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The Flow of Digital Labor

Abstract

Digital microwork is a type of labor that many – typically poorly paid – workers engage in. In our research, we focus on an experience-based model of digital labor and the nonmonetary benefits derived from such activities. Based on a survey of 701 workers at Amazon Mechanical Turk, we demonstrate that experiences during digital labor sequences generate flow-like states of immersion. We show that reaching flow-like states while performing microwork depends on certain work characteristics, such as the particular worker's degree of autonomy, the extent to which a worker's skills are utilized, and the apparent significance of and feedback derived from the task. The results both highlight the importance of flow-like immersion in explaining why individuals engage in digital labor projects and point to avenues that can lead to the design of better digital work experiences.

keywords: digital labor, microwork, flow, task characteristics

The Flow of Digital Labor

1. Introduction

"The time which we have at our disposal every day is elastic; the passions that we feel expand it, those that we inspire contract it; and habit fills up what remains."

Marcel Proust – In Search of Lost Time, 1913

As digital and social technologies advance, the nature and meaning of work continue to evolve, rendering work increasingly granular, modular, and decontextualized (Ashford et al. 2007; Connelly & Gallagher 2004; Irani, 2013). This evolution allows large-scale projects to be broken down into small work packages that can be distributed among a digital workforce (Kittur et al. 2013; Lehdonvirta & Ernkvist 2011; Paolacci, Chandler & Ipeirotis, 2010).

This type of digital microwork offers the advantage of an efficient and often relatively inexpensive workforce because laborers frequently work for low levels of compensation or even for free (Aytes, 2013; Kittur, Chi & Suh, 2008). Accordingly, a growing body of research focuses on how to motivate "better, cheaper and faster worker performance […] to get good data from workers, quickly and without paying much" (Silberman et al., 2010).

Concurrently, critics argue that such work undervalues human labor (Fuchs & Sevignani, 2013; Terranova, 2000) and fails to provide basic worker protections, such as a minimum wage, health insurance, and overtime compensation (Burston, Dyer-Witheford & Hearn 2010; Fuchs & Dyer-Witheford, 2013; Scholz, 2013). Furthermore, Aytes (2013) argues that the fragmentation of work in digital labor settings disenfranchises workers by detaching them from the final intellectual product. In this light, digital microwork might well represent "new forms of labor but old forms of exploitation" (Fuchs & Sevignani, 2013; Paolacci, Chandler &

Ipeirotis, 2010; Scholz, 2013), an insight that begs the question: why do laborers engage in digital work at all—considering the exploitation, precarity, and alienation associated with it?

In their survey, Paolacci, Chandler, and Ipeirotis (2010) address this question (partially) by showing that few digital workers, engaged in the digital crowdsourcing platform Amazon Mechanical Turk (AMT), rely on digital labor as their primary source of income. Nevertheless, most participants conceded that earning additional money was at least one of the drivers motivating their engagement in the platform. In addition to monetary incentives, the respondents indicated that they found their digital work to be an entertaining and fruitful way to spend their leisure time (Paolacci, Chandler & Ipeirotis, 2010). Similarly, Fuchs and Sevigniani (2013) argue that workers may perceive digital labor as both work and fun or play, a perception that may be related to the properties of digital microtasks, which often closely resemble leisure activities because they do not "feel, look or smell like labor at all" (Scholz, 2013, p. 4). In the same vein, Shirky (2010) argues that digital labor constitutes a form of digital volunteerism and that it should thus be regarded as a leisure activity that is a productive use of "cognitive surplus". From this perspective, digital labor is not so much exploitation but rather a means to empower workers to strive toward autonomy, skill improvement, community membership, and social connectedness (Fish & Srinivasan, 2012).

This dichotomy between exploitation and empowerment shapes a large part of the debate on digital labor (Fish & Srinivasan, 2012; Postigo, 2014). Although our contribution is set against the backdrop of this discussion, we would like to step back from the initial ideological discrepancies to gain perspective and scrutinize the digital work experience at the core of the debate. In particular, we want to examine how people experience their time spent working on granular, modular, and decontextualized tasks on the Internet to better understand workers'

motivations for engaging in digital labor. Through this experience-based lens, our work might complement extant research on both normative and utilitarian concerns in digital labor.

The AMT forum, found at turkernation.com, is one of many sites where workers exchange views and describe their multifarious digital microtasking experiences. One user describes digital work as "a game that pays you money" ['birdz'], whereas another muses that "it definitely helps the day go by faster" ['spowers88']. Some users even find themselves completely immersed in their digital work: "Don't be surprised if you find yourself [working] away into the wee hours of the morning" [Pbr_chick].

According to these users, digital labor may be characterized by flow-like experiences (Csikszentmihalyi, 1975, 1990) as enjoyment ('games') and absorption ('time flies') lead to complete immersion in the tasks ahead (Bakker, 2008). This finding is consistent with Paolacci, Chandler, and Ipeirotis (2010) and Aytes (2013), who find that positive experiences such as enjoyment are drivers of engagement in digital labor.

On the basis of these observations, we seek to explore (1) whether experiences during sequences of digital labor induce flow-like states of immersion and (2) how consideration of such experiences might help researchers better understand why individuals engage in digital labor projects. At this juncture, our work seeks to complement not only current research on extrinsic motivations, such as monetary rewards, but also research on intrinsic motivations, such as skill development and/or social capital. Consequently, we posit that flow-like experiences may have to be considered in explaining the digital labor phenomenon.

In this article, we first present a brief overview of the current discussion surrounding digital labor and then offer a synthesis of research on "flow" in general and on the particular types of enjoyment, absorption, and intrinsic motivation that are sometimes associated with work and

the workplace. Furthermore, we develop a survey instrument to measure key aspects of flow experiences in digital labor settings. Finally, we present an experience-based model of digital labor, discuss the key relationships in this model, and propose avenues for further research to reconcile our findings with the current debate on digital labor.

2 Literature Review and Research Model

The human face of computerized labor

Although an increasing number of microtasks era are performed by machines (Brynjolfsson & McAfee, 2012), some distinct tasks remain – for the time being – solely in the domain of human workers. According to Brynjolfsson and McAfee (2012), "computers so far have proved to be great pattern recognizers but lousy general problem solvers". Therefore, human labor is still relied upon for such microtasks as transcribing a snippet of hand-written text, classifying an image, categorizing the sentiment expressed in a comment, rating the relevance of a search engine result, and selecting the most representative frame in a video clip (Kittur et al. 2013; Lehdonvirta & Ernkvist 2011). Delegating tasks that are difficult, expensive, or simply impossible for computers to perform to an anonymous human workforce has been termed crowdsourcing or 'artificial artificial intelligence' (Amazon, 2005).

The coordination of digital work within an anonymous community has been explored in various contexts (Quinn & Bederson, 2011), including gamification (Von Ahn & Dabbish, 2004), peer production/co-creation (Benkler & Nissenbaum, 2006; Viegas, Wattenberg & Mckeon, 2007), the wisdom of crowds, and paid crowd work (Kittur et al., 2013). One of the most cited platforms for the mediation of microtasks is AMT, which connects "requesters" (employers) with "providers" (micro-contractors) of digital work around the globe. On AMT, completing a

microtask, i.e., a human intelligence task (HIT), typically takes seconds or minutes, and workers are paid a few cents at a time.

Critics argue that digital labor constitutes a modern form of exploitation (e.g., Fuchs & Sevignani, 2013; Terranova, 2000) because it undervalues human labor (Fuchs & Sevignani, 2013; Paolacci, Chandler & Ipeirotis, 2010; Scholz, 2013), lacks basic worker protections (e.g., Burston, Dyer-Witheford & Hearn 2010; Fuchs & Dyer-Witheford, 2013), and – through substantial task fragmentation – dissociates workers from the final product (Aytes, 2013).

Understanding the motivations for digital work from the perspective of flow

The most prominent question related to digital work asks why workers engage in digital labor projects even in the absence of a strong monetary incentive (e.g., Aytes, 2013; Paolacci, Chandler & Ipeirotis, 2010; Postigo, 2014; Ross et al. 2010; Scholz, 2013;). Nov, Arazy and Anderson (2011) report that the most important motivation for voluntary participation in a digital labor project is the collective and intrinsic fun or "enjoyment associated with participation in the project".

Csikszentmihalyi (1975, 1990) introduced the concept of "flow" as part of a theory of optimal experience. The notion of flow was originally derived from a series of qualitative interviews in which participants were asked why they performed certain autotelic activities. In this context, the term "flow" recurred continuously as a description of optimal experiences. Consequently, Csikszentmihalyi (1990) defines "flow" as a "state of consciousness where people become totally immersed in an activity, and enjoy it intensely". During experiences of flow, individuals feel cognitively efficient, motivated, and happy (Fagerlind et al., 2013; Fullagar & Kelloway, 2009; Moneta & Csikszentmihalyi, 1996). Park, Ahn, & Kim (2010) further de-

scribe flow as a state of extremely high emotional involvement in which one is engrossed in an activity. Gerow (2013) defines flow as a "holistic experience including playfulness, enjoyment, absorption in the activity, control, concentration, curiosity, intrinsic interest, and a match between the task challenge and the individual's skill level".

Individuals tend to experience flow in situations involving substantial challenge and skill utilization (Fagerlind et al., 2013). In other words, flow can be experienced during activities that are demanding enough to be interesting but not so difficult that they cause frustration (Nielsen & Cleal, 2010). Initially, research on flow focused primarily on recreational activities such as golf, athletics, swimming, chess, art, and music (Catley & Duda, 1997; Csikszentmihalyi & LeFevre, 1989; Jackson & Marsh, 1996; Kowal & Fortier, 1999). In the last decade, however, flow has increasingly been scrutinized in the work domain as well (Bakker, 2008, Demerouti, 2006; Fagerlind et al., 2013; Gerow et al., 2013; Nielsen & Cleal, 2010).

Work-related flow can be defined as "a short-term peak experience characterized by absorption, work enjoyment, and intrinsic work motivation" (Bakker, 2008). Achieving flow at work is associated with certain job characteristics, such as clear goals, adequate feedback, a balance of challenge and skill, a sense of control, and the flexible use of time (Csikszentmihalyi, 2003, p. 96). Furthermore, Fagerlind et al. (2013) find that active, low-stress jobs with a high degree of social capital and an innovative learning climate increase the likelihood that individuals will experience work-related flow. Work-related flow is highly desirable because it is associated with increased vigor and performance as well as decreased exhaustion.

Although workers typically experience flow in challenging and interesting situations, it is not impossible for workers to experience flow in jobs that are less stimulating and utilize only a

fraction of one's skills (Csikszentmihalyi, 2003). In addition, workers may find it difficult to do good work when the sole motivation for their job is monetary (Csikszentmihalyi, 2003).

Work-related flow has been conceptualized as an overarching construct because of the difficulty of assessing or "capturing" the volatile experience of flow itself (Rodriguez-Sanchez et al., 2011). According to Nielsen and Cleal (2010) and Bakker (2008), there are three core elements of work-related flow: (1) absorption, which refers to absolute concentration and involvement in an activity; (2) enjoyment, which refers to the experience of enjoying an activity; and (3) intrinsic motivation, which refers to the desire to perform a certain activity because of fascination with the activity. The term "flow" applies when absorption, enjoyment, and intrinsic motivation are experienced simultaneously, which implies that flow is a second-order construct (Demerourti, 2006). Similarly, Wang and Scheepers (2012) view enjoyment, concentration, and time distortion as integral dimensions of flow. Here, intrinsic motivation is understood not as a constituent but as an a posteriori dimension of flow.

The first component of flow, absorption, is marked by episodes of "total" attention that fully engage one's representational (i.e., perceptual, enactive, imaginative, and ideational) resources (Tellegen & Atkinson, 1974). Absorption is a state of attention that is highly centered and that greatly amplifies the experience of one part of reality while diminishing the focus on other aspects. Absorption is considered the *cognitive component* of flow (Rodriguez-Sanchez, 2008). To achieve a flow state, the amount of challenge should be neither too low (to avoid boredom) nor too high (to avoid frustration), but it is possible to also experience flow in situations of low challenge when one's skills are commensurate to the task (Haworth & Evans, 1995).

Enjoyment is the positive feeling that one derives from performing an activity or task. In the workplace, enjoyment has gained attention as both a determinant of behavioral intention (Davis et al., 1992; van der Heijden, 2004; Venkatesh et al., 2002; Turel & Serenko, 2012) and a factor that influences ease of use (Venkatesh et al., 2002). Rodriguez-Sanchez (2008) conceptualizes enjoyment as the emotional component of flow. Because enjoyment is often inherent in voluntary settings in which individuals have a high degree of control over the activities that they choose to perform (Turel & Serenko, 2012), we hypothesize that enjoyment might be present in voluntary digital work settings, such as AMT.

The third dimension of flow, intrinsic motivation represents the motivation to engage in an activity purely for the sake of the activity itself (Deci & Ryan 1985). Intrinsic motivation can be defined as an individual's interest in a task or as an individual's satisfaction that results from engaging in a task (Ryan & Deci, 2000). In the literature, intrinsic motivation has been regarded as a prerequisite for or antecedent of flow (e.g., Rodriguez-Sanchez, 2008) and as a constitutive element of flow (e.g., Bakker, 2008). In the present study, we posit that intrinsic motivation is a component of flow in digital work.

Model development

From the literature review, we derive a model that encompasses flow as a second order factor consisting of absorption, enjoyment and intrinsic motivation. Next, we consider the effect of job design on the probability that workers experience flow states during digital labor. Bakker (2008) and Nielsen (2010), among others, consider job characteristics to be powerful predictors of flow. In their job characteristics theory, Hackman and Oldham (1976) suggest five job characteristics that are likely to affect psychological states and work outcomes: *skill variety* (does the job require different skills?), *task identity* (is the outcome of the job visible from beginning to end?), *task significance* (does the worker feel that the work is important?), *au-*

tonomy (does the worker have some leeway in designing her approach to the task?), and *feedback* (does the worker know how well he is doing?).

Finally, as outcomes we consider job satisfaction, continuance commitment, and time investment. Humphrey et al. (1997) show in a meta-analysis that many job characteristics, such as autonomy and task significance, positively influence performance and job satisfaction. Given the relationship between job characteristics and flow, we argue that flow increases work satisfaction. In the literature, work-related flow is distinguished from job satisfaction, which is "a pleasurable and positive emotional state resulting from the appraisal of one's job" (Locke, 1976, p. 1300). For the same reason, flow is not identical to (intrinsic) motivation (Demerouti, 2006). Job satisfaction refers to how people feel about their jobs and different aspects of their jobs. Thus, we posit that flow increases satisfaction with work on AMT. An overview of the overall hypotheses model is provided below.

FIGURE 1: Hypotheses Model ABOUT HERE

3. Methods

3.1 Sample and Measures

In this section, we present the findings of a quantitative investigation of digital laborers' experience of flow states during work-related tasks – which depend on the characteristics of these tasks – and the effects of these flow states on work satisfaction. The survey sample was recruited from AMT, where 701 users were invited to participate in the survey in August 2014. Table 1 summarizes the overall sample composition.

TABLE 1 Sample Profile ABOUT HERE

The questionnaire that was employed in the survey questioned participants regarding certain demographic characteristics, including age, gender, education, and tenure on AMT. For purposes of comparison, the workers were recruited solely from the United States. The workers who took part in our survey were 35 years old on average (median = 29) and were thus slightly younger than both the U.S. population and the population of Internet users. Males were slightly overrepresented in our sample compared with other studies of AMT, where more participation among women was reported (Paolacci et al., 2010). The participants' (self-reported) education levels were high, with about half holding college degrees; this result is consistent with other surveys of the AMT population, which report a generally high level of education and life experience for this population (Berinsky et al., 2012; Paolacci et al., 2010). Survey participants spent an average of 22 hours per week on AMT (median 20 hours, standard deviation 14.5 hours, minimum 1 hour, and maximum 100 hours per week).

The questionnaire was based on measures found in the literature on work motivation and flow states, the emerging literature on digital labor, and the literature on job design and task characteristics: Work-related flow was measured using the work-related flow inventory, which consists of 13 items used to assess whether individuals have experienced flow at work during the preceding two weeks in terms of enjoyment, intrinsic motivation, and absorption (Bakker, 2008). The scales for job characteristics were taken from Hackman and Oldham (1976; 1980) and studies that adopt these scales in the ICT context (Tsaur, Yen & Yang, 2011). As outcome variables, we measured job satisfaction on a three-item scale adopted from Morris and Venkatesh (2010), continuance commitment and time spent per week working on AMT. Each item was rated by the survey participants on a five-point Likert scale (from 1 = absolutely applies to 5 = does not apply at all). All scales are listed in the Appendix.

3.2 Measurement Model

Overall, we considered ten latent constructs, the second-order flow construct, and time per week spent on AMT, for a total of 35 items in the measurement model. To conduct the analyses, we used MPlus (Version 7.1) Statistical Software and relied on robust Maximum Likelihood Estimation (MLE) to account for non-normality and other sources of distortion, such as heteroskedasticity and a non-normal distribution of error terms (Byrne, 2012). A confirmatory factor analysis was conducted to test for unidimensionality and scale reliability at the item and construct level. At the construct level, we used Cronbach's alpha (α), composite reliability (CR), and average variance extracted (AVE) to assess the internal consistency of the scales. Table 2 lists the results.

TABLE 2 Measurement Model ABOUT HERE

Following this procedure, two items (mo_1 and mo_2) were eliminated from the motivation scale, and one item (sa_2) was eliminated from the job satisfaction scale because their inclusion decreased the reliability coefficients. After this adjustment, α, CR, and AVE were above the required criterion values (Hair, Black, Babin, Anderson & Tatham, 2006). The other measures for these constructs showed good results; therefore, scale reliability can be assumed.

In addition to the confirmatory factor analysis, R^2 was calculated, and most items were well beyond the 0.4 criterion. The exceptions, which fell slightly below the criterion (Bearden & Sharma, 2003), were two items from the motivation scale (mo_4 and mo_5), one item from the task variety scale (va_1), one item from the task identity scale (id_2), and two items from the task feedback scale (fb_1 and fb_3). Because of their importance to the overall constructs, the items that fell below the threshold were retained. As shown in Table 3, the discriminant validity of the constructs can be assumed. To account for common method variance, we ap-

plied ex-ante measures, such as randomizing the items, separating the dependent and independent variables, and reverse coding some of the items, in the survey design, and we tested the results based on Harman's single factor test, which gave no indication of significant issues with common method variance in our data.

TABLE 3 Fornell-Larcker Criteria ABOUT HERE

4. Results

Based on the proposed hypotheses, we estimated the model shown in Figure 1 with Mplus for the sample (N = 701). The results include the standardized coefficients based on a maximum likelihood estimation (MLM) and the total variance explained (R^2) for each dependent construct for all participants. The results of the analysis are shown in Table 4. All the hypothesized and estimated paths were significant. The fitness indices for the model indicated good fit (Chi-Square = 804.555 (0.000) df= 431 Chi-Square/df =1.867; RMSEA = 0.035; CFI =.966 TLI = .960; SRMR= .048).

FIGURE 2: Structural Equation Model ABOUT HERE

TABLE 4 Hypothesis Testing and Indirect Effects ABOUT HERE

The results indicate that workers experienced flow states while performing microtasks. The coefficients for all the constituents of flow, namely, absorption, enjoyment, and intrinsic motivation, were highly significant. Absorption had the lowest loading of the constituents on perceived flow ($\beta = 0.613$) (H1a), whereas enjoyment ($\beta = 0.926$) (H1b) and internal motivation ($\beta = 0.920$) (H1c) loaded almost equally on perceived flow.

All five assessed task characteristics had a significant effect on perceived flow. In particular, higher skill variety was associated with higher perceived flow (β = .317) (H2a). Indeed, skill variety showed the strongest relationship with flow among all three task characteristics, suggesting that workers who performed tasks that demanded more skill and were more holistic in nature felt more immersed in their work. Both task significance (β = 0.185) (H2b) and task autonomy (β = 0.156) (H2c) had similar effects on perceived flow. Task identity had a lower and less significant effect on flow (β = 0.111) (H2d), which might be attributable to the granular nature of work on AMT, which may impede perceptions of a task as a constituent whole. Finally, task feedback exerted a significant effect on perceived flow (β = 0.148) (H2e).

Regarding indirect effects, all five task characteristics also had a highly significant effect on job satisfaction. For all of them, the indirect effect via flow is both larger and more significant than the direct effect (H4a-e).

Higher perceived flow was associated with higher perceived job satisfaction (β = 0.747) (H3), more time spent working on AMT per week (β = 0.372) (H5) and a stronger commitment to continue working on the platform in the future (β = 0.256) (H6). Job satisfaction was also positively related to commitment to the platform (β = 0.587) (H7).

In total, approximately 42 percent (R2 =.420) of the total variance in flow, 68 percent (R2 =.668) of the variance in job satisfaction, and approximately 66 percent (R2 =.655) of the variance in continuance commitment can be explained by the other constructs, which indicates that the constructs have good overall explanatory power for flow, job satisfaction, and continuance commitment. Time expenditure, however, had comparatively low explanatory power, accounting for only approximately 5 percent (R2 =.047) of the total variance.

5. Discussion and Conclusion

Our research suggests that flow in the form of enjoyment, absorption, and intrinsic motivation is present in digital labor settings. This finding may contribute to the discussion of why individuals engage in digital labor in general and in crowdsourced digital microwork platforms, such as AMT, in particular – even in the absence of significant monetary incentives. At this juncture, it can be argued that flow experienced during digital labor at least partially compensates for the lack of significant financial compensation.

All three components of flow were clearly perceived during the digital work experience. Enjoyment and intrinsic motivation may be present due to the rather playful nature of many microtasks such as usability testing, image tagging, audio transcription and/or evaluation, and text fragment categorization. It is human nature to enjoy playful activities – such as solving crossword puzzles or playing chess – that help individuals refine skills such as pattern recognition and problem solving. Similarly, dgital microtasks may be considered playful and intrinsically motivating because they challenge individuals' skills on various levels and help them refine their abilities. Absorption, on the other hand, may result from the granular nature of digital labor, which presents itself as a series of short work intervals that afford frequent micro-gratifications as one work package is successfully completed and a new one is taken up.

Our results further show that the nature and design of microtasks can be conducive to the experience of flow. More to the point, clearly identifiable tasks that demand a great variety of skills and come with a high degree of autonomy in terms of how work processes are organized are likely to predict flow. This finding is consistent with current research suggesting that flow occurs in situations involving high challenge and skill utilization (Fagerlind et al., 2013). Finally, the significance individuals attribute to the task determines whether individuals are likely to experience flow. This is interesting insofar as, in digital environments, work-

ers are somewhat disenfranchised and alienated from the final product, due to the high granularity and modularity of work packages (Aytes, 2013).

The presence of flow positively affects job satisfaction, time commitment, and continuance commitment. The occurrence of flow implies that users find digital labor sufficiently demanding to be interested in their work but not so difficult that it causes frustration (Nielsen & Cleal, 2010). In particular, the positive relationship between flow and job satisfaction suggests that workers may prefer tasks that provide a balance between challenge and skill utilization. Thus, if two tasks that are otherwise similar offer the same monetary compensation, workers may prefer the more challenging assignment to the easier one. Furthermore, individuals who experience flow not only invest more time in digital labor, they are also had higher continuance commitment.

Although our findings help explain why individuals work on AMT even if the expected monetary rewards are rather low, they do not suggest that monetary rewards should be dismissed entirely as drivers of engagement in digital labor. In the minds of digital laborers, it may be precisely the monetary incentives – low as they may be – that render digital labor enjoyable and playful in the first place. The role of monetary incentives may be scrutinized in a future study that considers the necessary and sufficient conditions for participation in digital work environments.

Our results suggest that flow occurs in digital work environments where workers may feel alienated and disenfranchised at the same time. This somewhat contrasts Mitchell's (1983) postulation that flow experiences and alienation are mutually exclusive. More to the point, Mitchell (1983) argues that flow is not possible in work environments where there is too much certainty and regulation in the form of 'alienation' (Marx, 1956, 1976) or too little cer-

tainty and structure in the form of ‘anomie’ (Durkheim, 1915, 1952). This prompts the question whether flow and alienation are in fact mutually exclusive or whether there are instances where both are present at the same time.

While micro-work is often associated with alienation, individual micro-workers may not experience all aspects of alienation (Seeman, 1959, 1967; Marx, 1956) equally severely. For example, while occasional feelings of powerlessness or isolation may occur, other aspects of alienation such as normlessness (anomie), self-estrangement or meaninglessness may be less pronounced or even absent. Here, further research is needed in order to determine which aspects of alienation are directly linked to digital microwork.

Also, in the case of alienation and flow, mutual exclusivity may be time relative. While specific microtasks may momentarily induce flow (in situ flow), the whole of the labor process may, in retrospect, be deemed alienating all the same (ex post alienation). Thus, after hours of being completely engrossed in microtasking, individuals may still feel a loss for that time. Here, the monetary compensation may (1) add to the playfulness of the acute flow experience on the one hand (in situ) and (2) counteract possible feelings of loss vis à vis other perhaps more meaningful activities on the other hand (ex post). Future research may build on the foundation of alienation as a starting point to further explore the ex-post evaluation of flow-inducing activities.

While our results suggest a correlation between job characteristics and flow, clear causality between the two cannot be assumed, as the flow experience remains at its core deeply individual – much like the individual perception of what makes “time go by” faster or slower. In his oeuvre, “In search of lost time”, Proust (1913) captures this notion well by suggesting that the perception of time seems to be “elastic” and highly subjective, depending not only on the

nature of the activity performed but on the individual's state of mind. Bearing in mind how individual the propensity to experience flow may be, we must assume that there may be self-selection bias in our sample: respondents in our survey were all somewhat experienced crowdworkers. We expect that individuals who did not find digital work intrinsically motivating, playful or absorbing did quit working in digital environments and are thus not present in our sample. With regard to future research, it would be interesting to test for flow in experimental settings with randomly selected participants.

Conclusion

Although our findings stress the playful and absorbing nature of digital labor, we do not mean to suggest that concerns about workforce exploitation (Fuchs & Sevignani, 2013; Terranova, 2000) are invalid. While digital laborers may experience flow-like states that are essentially positive peak experiences, when engrossed in completing work-packages, they may neglect important necessary tasks that are (1) less absorbing, less intrinsically motivating, and less enjoyable or (2) more productive in terms of material revenue. Aytes (2013) quotes a digital worker who describes a situation in which flow-like immersion in a digital task engendered a state similar to addiction: "[Digital labor] was kind of addictive as I always challenged myself to test and experiment and work for low-paying [tasks], thinking that I will be able to make decent money" (Mago in Aytes, 2013). Similarly, another worker on the AMT forum at turkernation.com reports missing a number of meals during periods of intense digital labor [cubbykatz] (AMT, 2014).

Thus, digital labor may be fun, but the actual return on the invested time and effort should be evaluated in a separate debate. Because of the granular, modular, and frequently decontextualized nature of digital labor, workers are often disenfranchised from the final intellectual prod-

uct of their labor (Aytes, 2013). This is criticized in digital labor research as an exploitative trait of such labor. Thus, digital employers and crowdworking platforms that serve as intermediaries between digital employers and the digital workforce may face an ethical responsibility to treat workers fairly and to counteract alienation and disenfranchisement in the digital workplace. Since flow, understood as a gratifying and intrinsically motivating experience, is essentially the antithesis of alienation (Mitchell, 1988, 1983), promoting tasks associated with flow in the digital workplace may be an interesting avenue to address alienation.

The question of alienation however cannot be addressed conclusively here, as the notion of whether or not individuals are alienated depends largely on their ability to express themselves creatively in a certain environment (Nygren and Gidlund, 2012). In this sense, digital labor could be interpreted in both a utopian and a dystopian sense, depending on whether or not one believes that in digital environments individuals are either empowered to autonomously create or used as mere tools of capital (based on Fromm, 1955; Marx and Engels, 1976; Comor, 2010; Nygren and Gidlund, 2012).

Our findings, however, may be a starting point for the design of high-quality digital work experiences. Tasks that are often associated with flow ideally involve a variety of skills, and they also allow for a degree of autonomy in terms of how individual work processes are carried out. Additionally, an optimal work experience may be expected to involve greater levels of difficulty as workers become more skilled. Even tenured workers should be able to find a degree of challenge in the work-packages at hand. Employers of digital laborers may, additionally, wish to provide meaningful tasks for workers or – at least – try to convey the overall significance of the final product to individual workers. Bearing this in mind, digital employers should help individuals refine their skills by offering adequate feedback and fair compensation for their time and resources invested. As in a non-virtual workplace, humans are at the

heart of the digital workplace — a fact that must not be forgotten, even if digital crowd work may create the somewhat technocratic illusion of “artificial artificial intelligence”.

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Table 1
Sample Profile (N = 701)

Variables	**Distribution**	**n**	**Percent**	**Missing**
Gender	male	391	55.8	-
	female	310	44.2	
	Total	*701*	*100*	
Age	18 - 24	112	16.0	-
	25 - 34	323	46.1	
	35-44	139	19.8	
	45-54	67	9.6	
	55-64	45	6.4	
	65 - older	15	2.1	
	Total	*701*	*100*	
Education	high school	90	12.8	-
	some college	260	37.1	
	college	351	50.1	
	Total	*701*	*100*	
Tenure	1-6 months	162	23.1	-
	6-12 months	171	24.4	
	1-2 years	214	30.5	
	more than 2 years	154	22.0	
	Total	*701*	*100*	

Table 2
Measurement Model

Construct	Item	Std. loading	t-values	R^2	α	C.R.	AVE	M	SD
Flow									
Absorption	ab_1	.770	37.911***	.593	.89	.90	.69	3.61	1.00
	ab_2	.792	41.971***	.627					
	ab_3	.852	60.073***	.725					
	ab_4	.892	64.738***	.795					
Enjoyment	en_1	.870	70.122***	.757	.95	.95	.82	3.73	.92
	en_2	.937	106.140***	.878					
	en_3	.922	104.064***	.850					
	en_4	.890	70.269***	.792					
Motivation	mo_3	.902	56.500***	.813	.73	.74	.50	3.24	.92
	mo_4	.553	16.475***	.306					
	mo_5	.620	23.969***	.384					
Second-order Factor Flow									
Flow	Absorption	.616	19.121***		.85	.87	.70	3.55	.80
	Enjoyment	.925	72.953***						
	Motivation	.919	50.080***						
Task Characteristics									
Task	va_1	.608	9.517***	.370	.78	.79	.57	4.17	.74
Variety	va_2	.793	24.531***	.628					
	va_3	.840	30.184***	.706					
Task	si_1	.913	47.288***	.833	.83	.85	.66	3.68	.90
Significance	si_2	.900	40.556***	.810					
	si_3	.589	15.603***	.346					
Task	au_1	.859	30.064***	.739	.86	.89	.73	4.08	.84
Autonomy	au_2	.780	25.979***	.608					
	au_3	.920	29.645***	.847					
Task	id_1	.649	18.200***	.421	.68	.70	.44	4.39	.62
Identity	id_2	.546	13.854***	.295					
	id_3	.769	25.521***	.597					
Task	fb_1	.580	15.390***	.343	.66	.72	.49	3.12	1.39
Feedback	fb_2	.977	26.024***	.935					
	fb_3	.430	11.962***	.189					
Outcomes									
Job	sa_1	.866	49.001***	.730	.81	.84	.72	3.49	.85
Satisfaction	sa_3	.827	44.551***	.707					
Continuance	cont_1	.629	15.878***	.395	.61	.66	.49	4.44	.65
Commitment	cont_2	.768	24.177***	.590					
Criterion		≥ 0.5		min* ≥ 0.4	≥ 0.7	≥ 0.6	≥ 0.5		

*** $p \leq 0.001$

Table 3

Discriminant Validity (Fornell-Larcker Criterion)

Construct	1	2	3	4	5	6	7	8
1 Flow	**.70**							
2 Variety	.28	**.57**						
3 Significance	.21	.22	**.66**					
4 Autonomy	.19	.17	.14	**.73**				
5 Identity	.15	.15	.15	.16	**.44**			
6 Feedback	.10	.04	.19	.11	.03	**.49**		
7 Satisfaction	.66	.17	.18	.19	.17	.12	**.57**	
8 Continuance	.53	.14	.14	.15	.19	.08	.64	**.49**

Diagonal items represent the average variance extracted for each construct. Shared variance among the constructs (squared correlations between constructs) is indicated below the diagonal line

FIGURE 1: Hypotheses Model

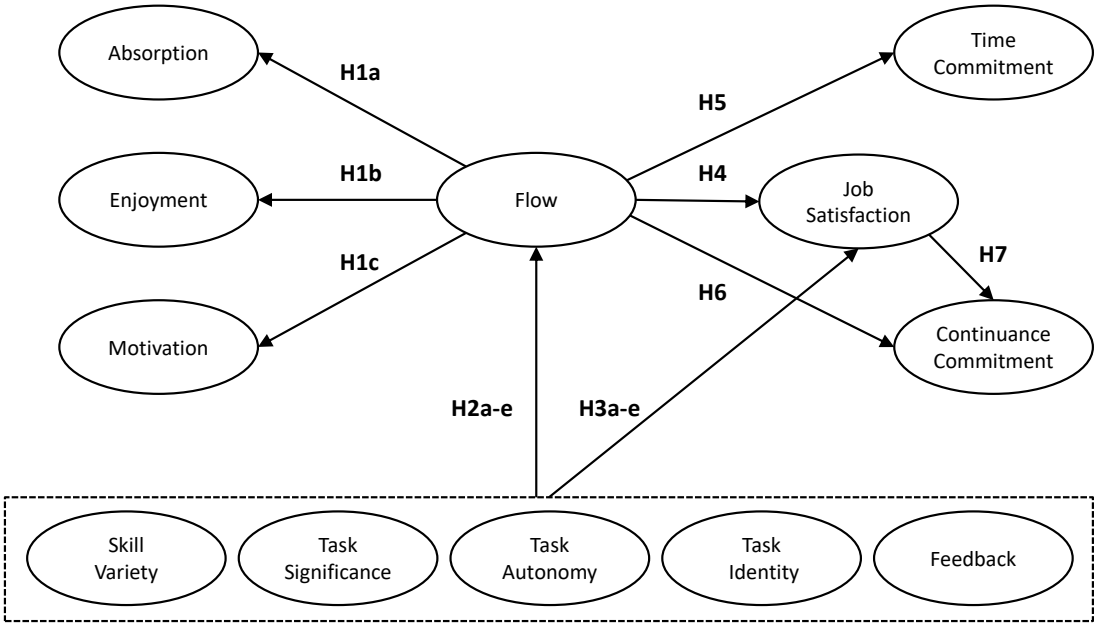
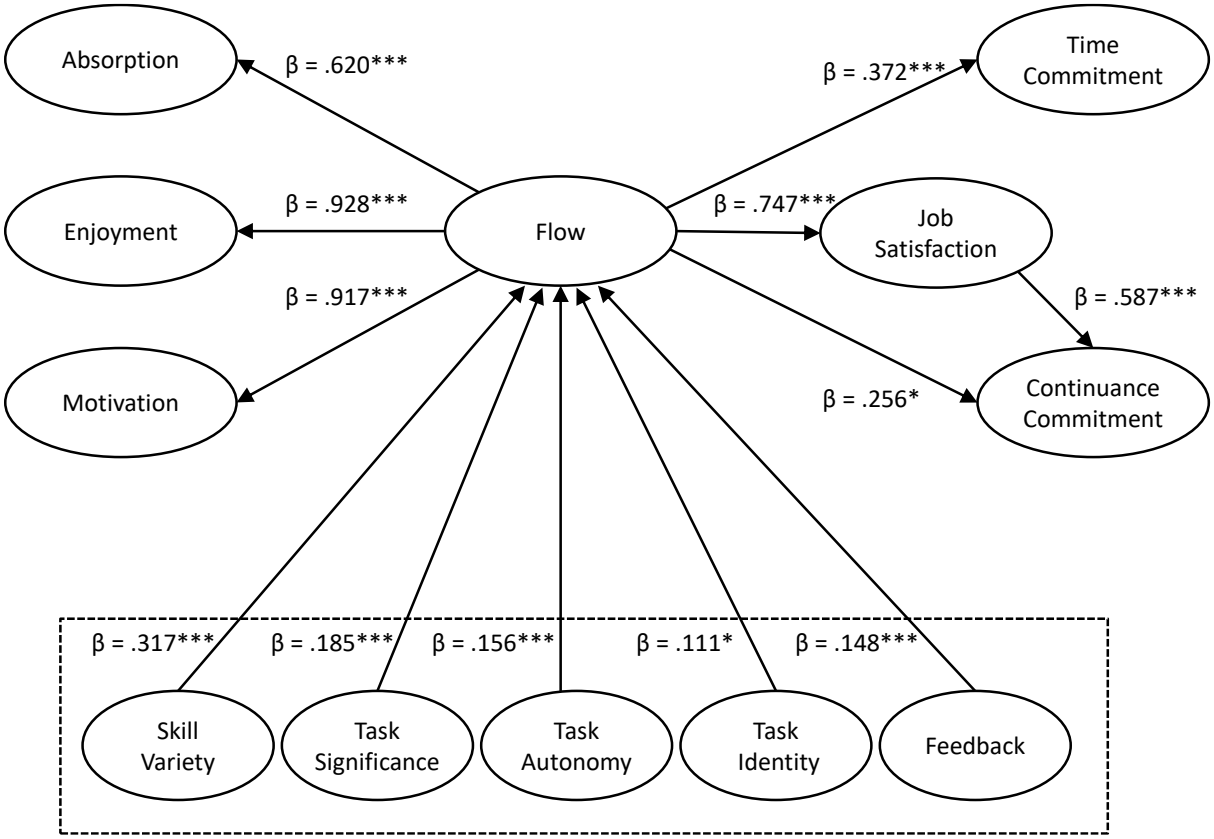


FIGURE 2: Structural Equation Model



(direct relationships from task characteristics to outcome variables not depicted)

Table 5
Parameter Estimates and Hypothesis Testing

Relationship	**Std. Estimate (t-value)**	**Result**
H2a. Skill Variety → Flow	.317 (7.111)***	supported
H2b. Task Significance → Flow	.185 (3.975)***	supported
H2c. Task Autonomy → Flow	.156 (3.643)***	supported
H2d. Task Identity → Flow	.111 (2.391)*	supported
H2e. Feedback → Flow	.148 (3.960)***	supported
H3. Flow → Satisfaction	.747 (18.650)***	
H4a. Variety → Job Satisfaction	-.10 (-2.443)*	supported
H4b. Significance → Job Satisfaction	.04 (1.030)	not supported
H4c. Autonomy → Job Satisfaction	.08 (2.170)*	supported
H4d. Task Identity → Job Satisfaction	.10 (2.303)*	supported
H4e. Feedback → Job Satisfaction	.08 (2.287)*	supported
H5. Flow → Time Commitment	.372 (4.508)***	supported
H6. Flow → Continuance Commitment	.256 (3.056)**	supported
H7. Job Satisfaction → Continuance Commitment	.587 (7.447)***	supported
Indirect Relationship		
Skill Variety → Flow → Satisfaction	.237 (6.310)***	supported
Task Significance → Flow → Satisfaction	.138 (3.964)***	supported
Task Autonomy → Flow → Satisfaction	.117 (3.549)***	supported
Task Identity → Flow → Satisfaction	.083 (2.383)*	supported
Feedback → Flow → Satisfaction	.111 (3.890)***	supported

* $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$

Appendix A: List of Variables

Construct	Item	Wording (Scale)[1]
Absorption	ab_1	When I am working on mechanical turk, I often think about nothing else
	ab_2	I often get carried away by my work on mechanical turk
	ab_3	When I am working on mechanical turk HITs, I often forget everything else around me
	ab_4	I am often totally immersed in my work on mechanical turk
Enjoyment	en_1	Working on mechanical turk gives me a good feeling
	en_2	I work on mechanical turk with much enjoyment
	en_3	I feel happy during my work on mechanical turk
	en_4	I feel cheerful when I am working on mechanical turk
Motivation	mo_3	I work on mechanical turk because I enjoy it
	mo_4	When I am working on a HIT, I am also doing it for myself
	mo_5	I get my motivation from the tasks I am doing and not primarily from the pay
Skill Variety	va_1	Working on mechanical turk involves doing a number of different things
	va_2	Working on mechanical turk requires me to utilize a variety of different skills in order to complete my HITs successfully
	va_3	Work on mechanical turk requires me to use a number of complex skills
Task Significance	si_1	The results of my work on mechanical turk are likely to affect the lives of other people
	si_2	Work on mechanical turk has an impact on people in the outside world
	si_3	Work on mechanical turk itself is not very significant or important in the broader scheme of things (R)
Task Autonomy	au_1	Work on mechanical turk allows me to decide on my own how to go about solving my HITs
	au_2	Mechanical turk gives me considerable opportunity for independence and freedom in how I do my work.
	au_3	My work on mechanical turk gives me the chance to use my personal initiative or judgment in carrying out work

[1] Likert Scale: 1 – Absolutely applies, 2 – Tends to apply, 3 – Applies in some cases, not in others, 4 – Tends not to apply, 5 – Does not apply at all

Task Identity	id_1	Working on mechanical turk involves completing a piece of work that has an obvious beginning and end
	id_2	My work on mechanical turk provides me with the chance to completely finish the pieces of work I begin
	id_3	Mechanical turk arranges work in such a way that I can do an entire piece of work from beginning to end
Task Feedback	fb_1	When I work on mechanical turk, I receive very few indications of whether I am performing well (R)
	fb_2	When I work on mechanical turk, I receive adequate feedback
	fb_3	When my work is being rejected, I usually know why
Job Satisfaction	sa_1	Overall, I am satisfied with being a turker
	sa_3	I am satisfied with the important aspects of mechanical turk
Continuance Commitment	cont_1	I plan to continue working for mechanical turk in the future
	cont_2	I would miss working on mechanical turk if it were gone
Time Commitment	time	How many hours do you spend working on mechanical turk per week?