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The Nature of Crowd Work and its Effects on Individuals' Work Perception

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ABSTRACT

Crowd work reflects a new form of gainful employment on the Internet. We study how the nature of the tasks being performed and financial compensation jointly shape work perceptions of crowd workers in order to better understand the changing modes and patterns of digital work. Surveying individuals on 23 German crowd working platforms, this work is the first to add a multi-platform perspective on perceived working conditions in crowd work. We show that crowd workers need rather high levels of financial compensation before task characteristics become relevant for shaping favorable perceptions of working conditions. We explain these results by considering financial compensation as an informational cue indicating the appreciation of working effort that is internalized by well-paid crowd workers. Resulting boundary conditions for task design are discussed. These results help us understand when and under what conditions crowd work can be regarded as a fulfilling type of employment in highly developed countries.



KEYWORDS

Crowd work; crowdsourcing; online compensation; online tasks; online employment; task design; self-determination theory; paid crowd work

Introduction

Digitization has linked the economy with all other areas of our society at different levels, resulting in various new forms of digital work. One of these new types of digital work is *crowd work*. According to Durward et al. [22], crowd work reflects a digital form of gainful employment that is based on the principles of crowdsourcing in order to orchestrate an undefined mass of people via an open call on IT-facilitated platforms.

Crowd working is already becoming a wide-spread societal phenomenon with both the number of platforms (e.g., 99designs¹ or Upwork²) and crowd workers growing continuously throughout the world [76]. For instance, in Europe, a recent study reported that a relatively high proportion of the population (ranging from 9 percent in the UK to a high of 22 percent in Italy) has already done some crowd work [34]. Similarly, surveys of German crowd working platforms (e.g., Testbirds³ or Clickworker⁴) estimate that there are about 1.1 million crowd workers in Germany [58, 76]. These figures demonstrate that crowd working is already affecting labor markets with more and more individuals working on crowd working platforms on a full- or part-time basis. However, crowd working substantially differs from more traditional work forms. As a unique feature, the idea of crowd work is based on the decomposition and re-aggregation of tasks that are

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orchestrated via an IT-facilitated platform [8, 22, 41]. Because handling such fine-grained tasks on IT-platforms renders a completely novel type of digital work, we need a better understanding of crowd work.

Prior research has mainly taken an organizational perspective of crowd work and examined its underlying strategies, potentials, and risks [1, 8, 9, 44, 46, 51]. Furthermore, it has analyzed how organizations must decompose and re-aggregate tasks in order to achieve the best possible results [1, 8, 19, 79]. However, with crowd work increasing, we also need a better understanding of crowd workers, as well as their working conditions, behaviors, attitudes, and outcomes [10, 17, 18, 41, 71]. Initial research has already investigated the motivational structures of crowd workers [11, 39, 44, 46, 69]; it shows that crowd workers are not only motivated extrinsically by financial rewards but also by intrinsic motivation such as the task itself [8, 51]. Although the nature of the task being completed reflects one of the most important intrinsic motivations [8, 11, 51], there is a minimal amount of research on the effects of various task characteristics [11, 51, 55, 62, 69]. Most notably, Deng et al. [18] found that task characteristics (such as task autonomy and task variety) can create feelings of empowerment *and* marginalization. Similarly, Moussawi and Koufaris [57] found that perceived meaningfulness of the performed tasks and a crowd worker's autonomy in solving tasks positively affect effort and working performance.

In order to deepen our understanding of crowd work as new type of digital work, we need to elaborate on the traits of the tasks being executed in crowd work [55, 62]. Task design is a key antecedent of work satisfaction [42] and the superordinate construct of work identification [4, 48]. Work satisfaction and identification are two of the most important attitudes associated with favorable working conditions. Since both attitudes reflect important parts in our working lives and essential determinants of professional wellbeing [68], their analysis in crowd work is indispensable. This is particularly true when we consider crowd work as gainful employment and also take financial compensation into account. Prior research has well understood how, when, and why increasing financial compensation impacts the working behavior and performance of crowd workers [11, 29, 49, 69]. However, the way in which financial compensation interacts with the intrinsic motivation grounded in perceiving the tasks being completed has hardly been addressed [25, 78]. Nonetheless, when considering crowd work as a new type of gainful employment, this question becomes very important because we need to understand the underlying mechanisms that influence the professional well-being of the crowd. Hence, we address the following research question: *How does the interaction between perceived task characteristics and financial compensation affect perceived satisfaction and identification of crowd workers?*

To answer this question, we draw on self-determination theory (SDT) and survey 434 crowd workers from 23 different German crowd working platforms. SDT allows for developing an integrated view on how financial compensation as extrinsic motivation and the perception of task characteristics as intrinsic motivation jointly affect the professional wellbeing of crowd-workers [16, 27]. More specifically, we apply SDT in order to examine how and why the perceptions of four central characteristics of crowd working tasks — that is, autonomy, task variety, task identity, and feedback — as well as financial compensation foster perceived satisfaction with crowd work that, in turn, acts as the generative mechanism for identification with crowd work. We perform propensity score matching in order to control for potential selection biases among crowd workers and conduct a moderated mediation analysis. We show that perceived satisfaction mediates the

effect of the perceived task characteristics on identification with crowd work. Furthermore, we find that financial compensation moderates the mediated effects of perceived task characteristics on identification with crowd work; we note that these effects are only significant for higher levels of financial compensation. Our results contribute to our understanding of crowd work by explaining how and why crowd workers develop satisfaction and identification with crowd work. They develop a strong emotional bond with this innovative type of work when working conditions are perceived as being favorable.

This paper proceeds as follows. First, we discuss related work and our theoretical background. Then, we outline our research model and hypotheses. After, we present the methodology and explain our results. Finally, we discuss our results and draw implications for research as well as for practice.

Related Literature

Crowdsourcing and Crowd Work

The fundamental idea of *crowdsourcing* is that a *crowdsourcer* (which could be a company, an institution, or a non-profit organization) proposes the voluntary undertaking of a task presented in an open call to an undefined group of crowd workers (individuals, formal or informal teams, other companies) [8]. The ensuing interaction process unfolds on IT-based platforms that connect crowdsourcers and crowd workers [8]. Research has found important differences between crowdsourcing and crowd work [22, 41]. While crowd work resembles a type of gainful employment and is paid [22], participation in crowdsourcing may be driven by other motives and does not require financial remuneration. Extending this argument, *crowd work* reflects a kind of gainful digital employment that is based on crowdsourcing as a principle for work organization and implies three structural characteristics [22]:

- *Financial Compensation*: Crowd workers are financially remunerated and crowd workers generate a substantial part of their income out of crowd work on a full- or part-time basis.
- *Autonomy*: Crowd workers are self-employed agents. They are not employed by crowdsourcers and can freely choose their working time and location.
- *IT-Facilitation*: Substantial parts of the value creation take place on IT-facilitated crowd working platforms that enable the exchange between crowd workers and crowdsourcers.

There are three streams of research on crowd work that are important for our paper. One major stream concerns crowd working platforms as online labor markets that balance demand (i.e., crowdsourcers broadcasting tasks) and supply (i.e., crowd workers contributing solutions) of labor [10, 11, 29, 37, 41, 61, 69, 71]. In this paper, we follow this conceptualization of crowd working platforms. However, the understanding of crowd work and these labor markets is mainly based on one type of task on one particular platform: that is, micro tasks on Amazon's Mechanical Turk (AMT) [10, 11, 17, 18, 49, 52, 61]. On such micro tasking platforms, crowd workers perform simplistic and repetitive tasks, such as classifying images, for which they earn a couple of cents. Existing research focuses on approaches that enable

organizations to make use of such crowd working platforms. For instance, Mason and Suri [52] describe techniques for using AMT, while Paolacci and Chandler [61] focus on selecting and managing crowd workers. Since micro tasking platforms have many peculiarities and a broad variety of crowd working platforms exists [8, 9, 51], existing research may suffer from a selection bias that hinders a generalizable understanding of crowd work. Nonetheless, this research provides important insights into the greater context and nature of crowd work that we take up and seek to complement by investigating the work perception of crowd workers on a broad variety of platforms.

A second research stream deals with unraveling the motivations [8, 44, 46, 51, 69] of crowd workers and developing incentive mechanisms that affect working behaviors and outcomes [11, 29, 46, 49, 61, 69]. This research shows that crowd workers are not only motivated extrinsically by financial compensation or reputation, but also motivated intrinsically by social exchange, learning, or the task itself. This research has mostly taken an organizational focus in order to enable organizations to use crowd work effectively [1, 8, 28, 46, 51]. Similarly, researchers have investigated how financial compensation affects working behaviors (e.g., effort and participation [11, 49, 61]) and outcomes (e.g., quality of work [11, 69]). While this research is important for leveraging crowd work in organizational contexts, the perspective of individual crowd workers has not been sufficiently explored [17, 28, 41, 71]. We must understand how crowd workers perceive their working conditions — of which financial compensation is a pivotal aspect — and how these conditions influence psychological work outcomes such as work satisfaction and identification [17, 18, 71]. However, the results of this research stream are important for this study because they provide a guiding framework of motivations in crowd work that helps explain different motivational mechanisms for intrinsic and extrinsic motivations that may shape perceived working conditions of crowd workers.

Finally, existing research on crowd work deals with task design. This research has a focus on decomposing complex tasks into small units of work such that they can be processed on crowd working platforms and re-aggregating the obtained results [1, 8, 19, 41, 79]. These studies suggest that decomposing tasks is beneficial in terms of quality control, automated task processing, and quality of results [1, 8, 19, 41]. Although the nature of the task being completed has been recognized as one of the most salient intrinsic motivators [8, 11, 51], there is little research on the perception of task characteristics [11, 51, 69] and their effects on higher level work outcomes that reflect an individual's evaluation of her or his working conditions like satisfaction [53] and identification with one's own work [16]. This is important in crowd work because the systematic decomposition of tasks has a strong impact on what type of tasks are offered. Most notably, Deng et al. [18] as well as Deng and Joshi [17] studied perceptions of highly decomposed tasks on AMT following a qualitative approach. They found that task characteristics such as autonomy or variety positively influence individuals' working attitudes and behaviors [17, 18]. We draw on this initial research for identifying structural task characteristics of crowd work that may influence the intrinsic motivation of crowd workers and unraveling the effects of task characteristics on psychological work outcomes in crowd work.

Perception of Work and Task Characteristics

When studying the perception of task characteristics in crowd work, we need to differentiate between the concepts of task, job, and work. A *task* reflects a set of assigned goals to be achieved and/or instructions to be performed [30]. By contrast, a *job* reflects the

aggregation of tasks assigned to a worker, while the term *work* captures a broader perspective including the content and organization of one's tasks and responsibilities [30, 62]. Following these conceptualizations, *perceived task characteristics* describe the worker's perception of accomplishing work as well as the nature of the associated tasks [55]. There is extant research focusing on the effects of different task characteristics such as task identity, autonomy, and feedback [60]. How these task characteristics are perceived has been found to be associated — to varying degrees and with different levels of consistency — with satisfaction and identification [30]. The perception of task characteristics is recognized as a key antecedent of most of the major dependent variables — such as *satisfaction with work* [55] and *identification with work* [62] — in the fields of management, organizational behavior, and psychology. Furthermore, researchers have explored how incorporating different contextual factors might influence relations between task characteristics and workers' satisfaction and identification [60]. For example, the career stage or the sense of uncertainty [77] have been found to significantly affect the task characteristics-work outcome relationship.

Current studies propose that new work arrangements fundamentally change the employees' perception of work [34, 41, 60, 62, 74]. As a context factor that is yet under-researched but gaining greater prominence in new work settings, task design affects the nature of work as well as its experience [79]. The decomposition of larger tasks into the smaller units performed in crowd work is different from task design in traditional work settings [8, 22, 41]. Thus, crowd work calls into question traditional assumptions regarding the constituting elements of work manifest in research domains such as organizational behavior and psychology [62]. Therefore, crowd work is an excellent research context for investigating the boundary conditions of existing task design theories in digital working contexts [10, 62].

Theoretical Background

Self-determination theory (SDT) is a theory of human motivation. It provides an overarching framework for studying the effects of task characteristics and financial compensation on work outcomes such as satisfaction and identification [16]. It is also well-established in crowdsourcing and crowd work research [6, 39, 46, 69, 78]. SDT proposes that the impact of environmental factors (e.g., task design and financial compensation) on workers' motivations and outcomes is affected by basic psychological needs such as autonomy, competence, and self-determination [16], which are essential for well-being [15, 27]. The theory suggests that professional wellbeing is affected by an individual's intrinsic and extrinsic motivation [16]. While *intrinsic motivation* refers to activities for which the motivation lies in the behavior itself, *extrinsic motivation* entails doing an activity to attain a separable consequence [16]. Thus, performing work is not only driven by the extrinsic motivation of obtaining financial compensation, but also by the characteristics of the tasks being performed [16].

In work contexts, SDT also distinguishes between controlled and autonomous motivation that comprise different degrees of intrinsic and extrinsic motivation [15]. *Controlled motivation* reflects the purest form of extrinsic motivation. Individuals experience no to little autonomy [15, 16]. They feel coerced or seduced into a behavior by external regulations such as compulsion, obligation, pressure, or performance-contingent rewards

[67]. In contrast, *autonomous motivation* includes intrinsic motivation and internalized extrinsic motivation [27]. The mechanism of internalization describes an active process through which individuals assimilate and reconstitute formerly external regulations so that individuals can be self-determined while enacting them [16]. Hence, autonomous motivation arises from an individual's preferences (i.e., intrinsic motivation) because the value and regulation of the activity has been internalized: that is, internalized extrinsic motivation [27]. Recent research suggests that financial compensation can convey positive competence information and may enhance the workers' autonomous motivation [16]. This is particularly the case for working contexts that allow for high autonomy [27]. Thus, as formerly extrinsic motivation, the financial compensation might get internalized and thereby shift individuals' perception of work and its effects on work outcomes [16].

SDT suggests that perceived task characteristics as intrinsic motivation and financial compensation as extrinsic motivation are likely to interact. By contrast, extant crowd work research has considered them as being independent from each other [8, 39, 46, 78], such that they are additive in their effects on constructs like satisfaction [25]. Furthermore, research has reported inconsistent results regarding the interaction of intrinsic and extrinsic motivation. For instance, Rogstadius et al. [69] and Bayus [6] report on crowding out effects in which extrinsic motivation undermines the intrinsic motivation of performing a task. On the flip side, Frey et al. [25] suggest that individuals with high intrinsic motivation are immune to such effects. Thus, it is still not clear how potential interactions between financial compensation and perceived task characteristics jointly shape work outcomes in crowd work. Our study strives to fill this knowledge gap. It also addresses a current call for research in the field of SDT [16] — examining how financial compensation affects the internalization of contextual regulations of work.

Hypothesis Development

Drawing on SDT, we investigate how perceived task characteristics — that is, perceived autonomy, task variety, task identity, and feedback — affect an individual's satisfaction and identification with crowd work (see Figure 1). We expect satisfaction to be a mediator between task characteristics and identification and financial compensation to moderate these relationships.

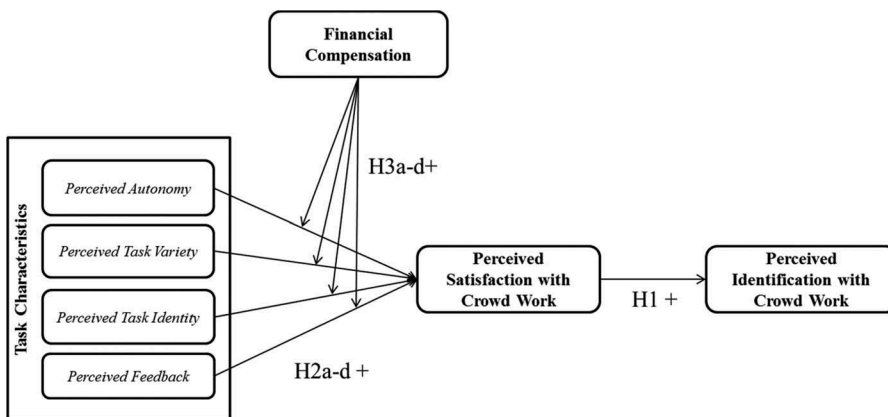


Figure 1. Research model.

Effect of Perceived Satisfaction on Identification with Crowd Work

In work settings, satisfaction is conceptualized as an individual's feeling, attitude, or preference related to the work itself [12]. We define perceived satisfaction with crowd work as the degree to which a crowd worker's experiences with crowd work meets her or his expectations [17]. Thus, perceived satisfaction with crowd work reflects a cost-benefit calculation-based attitude. Identification refers to the perception of belongingness to an entity [4]. Thus, we define identification with crowd work as an enduring psychological state that describes an individual's cognitive and emotional attachment to crowd work [54].

Perceived satisfaction with crowd work is the positive result of an emotional or cognitive cost-benefit evaluation during an individual's crowd working activities. If crowd workers' expectations are constantly met, the repeated positive evaluation of crowd work should be strengthened such that crowd workers may develop a strong psychological bond with their crowd work like identification [42]. Consequently, perceived satisfaction should precede identification with crowd work [14] and the execution of more satisfying tasks should contribute to a crowd worker's identification as the result of repeated positive evaluation [14]. Several studies found that perceived satisfaction is positively related to identification with one's work in various work settings [14, 48]. Hence, higher levels of perceived satisfaction with crowd work should result in higher levels of identification with crowd work. We hypothesize:

Hypothesis 1: A crowd worker's perceived satisfaction with crowd work positively influences her or his perceived identification with crowd work.

Effect of Task Characteristics on Perceived Satisfaction with Crowd Work

Intrinsic motivation is grounded in the perception of task characteristics [16, 30] and promotes positive work outcomes [27]. We hypothesize that task characteristics (i.e., perceived autonomy, task variety, task identity, and feedback) are each positively associated with satisfaction and identification with crowd work.

Perceived Autonomy

Autonomy is defined as the amount of freedom an individual has when carrying out her or his tasks [30]. The autonomy of work is related to perceived satisfaction since workers can act in a more self-determined manner [26]. A certain amount of autonomy among workers provides them the freedom and the flexibility to manage their own workload [2] and influences their perception of digital work settings [3]. In crowd work, this need for autonomy seems to be augmented because it can be performed at any time from any location on various platforms. Thus, crowd work implies certain autonomy for participating individuals in terms of working time, workload, or the actual process of work. Deng et al. [18] show that autonomy is one of the most salient values held by crowd workers and one of the main motivators for participation. Hence, crowd workers with high levels of perceived autonomy should see one of their basic expectations of why they have engaged in crowd work as being fulfilled. Higher perceptions of autonomy should result in higher levels of satisfaction. Since autonomy is an integral characteristic of crowd work — crowd workers can decide when they want to work, with whom they want to work, and how they

want to work for each task — these feelings of satisfaction should be strengthened and reinforce their identification with crowd work. We suggest:

Hypothesis 2a: The positive effect of perceived autonomy on perceived identification with crowd work is mediated by perceived satisfaction with crowd work.

Perceived Task Variety

Task variety refers to the degree to which a job requires workers to perform a wide range of tasks [55]. Workers want their work to offer them some variety in order to make it more motivating and less monotonous [43]. This finding can be confirmed in digital work settings; increased levels of task variety have positive effects on perceived satisfaction [74]. By contrast, task repetition can lead to feelings of boredom [38], which is described as a negative dissatisfying emotional state; this risk is augmented in crowd work. Although there are many different crowd working platforms that offer various tasks [9], crowd workers frequently have to deal with long series of almost identical and highly decomposed tasks. Task decomposition is not only salient in micro tasking [41], but is also widely applied for more complex tasks (e.g., software development [44, 45]). Consequently, at a given point of time, crowd workers frequently face the situation in which they only have access to similar tasks of low variety. Given the fact that crowd workers participate voluntarily, and individuals generally want a certain degree of task variety from their work, we assume that crowd workers who take on tasks of greater variety are more satisfied. Thus, higher levels of perceived task variety should result in higher degrees of perceived satisfaction with crowd work that should then increase identification with crowd work. We propose:

Hypothesis 2b: The positive effect of perceived task variety on perceived identification with crowd work is mediated by perceived satisfaction with crowd work.

Perceived Task Identity

Task identity reflects the degree to which workers can clearly identify the result of their work effort [72]. It is related to the extent to which a task enables individuals to complete an entire piece of work from the beginning to the end [3]. Tasks that result in a self-contained and independent solution increase job satisfaction [35]. For instance, workers who usually only perform software programming tasks in large development projects and do not have the opportunity to see the results of their work after the system's deployment have reported low levels of perceived task identity, that in turn resulted in low satisfaction [3]. Although task decomposition is widely used in crowd work [1], a large spectrum of task identity can be found. One end of this spectrum is associated with micro tasks whose results need to be aggregated to form an overarching solution. Thus, crowd workers performing such tasks should perceive these tasks as having a low task identity. The other end of this spectrum consists of complex tasks, for example, solving scientific problems, in which crowd workers usually have to contribute a self-contained solution that constitutes a whole piece of work, leading to high levels of perceived task identity. Given that seeing the results of one's work is a basic prerequisite of crowd workers for perceived satisfaction, we assume that higher levels of perceived task identity should lead to higher levels of perceived satisfaction with crowd work. Extending this argument, it is reasonable to assume that increased levels of perceived satisfaction that are grounded in

completing tasks of high perceived task identity should also lead to higher levels of identification with crowd work. We assume:

Hypothesis 2c: The positive effect of perceived task identity on perceived identification with crowd work is mediated by perceived satisfaction with crowd work.

Perceived Feedback

Feedback reflects the degree to which tasks provide direct information about the effectiveness of task performance [30]. Feedback has a strong relationship with work satisfaction because obtaining information about the appropriateness of one's working efforts is a basic expectation of individuals in work settings [26, 56]. In crowd work, substantial parts of the value creation take place on IT-facilitated platforms that determine the way crowd workers obtain feedback [22]. Generally, direct feedback is an integral part of crowd work since the acceptance of crowd workers' results by crowdsourcers is a necessary condition for remuneration. However, feedback may include pure notifications of acceptance, ratings of work quality, as well as individual feedback from crowdsourcers. Because obtaining feedback can also be regarded as a basic desire of crowd workers, we assume that crowd workers who obtain important information about the appropriateness of their work are more likely to develop high levels of perceived satisfaction that should in turn increase their identification with crowd work. We hypothesize:

Hypothesis 2d: The positive effect of perceived feedback on perceived identification with crowd work is mediated by perceived satisfaction with crowd work.

Moderating Effects of Financial Compensation

On most crowd working platforms, access to more interesting and better paid tasks requires a positive track record of having successfully completed tasks in the past. Positive track records are associated with increased bargaining power that enables crowd workers to obtain higher financial compensation for their work efforts [21]. Thus, high financial compensation is likely to be associated with feelings of competence and may be an integral part of the autonomous motivation of crowd workers [16]. Extending this line of reasoning, we believe that the different autonomous motivations of crowd workers, that is, intrinsic motivation that is grounded in the perceived characteristics of the performed tasks and internalized extrinsic motivation, such as financial compensation for these tasks, are likely to interact. Thus, we assume that the effects of perceived task characteristics on perceived identification, mediated by perceived satisfaction, are moderated by financial compensation.

Financial Compensation and Perceived Autonomy

The perceived autonomy of crowd workers may lead to higher levels of perceived satisfaction with crowd work that should in turn positively influence identification with crowd work. We believe that the crowd workers' financial compensation influences the mediation effect of perceived satisfaction. The mediation effect of perceived satisfaction should be weaker for crowd workers that can realize only low levels of financial compensation. This is because low financial compensation is experienced as more controlled in this condition since the crowd workers feel more pressure to behave in a certain way to receive the remuneration. Crowd workers receiving low financial compensation have been frequently associated with low power

in comparison to crowdsourcers such that their working conditions are strongly shaped by the external regulation of the crowdsourcer [21, 41, 71]. In such settings, the individuals' autonomous motivation might be undermined.⁵ Instead, these crowd workers are rather driven by controlled motivation so that they are more likely to accept the external regulations of crowdsourcers. Consequently, their expectations of autonomy would be realized to a lesser extent such that the effect of perceived autonomy on perceived satisfaction with crowd work should be comparably weak.

By contrast, crowd workers that can obtain high levels of financial compensation for their tasks may exhibit higher degrees of autonomous motivation. For these crowd workers, financial compensation may serve as a signal that their competence qualifies them to complete tasks that best suits their autonomous motivation. As a result, high financial compensation gets internalized by satisfying the crowd worker's basic psychological need for competence and further enhances their intrinsic motivation grounded in perceived autonomy [16]. Thus, crowd workers obtaining high financial compensation should be better able to satisfy their expectations such that perceived autonomy should have a comparably strong effect on perceived satisfaction in the high compensation condition. In summary, we assume that increasing levels of financial compensation should lead to a stronger effect of perceived autonomy on perceived satisfaction that in turn strengthens the effect on identification with crowd work. We purport:

Hypothesis 3a: Financial compensation moderates the indirect effect of perceived autonomy on perceived identification with crowd work through perceived satisfaction with crowd work; the higher the financial compensation, the stronger the mediation effect of perceived satisfaction.

Financial Compensation and Perceived Task Variety

Similarly, we suggest a mediation effect of perceived task variety on identification with crowd work through perceived satisfaction. Crowd workers who can only realize low financial compensation may experience more controlled motivation that, in turn, might undermine the effects of intrinsic motivation derived from perceived task variety on perceived satisfaction with crowd work [16]. Such crowd workers are more likely to be motivated by external regulations. Hence, the diversity of the performed tasks should have only small effects on their perception of crowd work [16, 69]. To be more specific, their expectations regarding the processing of high variety are less likely to be fulfilled such that the effect of perceived task variety on identification might be comparably weak.

On the flipside, crowd workers that are able to realize higher levels of financial compensation experience a feeling of competence that supports the internalization of financial compensation. This positive feedback is likely to enhance the effects of performing tasks of high variety on perceived satisfaction because the feeling of competence might be grounded in a more diverse set of tasks such that it is likely to become more salient. Consequently, high financial compensation as positive feedback obtained from diverse tasks, may strengthen crowd workers' autonomous motivation. The expectations of high task variety are more likely to be fulfilled for crowd workers who obtain high levels of financial compensation. As a result, the effect of perceived task variety on perceived satisfaction and its indirect effect on the identification with crowd work should become stronger. We propose:

Hypothesis 3b: Financial compensation moderates the indirect effect of perceived task variety on perceived identification through perceived satisfaction with crowd work; the higher the financial compensation, the stronger the mediation effect of perceived satisfaction.

Financial Compensation and Perceived Task Identity

Comparable effects can also be assumed for the perceived task identity and financial compensation interaction because the completion of an entire piece of work may become more important with increasing levels of financial compensation. Both task identity and financial compensation affect the formation of controlled and autonomous motivation [16, 27]. In particular, crowd workers obtaining low financial compensation are likely to show higher levels of controlled motivation such that perceived task identity might be less important for them. In this context of controlled motivation, through financial compensation, the extrinsic focus that results can undermine the intrinsic desire of performing overarching and coherent tasks of high task identity [16]. Those crowd workers tend to be less motivated by performing tasks that are specifically linked since earning money is superficial. Consequently, the effect of task identity on perceived satisfaction should be comparably weak for crowd workers that obtain little financial compensation.

For crowd workers that receive high levels of financial compensation, task identity might be a central concept of their autonomous motivation such that individual expectations might focus on aspects of the work itself, such as being able to inspect the results of their work [27]. As former external motivation, increasing financial compensation gets internalized and consequently conveys positive competence information [16]. In particular, a high level of compensation may constitute positive feedback on the work outcomes and, thus, supports the positive evaluation of the work itself when tasks of high task identity are performed. Therefore, high levels of financial compensation are likely to enhance the autonomous motivation based on the performance of entire and coherent tasks. Hence, the expectations of crowd workers regarding completing tasks of high perceived identity are more likely to be fulfilled. Thus, we assume that financial compensation increases the indirect effect between the perceived task identity and the identification with crowd work since the provision of whole solutions rather than of individual parts becomes more important for well-paid crowd workers. We assume:

Hypothesis 3c: Financial compensation moderates the indirect effect of perceived task identity on perceived identification through perceived satisfaction with crowd work; the higher the financial compensation, the stronger the mediation effect of perceived satisfaction.

Financial Compensation and Perceived Feedback

Finally, we assume that the “perceived feedback – perceived satisfaction” link is moderated by financial compensation. For crowd workers who can only realize low levels of financial compensation, it is likely that payment will be the most important form of recognition of their performance [15, 16]. This is because the crowd workers feel pressured to perform well in order to get paid. In these contexts, financial compensation is experienced as a more controlled motivation. Thus, low financial performance may offset the cognitive and emotional evaluation of the obtained feedback such that it hinders the development of autonomous motivation derived from perceived feedback and its effect on satisfaction.

For crowd workers attaining high levels of remuneration, however, an elevated autonomous motivation may render the work itself into an essential source of feedback. This is because the external regulation of financial compensation has been internalized and facilitates

the crowd worker's autonomous motivation. Thus, the feedback from tasks as constant information about the appropriateness of working performance occupies an important role [27]. In these contexts, high financial compensation as informational cue might support the positive evaluation of perceived feedback such that it reinforces the results of this cognitive and emotional evaluation process. The expectation of receiving feedback should be more likely to be fulfilled for crowd workers with high financial compensation than for crowd workers that receive only low financial compensation. Thus, we assume that higher financial compensation reinforces the effect of perceived feedback on satisfaction with crowd work such that the strength of the overarching mediation increases. We believe:

Hypothesis 3d: Financial compensation moderates the indirect effect of perceived feedback on perceived identification through perceived satisfaction with crowd work; the higher the financial compensation, the stronger the mediation effect of perceived satisfaction.

Methodology

Research Context and Data Collection

We collected data from 447 crowd workers on 23 crowd working platforms in Germany. We excluded records from respondents that did not work on paid crowd working platforms or whose responses indicated inappropriate response behavior, for example, having spent too little time for completion. In our questionnaire, we offered a “no opinion/don't know” option because we asked for sensitive information such as income and respondents should have had the opportunity to opt-out questions for which they did not want to disclose information. In total, six respondents have used that option. All of them were excluded because they also showed other types of inappropriate response behaviors. Ultimately, we used 434 completed responses for our analysis. In line with prior research [17, 18], we paid crowd workers for participation. The survey was online from May to July 2015 and focused on German-speaking crowd workers. The perception of task characteristics may vary in terms of the actual tasks performed. Assuming that crowd working platforms offer a set of specific tasks in a more or less similar fashion, we followed the well-established typology by Brabham [9] and made sure that our data collection approach covered the four main types of crowd working platforms: Knowledge Discovery and Management, Broadcast Search, Peer-Vetted Creative Production, and Distributed Human Intelligence Tasking. Since we collected data from all types of platforms and covered the entire German crowd working market, our survey can be considered to be representative for Germany.

Variables

Perceived Task Characteristics

We measured perceived autonomy, perceived task variety, perceived task identity, and perceived feedback using well-established scales [55]. We modified the wordings of some items to adjust them to our research context.

Perceived Satisfaction and Perceived Identification with Crowd Work

We adapted established scales for measuring perceived satisfaction [75] and perceived identification [20].

Financial Compensation

We calculated financial compensation of crowd workers by dividing their self-reported monthly average income exclusively from crowd work (i.e., the average of the last three months) by their self-reported monthly average number of hours worked on crowd working platforms. We applied single item measures because such measures are most appropriate when respondents can easily develop a clear mental picture of the entity being measured and its attributes [7]. We considered this condition as being met for income and hours.

Controls

We controlled for socio-demographic differences in the predictor, mediator, and outcome variables and included the crowd workers' age, gender, education level, and employment status [29, 69, 78]. Also, we accounted for the crowd workers' total monthly income, the share of crowd work from total income, and the period they have been active as a crowd worker [39, 78]. We included dummy variables that reflected the type of crowd working platform on which crowd workers primarily perform work [9]. Furthermore, we integrated additional controls for important task characteristics that might influence task perceptions but are not directly rooted in the nature of crowd work. In detail, we measured task complexity, task specialization as well as cognitive demand and equipment use that are associated with performing the tasks [30, 55, 62]. While task complexity refers to the degree a job is difficult to perform and requires the application of high-level skills, task specialization involves possessing specialized knowledge and skills of high depth [55]. Furthermore, cognitive demands reflect the level of cognitive effort required, while equipment use describes the variety and complexity of the technology used in the tasks [55]. In so doing, we are able to control for the type of crowd work performed.

Participants

We define individuals performing tasks on crowd working platforms as the target population. Prior studies have shown that these crowd workers tend to be gender-balanced and well-educated [39]. The "average crowd worker" is in her or his early thirties and earns ca. USD \$8 per hour [17, 18]. Our participants are between 14 and 71 years old, with an average age of 30. Almost half of the participants are female (ca. 48 percent). Average financial compensation is about EUR €10 per hour. The majority of participants (ca. 86 percent) have finished high school and some 44 percent of them have a college degree. Our sample mirrors the socio-demographic profile of crowd workers from previous studies. Thus, the surveyed crowd workers are appropriate subjects for our study.

Results

We assume a moderated mediation effect that describes when and under what conditions an effect occurs, i.e., the strength of a mediation effect is based on a moderator [64]. A variable is a *mediator* when it represents the generative mechanism through which one variable influences another. A focal independent variable influences the mediator, which in turn, impacts a dependent variable in a causal fashion [36, 70]. By contrast, a *moderator* influences the strength and direction of a relationship between two variables. Therefore,

moderated mediation models reflect mediation models in which one or several relationships are moderated [32, 64].

We applied ordinary least squares (OLS) regression and a causal mediation analysis [36] that is based on *parametric* resampling using a Monte Carlo simulation to compute confidence intervals to test our hypotheses for the significance of the mediation and moderated mediation effects. The resampling procedure provides two advantages. First, resampling illustrates low type-I errors and has a higher power than its alternatives, for example, the product of coefficients approach, for testing mediation and moderated mediation. The chosen approach has a comparable performance to other state of the art resampling methods such as bootstrapping [36, 50, 65]. Second, it neatly integrates with our propensity score matching approach that reflects a data pre-processing approach for testing *parametric* causal interferences [33].

Construct Validation

We applied exploratory and confirmatory factor analysis to confirm the validity and reliability of our measures (Table 1). The measure of sampling adequacy is 0.84, indicating excellent applicability of exploratory factor analysis. We extracted six clearly interpretable factors. Cronbach's alphas and individual item reliabilities suggest a good reliability of factors. Each factor's composite reliability (CR) and average variance explained (AVE) surpasses the

Table 1. Exploratory and confirmatory factor analysis.

Item	Factors							AVE	α	CR
	Perceived Autonomy	Perceived Task Variety	Perceived Task Identity	Perceived Feedback	Perceived Satisfaction with Crowd Work	Perceived Identification with Crowd Work	Individual Item Reliability			
TI2	0.85	0.12	0.14	0.08	0.07	0.08	0.87**	0.73	0.88	0.89
TI3	0.85	0.08	0.10	0.10	0.03	0.05	0.84**			
TI1	0.84	0.13	0.13	0.07	0.16	0.04	0.89**			
TI4	0.78	0.07	-0.01	0.06	0.17	0.10	0.82**			
TV3	0.13	0.86	0.06	0.11	0.07	0.07	0.89**	0.73	0.88	0.89
TV1	0.11	0.84	0.07	0.09	0.01	0.05	0.82**			
TV4	0.10	0.82	0.03	0.11	0.07	0.02	0.83**			
TV2	0.05	0.81	0.12	0.10	0.13	0.08	0.87**			
ID1	0.11	0.03	0.85	0.08	0.19	0.12	0.89**	0.75	0.84	0.87
ID2	0.11	0.14	0.84	0.17	0.02	0.03	0.80**			
ID3	0.13	0.10	0.77	0.10	0.35	0.08	0.91**			
F2	0.03	0.13	0.13	0.84	0.00	0.05	0.81**			
F3	0.12	0.07	0.07	0.81	0.13	0.01	0.86**	0.71	0.80	0.84
F1	0.12	0.18	0.11	0.81	0.08	0.06	0.86**			
SAT3	0.08	0.06	0.06	-0.06	0.81	0.04	0.70**			
SAT1	0.15	0.10	0.27	0.15	0.77	0.16	0.90**			
SAT2	0.20	0.11	0.18	0.18	0.73	0.07	0.86**	0.68	0.75	0.81
A3	0.12	0.07	0.04	0.04	0.16	0.79	0.87**			
A1	0.02	0.06	0.01	0.00	0.08	0.75	0.71**			
A2	0.08	0.03	0.14	0.06	-0.01	0.74	0.74**			
Eigen-values	5.58	2.30	2.00	1.71	1.50	1.20				

Notes: CR, Composite Reliability; AVE, Average Variance Explained; α , Cronbach's Alpha; A, Perceived Autonomy; TV, Perceived Task Variety; TI, Perceived Task Identity; F, Perceived Feedback; SAT, Perceived Satisfaction with Crowd Work; ID, Identification with Crowd Work.

N = 434; **p < 0.01; *p < 0.05

Measure of Sampling Adequacy = 0.84; Bartlett's test of specificity: $\chi^2 = 3772.09$; p = 0.000; principal component analysis; varimax rotation; bold values indicate the attribution of the variables to one of the six factors.

thresholds of 0.5. Thus, convergent validity can be assumed [5]. To test for discriminant validity, we used the Fornell-Larcker criterion, which claims that the square root of one factor's AVE should be higher than its correlations with every other factor [23]. Table 2 shows that discriminant validity can be assumed and gives descriptive statistics.

Common Method Variance

As all variables were measured by a survey, we carefully designed our questionnaire to prevent common method bias (CMB) [63]. We provided a cover story in which we emphasized that the independent and dependent variables were unconnected. We also pointed out that all answers are anonymous and that no connection between answers and individuals would be established. Further, we structured our survey questions as simply as possible and avoided ambiguous terms. To check the extent of CMB, we applied the Harman's Single factor test [13, 47, 63, 73] and the Unmeasured Latent Marker Construct (ULMC) technique [13, 47, 73]. Following Harman's Single factor test, we applied an exploratory factor analysis and extracted one single factor, which accounted for 31.2 percent of the variance. As this is below the threshold of 50 percent, this test suggests that CMB is not a serious concern [73]. Subsequently, we applied the ULMC approach [47], which specifies factor loadings from a method factor to all other items in the model [13]. The results of the ULMC analysis show that the average variance explained by our constructs is 0.706, while the average method-based variance is 0.004. In addition, most method factor loadings are not significant. These results support the absence of CMB in our study.

Propensity Score Matching

For testing of our research model, it is pivotal to control for potential selection biases among crowd workers. Different levels of financial compensation might result in different search and selection patterns for tasks among crowd workers such that our results might be biased.

To address this potential concern, we performed propensity score matching. The central idea of this technique is that a treatment case is matched against a control case based on each case's propensity score [66]. In so doing, it is possible to generate causal inferences that are substantially more robust and less sensitive to modeling assumptions [40, 66]. We applied the approach of King et al. [40] that has been designed for observational studies and integrates with any kind of subsequent parametric analysis [33, 66]. We used nearest neighbor matching that calculates propensity scores using logistic regression. Researchers have to define a dichotomous treatment variable which is regressed on a series of covariates that are used for the matching. The propensity score can be defined as the probability of receiving treatment, conditional on the covariates [28]. The propensity scores are used as distance measures such that individuals in the treatment and control groups are matched to their closest counterfactuals. Thus, covariate distributions are balanced such that they become more comparable to distributions one would obtain in randomized experiments [40]. We used the perceived task characteristics as covariates and financial compensation as treatment. Financial compensation was dichotomized using a cutoff of EUR 8 per hour, that is, we created a low (0; control) and a high financial compensation group (1; treatment). We found that this cutoff best balances our central

Table 2. Descriptive statistics and correlations.

Variable	Min	Max	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1) Perceived Identification with Crowd Work	1.00	5.0	2.81	1.08	0.87																			
(2) Perceived Satisfaction with Crowd Work	1.00	5.0	3.75	0.81	0.45**	0.82																		
(3) Perceived Autonomy	1.67	5.0	4.12	0.77	0.21**	0.25**	0.77																	
(4) Perceived Task Variety	1.00	5.0	3.67	0.84	0.29**	0.33**	0.20**	0.85																
(5) Perceived Task Identity	1.00	5.0	3.7	1.00	0.23**	0.23**	0.16**	0.26**	0.85															
(6) Perceived Feedback	1.00	5.0	3.66	0.93	0.30**	0.24**	0.13**	0.24**	0.30**	0.84														
(7) Financial Compensation	0	373.3	10.26	32.25	-0.03	-0.05	0.01	-0.04	0.05	0.02														
(8) Share of Crowd Work in Total Income	0	100.0	31.96	34.78	0.08	0.12*	0.06	0.07	0.07	-0.03	-0.06													
(9) Total Income	0	5000.0	802.00	956.73	0.06	-0.03	0.06	0.07	0.19**	0.18**	0.10*	-0.32**												
(10) Crowd Work Activity	0	140.0	14.53	17.01	0.04	0.08	0.06	0.08	0.07	0.10*	0.01	0.06	0.17**											
(11) Gender	0	1.0	0.48	0.50	0.04	-0.09	0.04	0.02	0.03	0.06	0.02	-0.05	0.29**	0.04										
(12) Age	14.00	71.0	30.41	11.60	0.16**	0.13**	0.01	0.11*	0.12*	0.05	0.05	-0.09	0.30**	0.37**	-0.03									
(13) Education Level	1.00	5.0	3.56	1.03	-0.04	-0.06	-0.01	0.04	0.08	0.10*	0.08	-0.07	0.18**	0.13**	0.01	0.20**								
(14) Employment Status	0	1.0	0.12	0.33	0.09	0.07	0.08	0.06	0.05	0.06	0.06	-0.23**	0.49**	0.06	0.24**	0.16**	-0.01							
(15) Peer-Vetted Creative Production	0	1.0	0.08	0.27	-0.01	-0.02	-0.01	0.06	0.11*	0.14**	0.20**	0.05	0.08	0.04	0.03	0.01	0.15**	-0.03						
(16) Knowledge Discovery and Management	0	1.0	0.1	0.30	0.13**	0.11*	-0.01	0.01	-0.07	0.07	-0.04	-0.06	0.12*	0.02	0.02	0.25**	-0.10*	0.20**	-0.10*					
(17) Broadcast Search	0	1.0	0.33	0.47	0.12*	0.09	0.09	0.11*	0.18**	0.03	0.01	0.08	0.22**	0.26**	0.11*	0.38**	0.08	0.11*	-0.20**	-0.23**				
(18) Task Specialization	1.00	5.0	2.87	1.09	0.22**	0.08	0.06	0.27**	0.29**	0.30**	0.10*	0.02	0.33**	0.27**	0.19**	0.27**	0.21**	0.08	0.32**	-0.10*	0.35**			
(19) Equipment Use	1.00	5.0	2.79	1.17	0.20**	0.09	0.02	0.28**	0.22**	0.22**	0.08	0.04	0.30**	0.16**	0.17**	0.22**	0.13**	0.12*	0.36**	0.07	0.21**	0.62**		
(20) Task Complexity	1.00	5.0	3.11	0.94	-0.20**	-0.13**	-0.05	-0.25**	-0.26**	-0.23**	-0.07	-0.13**	-0.23**	-0.25**	-0.14**	-0.28**	-0.20**	-0.13**	-0.29**	-0.01	-0.38**	-0.63**	-0.45**	
(21) Cognitive Demands	1.00	5.0	3.69	0.88	0.18**	0.13**	0.07	0.22**	0.26**	0.25**	-0.03	0.04	0.09	0.14**	-0.05	0.21**	0.13**	0.04	0.09	-0.12*	0.21**	0.51**	0.31**	-0.47*

Notes: N = 434; **p < 0.01; *p < 0.05.
Bold values indicate the squared average variance explained (AVE) for each factor for assessing discriminant validity.

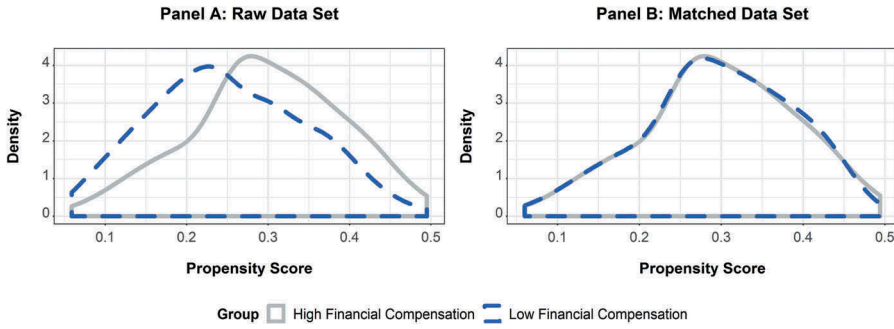


Figure 2. Distribution of propensity scores.

requirements of improving balance and maintaining an appropriate sample size for making generalizable inferences. We ensured that our results are robust against other cutoffs.

The propensity score matching considerably reduces the size of our data set (from 434 to 226). The procedure matched 113 crowd workers that earned above 8 EUR per hour with 113 crowd workers that earned less than 8 EUR per hour as closest counterfactuals. [Figure 2](#) compares the density of propensity scores before and after the matching. Panel A (left side) shows the distribution of the propensity scores before the matching. Panel A suggest that the distribution of propensity scores differs considerably. For crowd workers receiving high financial compensation the density of propensity scores is considerably more left-skewed than for crowd worker in the low financial compensation group. Panel B (right side) shows that the matching procedure has equalized the distribution of propensity scores. The overall balance in propensity scores in our dataset has increased by 96 percent.

Regression and Causal Mediation Analysis

Interaction effects that include moderation and mediation may come in many different forms. Hence, we used an approach that allowed us to investigate our research model while ruling out alternative models. We tested moderated mediation with a series of OLS regressions [59] and also applied the causal mediation approach with 10,000 resamples to assess the significance of the mediations effect and their moderation [36]. We used z-standardized factors and variables for all measures (except dummies). We estimated the following regression equations:

$$\begin{aligned}
 \text{Perceived Identification with Crowd Work} = & \alpha + \beta_1 \text{Perceived Autonomy} \\
 & + \beta_2 \text{Perceived Task Variety} + \beta_3 \text{Perceived Task Identity} \\
 & + \beta_4 \text{Perceived Feedback} + \beta_5 \text{Financial Compensation} \\
 & + \beta_6 \text{Perceived Autonomy} \times \text{Financial Compensation} \\
 & + \beta_7 \text{Perceived Task Variety} \times \text{Financial Compensation} \\
 & + \beta_8 \text{Perceived Task Identity} \times \text{Financial Compensation} \\
 & + \beta_9 \text{Perceived Feedback} \times \text{Financial Compensation} + \text{Controls} + r;
 \end{aligned} \tag{1}$$

$$\begin{aligned}
\text{Perceived Satisfaction with Crowd Work} = & \alpha + \beta_1 \text{Perceived Autonomy} \\
& + \beta_2 \text{Perceived Task Variety} + \beta_3 \text{Perceived Task Identity} \\
& + \beta_4 \text{Perceived Feedback} + \beta_5 \text{Financial Compensation} \\
& + \beta_6 \text{Perceived Autonomy} \times \text{Financial Compensation} \\
& + \beta_7 \text{Perceived Task Variety} \times \text{Financial Compensation} \\
& + \beta_8 \text{Perceived Task Identity} \times \text{Financial Compensation} \\
& + \beta_9 \text{Perceived Feedback} \times \text{Financial Compensation} + \text{Controls} + r;
\end{aligned} \tag{2}$$

$$\begin{aligned}
\text{Perceived Identification with Crowd Work} = & \alpha + \beta_1 \text{Perceived Autonomy} \\
& + \beta_2 \text{Perceived Task Variety} + \beta_3 \text{Perceived Task Identity} \\
& + \beta_4 \text{Perceived Feedback} + \beta_5 \text{Financial Compensation} \\
& + \beta_6 \text{Perceived Autonomy} \times \text{Financial Compensation} \\
& + \beta_7 \text{Perceived Task Variety} \times \text{Financial Compensation} \\
& + \beta_8 \text{Perceived Task Identity} \times \text{Financial Compensation} \\
& + \beta_9 \text{Perceived Feedback} \times \text{Financial Compensation} \\
& + \beta_{10} \text{Perceived Satisfaction} \\
& + \beta_{11} \text{Perceived Satisfaction} \times \text{Financial Compensation} + \text{Controls} + r.
\end{aligned} \tag{3}$$

Equation (1) establishes a direct effect of the independent variables on perceived identification with crowd work including financial compensation as moderator. Equation (2) reflects the same regression equation but with perceived satisfaction with crowd work as the dependent variable. Equation (3) tests the effect of our independent variables on perceived identification while controlling for perceived satisfaction as a mediator as well as taking into account the effects of the moderator (financial compensation).⁶ We test these equations in a stepwise fashion. First, we test them without the moderating effects of financial compensation (Models 1a to 3a in Table 3). Then, as a second step, we include also the interaction terms (Models 1b to 3b in Table 3). Furthermore, we apply the resampling procedure that conducts a direct test for the significance of the supposed mediation effects (at different levels of financial compensation).

Testing models 1a to 3a, we find that perceived satisfaction with crowd work is significantly and positively associated with the crowd workers' identification ($\beta = 0.29$; $p < 0.01$). Thus, we find support for Hypothesis 1. All task characteristics directly affect perceived satisfaction with crowd work. Perceived autonomy ($\beta = 0.15$; $p < 0.05$), perceived task variety ($\beta = 0.17$; $p < 0.05$), perceived task identity ($\beta = 0.11$; $p < 0.05$), and perceived feedback ($\beta = 0.17$; $p < 0.01$) have a positive direct effect on our supposed mediator perceived satisfaction with crowd work. Furthermore, we find no direct main effect of financial compensation on perceived satisfaction or identification with crowd work. When comparing models 1a and 3a, which controls for perceived satisfaction as mediator, we see that the direct effects of the perceived task characteristics variables tend to become smaller and less significant. This gives a first indication of mediation. However, we do only find perceived autonomy and perceived feedback to be directly associated with identification.⁷ In order to further assess these mediation effects, we apply the resampling procedure and estimate 95 percent and 99 percent confidence intervals for the significance of the mediation effects (Table 4). We find that the mediation effects of perceived

Table 3. Regression results for perceived identification with crowd work.

Tested Effect	Independent Variable	Mediation without Moderators			Mediation with Moderators		
		Model 1a	Model 2a	Model 3a	Model 1b	Model 2b	Model 3b
		DV: ID	DV: SAT	DV: ID	DV: ID	DV: SAT	DV: ID
Independent Variables (IV)	Perceived Autonomy	0.17**	0.15*	0.13*	0.15*	0.15*	0.10
	Perceived Task Variety	0.11	0.17*	0.06	0.08	0.19**	0.02
	Perceived Task Identity	0.02	0.11*	-0.03	0.06	0.14	0.01
	Perceived Feedback	0.16*	0.17**	0.12	0.08	0.20**	0.02
Moderator (MO)	Financial Compensation	-0.03	-0.01	-0.03	-0.42**	0.15	-0.46**
IV x MO	Perceived Autonomy x Financial Compensation				-0.06	0.07	-0.08
	Perceived Task Variety x Financial Compensation				-0.00	0.17	-0.06
	Perceived Task Identity x Financial Compensation				0.19	-0.04	0.12
	Perceived Feedback x Financial Compensation				-0.73**	0.09	-0.74**
Mediator (ME)	Perceived Satisfaction with Crowd Work			0.29**			0.30**
ME x MO	Perceived Satisfaction with Crowd Work x Financial Compensation						0.02
Controls	Total Income	-0.13	-0.17*	-0.08	-0.07	-0.17*	-0.02
	Share of Crowd Work in Total Income	0.05	0.09	0.03	0.09	0.10	0.07
	Gender	0.09	0.06	0.07	0.09	0.02	0.08
	Age	0.10	0.09	0.08	0.12	0.09	0.09
	Education Level	-0.05	-0.07	-0.02	-0.06	-0.09	-0.03
	Employment Status	0.15	0.17	0.10	0.22	0.28	0.14
	Crowd Work Activity	-0.04	0.05	-0.06	-0.06	0.05	-0.07
	Peer-Vetted Creative Production	-0.43	-0.12	-0.40	-0.56*	-0.20	-0.49
	Knowledge Discovery and Management	0.24	0.49	0.10	0.09	0.46	-0.05
	Broadcast Search	-0.28	0.10	-0.32	-0.35	0.08	-0.37*
	Task Specialization	0.02	-0.15	0.07	0.05	-0.15	0.09
	Equipment Use	0.14	0.04	0.13	0.16	0.05	0.15
	Task Complexity	-0.06	-0.03	-0.05	-0.06	-0.01	-0.06
	Cognitive Demands	0.06	0.12	0.03	0.04	0.11	0.01
	Adjusted R ²	0.13	0.23	0.19	0.18	0.24	0.24
	R ²	0.20	0.29	0.26	0.26	0.32	0.32

Notes: N = 226; **p < 0.01, *p < 0.05.

Table 4. Confidence intervals for mediation effects.

Items	Estimate	95 percent Confidence Intervals		99 percent Confidence Intervals	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Perceived Autonomy	0.044	0.008	0.090	-0.002	0.109
Perceived Task Variety	0.049	0.009	0.100	-0.001	0.123
Perceived Task Identity	0.047	0.007	0.099	-0.005	0.119
Perceived Feedback	0.049	0.011	0.099	0.001	0.118

Notes: N = 226.

Bold confidence intervals indicate significant effects.

autonomy, task variety, and identity are significant with $p < 0.05$. Perceived Feedback is significant with $p < 0.01$. Thus, we also receive support for Hypothesis 2a to Hypothesis 2d.

In order to investigate our moderated mediation hypotheses, we inspect regression models 1b to 3b and apply resampling whose results indicate the strength of the mediation effect for different percentiles of financial compensation. However, in the OLS regressions, we could only detect a significant interaction effect for perceived feedback for which we found also the strongest mediation effect. By contrast, resampling indicates that the mediation effects become stronger for rising levels of financial compensation (Table 5). When referring to 95 percent

Table 5. Confidence intervals for moderated mediation effects.

Items	Percentile	Estimate	95 percent Confidence Intervals		99 percent Confidence Intervals	
			Lower Bound	Upper Bound	Lower Bound	Upper Bound
Perceived Autonomy	10 th	0.030	-0.008	0.077	-0.020	0.098
	25 th	0.031	-0.006	0.078	-0.018	0.098
	50 th	0.037	0.002	0.083	-0.009	0.104
	75 th	0.043	0.008	0.089	-0.002	0.112
	90 th	0.053	0.015	0.103	0.006	0.126
Perceived Task Variety	10 th	0.034	-0.002	0.082	-0.015	0.101
	25 th	0.036	0.000	0.084	-0.013	0.103
	50 th	0.043	0.006	0.092	-0.004	0.112
	75 th	0.050	0.011	0.101	0.002	0.123
	90 th	0.063	0.019	0.119	0.010	0.143
Perceived Task Identity	10 th	0.028	-0.006	0.072	-0.016	0.089
	25 th	0.029	-0.004	0.074	-0.014	0.092
	50 th	0.038	0.003	0.086	-0.008	0.103
	75 th	0.048	0.009	0.099	-0.001	0.118
	90 th	0.068	0.021	0.127	0.010	0.152
Perceived Feedback	10 th	0.042	-0.000	0.096	-0.014	0.119
	25 th	0.043	0.002	0.096	-0.012	0.118
	50 th	0.047	0.009	0.098	-0.002	0.117
	75 th	0.052	0.013	0.103	0.002	0.122
	90 th	0.060	0.013	0.120	0.001	0.145

Notes: N = 226.

Bold confidence intervals indicate significant effects.

confidence intervals, we find that the mediation effects for perceived task autonomy, variety, identity, and feedback to be significant for moderate to high levels of financial compensation only. For 99 percent confidence intervals, we find all mediation effects to be significant for high to very high levels of financial compensation only. As research points to the superior power of resampling approaches in testing mediation and combined indirect effects [64, 65, 70], we partially accept Hypothesis 3a to Hypothesis 3c and accept Hypothesis 3d.⁸

We probed our moderated mediation analyses through visual representations. We plotted the strength of the moderated mediation effect (Figures 3–6) of the perceived task characteristics on identification with crowd work through perceived satisfaction with crowd work for different values of financial compensation. Furthermore, we included the threshold values for which the mediating effects are significant with $p < 0.01$. Results indicate that the mediation effect becomes significant for a minimum compensation of €9.7 EUR per hour (59th percentile) for perceived feedback, a minimum compensation of €12.5 EUR per hour (74th percentile) for perceived task variety, and a minimum compensation of €14.5 EUR per hour (79th percentile) for perceived task identity and autonomy.

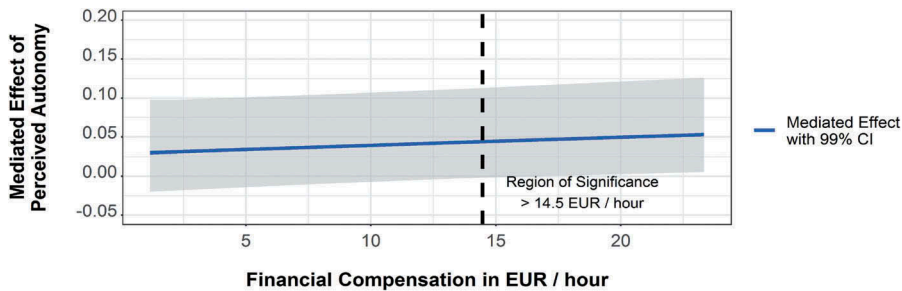


Figure 3. Strength of mediated effect of perceived autonomy by financial compensation.

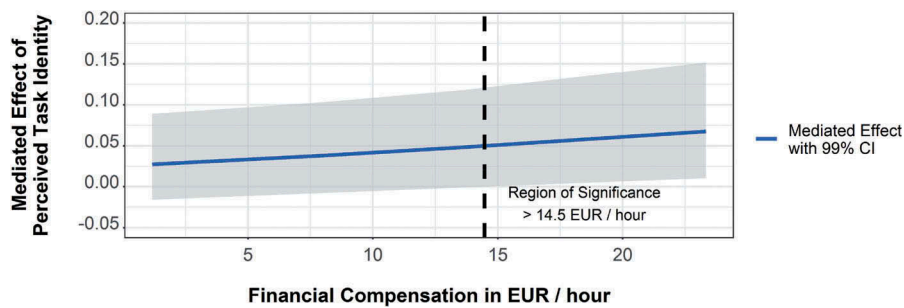


Figure 4. Strength of mediated effect of perceived task identity by financial compensation.

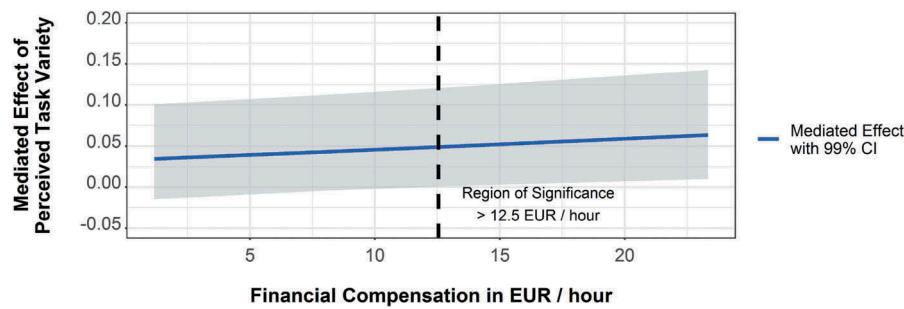


Figure 5. Strength of mediated effect of perceived task variety by financial compensation.

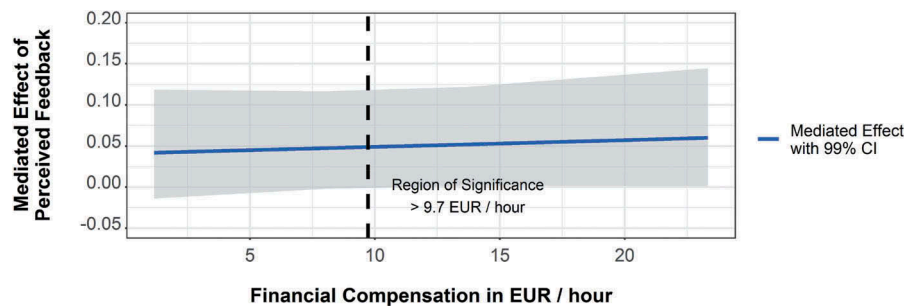


Figure 6. Strength of mediated effect of perceived feedback by financial compensation.

In sum, these interaction plots confirm our numerical results of the moderated mediation analyses. [Table 6](#) summarizes our hypotheses and testing results.

Discussion

Theoretical Implications

We offer three important contributions that improve our understanding of crowd work.

Table 6. Summary of hypotheses testing.

Hypothesis	Effect	Decision
H1	Perceived Satisfaction → Perceived Identification	Accepted
H2a	Perceived Autonomy → Perceived Satisfaction → Perceived Identification	Accepted
H2b	Perceived Task Variety → Perceived Satisfaction → Perceived Identification	Accepted
H2c	Perceived Task Identity → Perceived Satisfaction → Perceived Identification	Accepted
H2d	Perceived Feedback → Perceived Satisfaction → Perceived Identification	Accepted
H3a	Perceived Autonomy → Perceived Satisfaction → Identification; Moderated (+) by FC	Partially Accepted
H3b	Perceived Task Variety → Perceived Satisfaction → Identification; Moderated (+) by FC	Partially Accepted
H3c	Perceived Task Identity → Perceived Satisfaction → Identification; Moderated (+) by FC	Partially Accepted
H3d	Perceived Feedback → Perceived Satisfaction → Identification; Moderated (+) by FC	Accepted

Notes: FC, Financial Compensation.

Multi-Platform Perspective on Perceived Working Conditions in Crowd Work

We enlarge existing research on crowd work by studying the perceptions of individual crowd workers [41, 71]. Although a few studies have already examined the experiences, perceptions, and behaviors of crowd workers [17, 18, 37, 41, 49], they focus on one specific type of crowd work on one specific platform – micro tasking on AMT. In contrast, we analyze data collected on 23 different platforms and including various crowd working tasks, for example, micro tasking, knowledge, or creative tasks. To our knowledge, this study is the first to add a multi-platform perspective on perceived working conditions in crowd work. Thus, we contribute to existing research that considers platforms as labor markets by helping overcome selection biases in prior research. Our results are also noteworthy since they are based on data from survey respondents in a highly developed country (Germany) with a comparably high level of wages.

Interacting Effects of Perceived Task Characteristics and Financial Compensation

We extend research on motivational factors and task design in crowdsourcing and crowd work as well as their influence on psychological work outcomes such as satisfaction and identification with one's work [11, 44]. Applying SDT as a theoretical framework, we show how the interaction of intrinsic (i.e., perception of task characteristics) and extrinsic (i.e., financial compensation) motivation jointly shape the perceived satisfaction and perceived identification with crowd work. While there is abundant research on motivation [39, 51] and task design in the fields of crowd work and crowdsourcing, these studies focus on effects on work performance [6, 11, 25, 29, 69] or cognitive and emotional short-term evaluations such as participation [10, 46, 78]. We extend this research in two important ways.

First, we abandon the prevalent organizational focus of these studies [1, 8-10, 44, 46, 51] and put the working perceptions of individual crowd workers at the heart of our study. Thus, our results explain how and why crowd workers develop a strong emotional bond with this innovative type of labor in highly-developed countries such as Germany. Satisfying working conditions are not only grounded in appropriate financial compensation but also in sufficient task autonomy, variety, identity, and feedback. These results help us to better understand when and under what conditions crowd work can be regarded as a fulfilling type of digital labor. This is important because these findings enable us to better understand the nature of work that is performed on crowd working platforms. We go beyond prior qualitative research on crowd workers' perception [17, 18] and show — by means of large quantitative survey — how satisfaction reflects the generative mechanisms through which perceived task characteristics and financial mediation facilitate the emergence of identification.

Second, we provide a better understanding of the role of financial compensation in these processes. Our results suggest that financial compensation has no direct effect on satisfaction that reflects a crowd worker's short-term evaluation of the completed tasks. Similarly, we found no direct effect of financial compensation on identification with crowd work that can be regarded as the result of a magnitude of such short-term evaluations over time [14]. By contrast, we find that financial compensation only indirectly affects perceived identification with crowd work via strengthening the link to the perceptions of the tasks being performed through perceived satisfaction with crowd work. Drawing on prior SDT research [15, 16], our results suggest an alternative interpretation of the effects of increasing financial compensation. While existing research reported on certain effects that undermine intrinsic motivation of crowd workers [6, 69], our research suggests that high financial compensation is perceived as an informational cue. Our results advocate that financial compensation reflects a well-internalized extrinsic motivation and serves as an indication of appreciation and competence that crowd workers have built up on crowd working platforms. Thus, increasing financial motivation reduces the controlled motivation of crowd workers such that the effects of perceived task characteristics as intrinsic motivation on perceived satisfaction and identification with crowd work become more salient. Thus, we do not only extend prior research dealing with the effects of intrinsic and extrinsic motivation in the domain of crowd working and crowdsourcing, but we also contribute to SDT research that calls for additional studies examining how financial compensation affects the internalization of external regulations [16].

Boundary Conditions of Task Design

Our results exhibit the interrelated nature of perceived task characteristics and financial compensation in crowd work. In general, our results suggest that crowd workers need a certain level of financial compensation, before task characteristics become relevant for shaping favorable perceptions of working conditions. Our results support the role of financial compensation as a hygiene factor in crowd work. However, two effects are particularly noteworthy for better understanding the boundary conditions of task design in crowd work: perceived task identity and autonomy.

In line with prior research on new work arrangements, we identified task decomposition as a contextual element that affects the design as well as the perception of work [60, 62, 79]. We offer a better understanding of the effects of division of labor on crowd working platforms. In general, our results suggest that the potential of task decomposition is limited when we also consider the perspective of crowd workers; overly decomposed tasks may hinder the creation of satisfaction and identification with one's work. However, this mechanism is contingent on a crowd worker's level of financial compensation. Our results suggest that perceived task identity has an effect on identification for crowd workers with high financial compensation only. This implies that many crowd workers are captured in a kind of "task decomposition trap" from which they can only escape by performing a multitude of tasks on a given crowd working platform until they have the status, competence, and bargaining power to realize high levels of financial compensation [21]. This contrasts existing research that has predominantly considered task decomposition in crowd work as beneficiary in terms of quality control, automation, and quality of obtained results [1, 8, 19, 41, 79].

Similarly, autonomy has been characterized as one of the most important motivations for why individuals participate in crowd work [17, 18]. We extend this research by showing that perceived autonomy is also an important factor for creating favorable crowd working conditions. However, we found that this effect is contingent on the financial compensation that crowd workers receive and that the indirect effect of perceived autonomy becomes salient for individuals that receive an above average compensation only. Crowd workers might be attracted by the autonomy to decide when, where, and how to work. However, our results imply that reaping the psychological benefits from this autonomy is reserved for a comparable small group of crowd workers, while they remain elusive for the majority of the crowd.

Practical Implications

For Crowd Working Platforms

Crowd working platforms should consider our results because identification is essential to retain crowd workers. Today, most platforms do not design tasks on their own. Instead, they provide the infrastructure with which crowdsourcers can broadcast tasks. In addition to developing incentive schemes that ensure sufficient remuneration to crowd workers, platforms should develop governance mechanisms [8] that encourage crowdsourcers to create tasks that allow for autonomy, variety, and identity as well as ensure that crowdsourcers provide constructive feedback. Our work suggests that creating highly decomposed, repetitive, and rigid tasks, particularly in combination with a low financial remuneration, hinder crowd workers in developing a strong psychological bond with crowd work. This finding is important since crowd workers usually start with simple, repetitive, and highly decomposed tasks for little remuneration. Thus, platforms following this well-established scheme may lose potential crowd workers at the beginning of their crowd working career such that platforms must constantly invest in renewing their labor pool.

For Crowdsourcers

Since crowd work provides on-demand access to labor, crowdsourcer – crowd worker exchanges are likely to be one-time interactions. Therefore, crowdsourcers should focus on satisfying crowd worker preferences regarding the tasks at hand. We show that perceived task characteristics have a more important influence on perceived satisfaction than financial compensation in the short-term. Thus, crowdsourcers can contribute to favorable working conditions by offering tasks that allow for a high degree of autonomy, variety, and identity. For instance, a crowdsourcer could compile a work assignment that is composed of several different subtasks, whose results add up to an overarching solution; this assignment is then allocated to a single crowd worker. Also, providing constructive feedback to crowd workers regarding their work performance is beneficial, that is, by properly using the review systems. However, financial compensation is not irrelevant. Only if appropriately paid, such positive working experiences can contribute to the crowd workers' professional wellbeing in the long run.

Limitations and Future Research

Our study is not without limitations. First, we did not examine the influence of perceived task characteristics on satisfaction and identification over time. There might be time-variant effects that are caused by changing perceptions of task characteristics or the work environment. A longitudinal study might help develop a more dynamic understanding of the phenomenon. Second, we did not observe any effects on actual task performance; this may be a potential avenue for future research. Prior studies found that task characteristics as well as financial compensation may positively affect task performance [3, 11, 69]. Our findings illustrate how task characteristics and financial compensation affect psychological work outcomes. Thus, further research should examine interrelations between work performance and psychological work outcomes, potentially also taking into account varying contingencies. These analyses would provide important insights on how crowd working platforms as well as crowdsourcers might influence the performance of their crowd workers via more effective task design.

Conclusion

We show how the nature of the tasks being performed and financial compensation jointly shape work perceptions of crowd workers in a highly developed country. Our results indicate that only crowd workers who realize high levels of financial compensation can psychologically benefit from crowd work and its potential advantages such as autonomy or task variety. These results are important because they challenge the dominant design that has established among current crowd working platforms.

Notes

1. www.99designs.com
2. www.upwork.com
3. www.testbirds.de
4. www.clickworker.de
5. In contrast to perceived autonomy as a task characteristic, autonomous motivation reflects an individual's engagement in an activity with a full sense of willingness, volition, and choice [15, 16].
6. Equation (3) also contains a perceived satisfaction with crowd work and financial compensation interaction. We included that term in order to rule out that the 'perceived satisfaction with crowd – identification with crowd work' link in the mediation relationship is moderated by financial compensation and to increase the robustness of our results [59].
7. A direct statistically significant relation between the predictor and the outcome is not a necessary condition for establishing mediation [24, 36, 70], in particular if the formation of the outcome requires a longer period of time to manifest – such as identification with crowd work that we conceptualized as the result of a magnitude of short term evaluations over time.
8. Given that resampling has greater power in detecting moderated mediation effects than OLS regressions, a potential explanation for these findings could be that perceived feedback involves the direct evaluation of one's working performance by an external third party. If personal perceptions of perceived feedback given by a third party match with internalized financial compensation signaling the own competence, the effect might be much more salient for crowd workers receiving high financial compensation than the effects of the other three task characteristics that are based on 'internal' evaluation processes only. To rule out alternative explanations, we also performed an analysis of multicollinearity [31] for which we found no indication.

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