Effects on customer and firm performance', *Journal of Marketing* **81**(1), 36–58.

Möhlmann, M. & Henfridsson, O. (2019), 'What people hate about being managed by algorithms, according to a study of uber drivers'.

Möhlmann, M., Zalmanson, L., Henfridsson, O. & Gregory, R. W. (2021), 'Algorithmic management of work on online labor platforms: When matching meets control', *MIS Quarterly* **45**(4), 1999–2022.

Palan, S. & Schitter, C. (2018), 'Prolific.ac—a subject pool for online experiments', *Journal of Behavioral and Experimental Finance* **17**, 22–27.

Parent-Rocheleau, X. & Parker, S. K. (2022), 'Algorithms as work designers: How algorithmic management influences the design of jobs', *Human Resource Management Review* **32**(3), 100838.

Peer, E., Brandimarte, L., Samat, S. & Acquisti, A. (2017), 'Beyond the turk: Alternative platforms for crowdsourcing behavioral research', *Journal of Experimental Social Psychology* **70**, 153–163.

Polites, G. L., Roberts, N. & Thatcher, J. (2012), 'Conceptualizing models using multidimensional constructs: a review and guidelines for their use', *European Journal of Information Systems* **21**(1), 22–48.

Ringle, C. M., Wende, S. & Becker, J.-M. (2022), 'Smartpls 4', `http://www.smartpls.com`.

Ringle, Sarstedt & Straub (2012), 'Editor's comments: A critical look at the use of pls-sem in "mis quarterly"', *MIS Quarterly* **36**(1), iii.

Rosen, L. D., Whaling, K., Carrier, L. M., Cheever, N. A. & Rokkum, J. (2013), 'The media and technology usage and attitudes scale: An empirical investigation', *Computers in human behavior* **29**(6), 2501–2511.

Salminen, J., Santos, J. M., Jung, S.-G., Eslami, M. & Jansen, B. J. (2020), 'Persona transparency: Analyzing the impact of explanations on perceptions of data-driven personas', *International Journal of Human–Computer Interaction* **36**(8), 788–800.

Shin, D., Lim, J. S., Ahmad, N. & Ibahrine, M. (2022), 'Understanding user sensemaking in fairness and transparency in algorithms: algorithmic sensemaking in over-the-top platform', *AI & SOCIETY* .

Smith, W. P. & Tabak, F. (2009), 'Monitoring employee e-mails: Is there any room for privacy?', *Academy of Management Perspectives* **23**(4), 33–48.

Spector, P. E. (2019), 'Do not cross me: Optimizing the use of cross-sectional designs', *Journal of Business and Psychology* **34**(2), 125–137.

Spiekermann, S., Krasnova, H., Hinz, O., Baumann, A., Benlian, A., Gimpel, H., Heimbach, I., Köster, A., Maedche, A., Niehaves, B., Risius, M. & Trenz, M. (2022), 'Values and ethics in information systems', *Business & Information Systems Engineering* **64**(2), 247–264.

Tabak, F. & Smith, W. P. (2005), 'Privacy and electronic monitoring in the workplace: A model of managerial cognition and relational trust development', *Employee Responsibilities and Rights Journal* **17**(3), 173–189.

Tarafdar, M., Page, X. & Marabelli, M. (2023), 'Algorithms as co–workers: Human algorithm role interactions in algorithmic work', *Information Systems Journal* **33**(2), 232–267.

Thielsch, M. T. & Hirschfeld, G. (2019), 'Facets of website content', *Human–Computer Interaction* **34**(4), 279–327.

Vaassen, B. (2022), 'Ai, opacity, and personal autonomy', *Philosophy & Technology* **35**(4).

Wang, W. & Benbasat, I. (2007), 'Recommendation agents for electronic commerce: Effects of explanation facilities on trusting beliefs', *Journal of Management Information Systems* **23**(4), 217–246.

Wang, W. & Benbasat, I. (2016), 'Empirical assessment of alternative designs for enhancing different types of trusting beliefs in online recommendation agents', *Journal of Management Information Systems* **33**(3), 744–775.

Wiener, M., Cram, W. A. & Benlian, A. (2023), 'Algorithmic control and gig workers: a legitimacy perspective of uber drivers', *European Journal of Information Systems* **32**(3), 485–507.

Zhou, L., Wang, W., Xu, J., Liu, T. & Gu, J. (2018), 'Perceived information transparency in b2c e-commerce: An empirical investigation', *Information & Management* **55**(7), 912–927.