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# PEER RATINGS AND ASSESSMENT QUALITY IN CROWD-BASED INNOVATION PROCESSES

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*Research in Progress*

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## Abstract

*Social networks – whether public or in enterprises – regularly ask users to rate their peers' content using different voting techniques. When employed in innovation challenges, these rating procedures are part of an open, interactive, and continuous engagement among customers, employees, or citizens. In this regard, assessment accuracy (i.e., correctly identifying good and bad ideas) in crowdsourced evaluation processes may be influenced by the display of peer ratings. While it could sometimes be useful for users to follow their peers, it is not entirely clear under which circumstances this actually holds true. Thus, in this research-in-progress article, we propose a study design to systematically investigate the effect of peer ratings on assessment accuracy in crowdsourced idea evaluation processes. Based on the elaboration likelihood model and social psychology, we develop a research model that incorporates the mediating factors extraversion, locus of control, as well as peer rating quality (i.e., the ratings' correlation with the evaluated content's actual quality). We suggest that the availability of peer ratings decreases assessment accuracy and that rating quality, extraversion, as well as an internal locus of control mitigate this effect.*

*Keywords: Crowdsourcing, Open Innovation, Participation, Peer Ratings*

## 1 Introduction

In March 2016, the British Natural Environment Research Council engaged the public to find a name for a new arctic research vessel. One suggestion, "Boaty McBoatface," received much attention via social media and received more than 100,000 votes by users, followed by "Poppy Mai" at some 30,000 votes (Ellis-Petersen 2016). The British science minister refused to accept this vote, stating that "the new royal research ship will […] address global challenges that affect the lives of hundreds of millions of people. […] That's why we want a name that lasts longer than a social media news cycle." (Heritage 2016).

The Boaty McBoatface incident, though it may appear humorous, exemplifies a serious and meaningful peculiarity of crowd-based innovation, evaluation, and decision processes. People are led by what others have said and done (Bhanji and Delgado 2014; Cialdini 1993), in particular, they tend to follow heuristic cues when there is too much information to process which is especially the case for social media and similar digital platforms (Koroleva et al. 2011; Maier et al. 2015; Margetts et al. 2015). For crowdsourced processes, this can be disastrous and facilitate marked "collective stupidity" patterns (Albrecht 2003). Whether users are engaged to find a boat name or tasked with more serious subjects, such as participatory budgeting or crowdfunding neighbourhood projects (Niemeyer et al. 2016), it is usually hard, if not impossible, to assess how outcomes are affected. This certainly holds for most creativity- and decision-related settings. In contrast, the outcomes of innovation and ideation process can at least be assessed in terms of criteria such as novelty, originality, or feasibility (Blohm et al. 2010).

Organizations tap into the wisdom of citizens, employees, and other stakeholders on (enterprise) social networks, crowdfunding, and other digital platforms for various reasons, including strategic planning, product innovation, customer engagement, process optimisation, knowledge transfer, and many more (Ciriello et al. 2016; Feldmann et al. 2014; Oeste-Reiss et al. 2016; Stieglitz and Hassannia 2016). Despite the professionalization and widespread use of open innovation and crowdsourcing systems, facilitators of the underlying processes constantly face the challenge of managing large amounts of ideas and proposals (Wagenknecht et al. 2017a). Thereby, the crowd is often not only given the task to *generate* new ideas, but also to *evaluate* them. For the facilitators of such processes, it is then difficult to accurately assess the ideas' actual quality based on the crowd's verdict as it may be subject to a variety of judgemental biases (Di Gangi and Wasko 2009; Hossain and Islam 2015). In view of this issue, the Information Systems (IS) literature has recently explored a wide range of mechanisms for idea evaluation, where many studies have focused on the effects of rating scales, such as Likert or thumbs-up voting, and how these affect assessment accuracy (Bao et al. 2011; Blohm et al. 2016; Klein and Garcia 2015; Riedl et al. 2013; Wagenknecht et al. 2017b).

In doing so, however, prior research has regularly evaluated the effect of rating techniques *in the absence of peer ratings*, that is, without information on how *others* have rated the propositions at hand (Salganik et al. 2006). Yet, most websites and social media platforms *do* provide information of this kind and hence users will be exposed to it when forming and submitting their own evaluation (Margetts et al. 2015). While IS research has demonstrated that peer ratings significantly impact user decisions (Duan et al. 2009; Lee et al. 2015; Salganik and Watts 2009), it is still not clear how and why exactly the availability of ratings exerts influence on the crowd's assessment accuracy (Bikhchandani et al. 1992; Salganik et al. 2006). To illustrate this notion, it might be helpful to think of what would have happened if another popular name came up (earlier) in the Boaty McBoatface process. It is well conceivable that, depending on the initial direction of the peer proposals, the campaign may have turned out quite differently.

Furthermore, scholar in various disciplines emphasize the continuous impact of personality factors in decision-making and even more so for group- and crowd-based decisions (Hess et al. 2009; Margetts et al. 2015; Venkatesh 1999). While some users may find it psychologically convenient to ally into a leading opinion, others will tend to sympathize with off-track ideas and be sticklers with popular ones in particular. In this regard, Margetts et al. (2015) recently showed personality traits – in particular, *locus of control* (Rotter 1966) and *extraversion* (Goldberg 1981) – to be strong predictors of whether or not users follow (i.e., imitate) their peers' behaviour in a public goods experiment. Moreover, extraverts and people with an internal locus of control are also associated with being (perceived as) leaders (Judge et al. 2002; Margetts et al. 2015; Ng et al. 2008, 2006; Spector 1982). Thus, personality traits might determine how people adapt to peer ratings. This, in turn, might be interesting for facilitators of crowdsourced idea evaluations when identifying whether and how to display peer ratings.

In this research in progress paper, we hence seek to combine crowdsourcing and personality-based strands of research to investigate the effects of peer rating availability on assessment accuracy. In doing so, this paper makes two main contributions. First, based on a real-world open innovation process in a private-public institute, we propose an experimental design to systematically assess the effects of peer rating availability and – if provided – the role of quality (that is, their correlation with the ideas' quality). Second, drawing on social proof theory, the elaboration likelihood model (Petty and Cacioppo 1986), and findings from social psychology (Cialdini 1993; Goldberg 1990), we propose a theoretical model of how peer ratings impact assessment accuracy, and how this relationship is moderated by the personality factors extraversion (Goldberg 1990) and internal locus of control (Rotter 1966). In effect, this research can serve as a guide for organisers of crowdsourced idea evaluations as they may learn under which circumstances peer ratings enhance or impair assessment accuracy.

The remainder of this paper is organized as follows. We develop our research model and hypotheses in Section 2. In Section 3, we describe our study design along with treatment schemes and measures. We then discuss theoretical as well as practical implications in Section 4 and draw our conclusions.

# 2 Theoretical Background and Related Work

Social information can be understood as the kind of information provided by other participants or users about what they are doing or have been doing (Bhanji and Delgado 2014; Hale et al. 2014). In crowdsourced idea evaluation, social information may be transmitted by peer ratings. People sometimes change their own in light of their peers' evaluations in order to conform to the prevailing attitudes and popular opinion (Bhanji and Delgado 2014). Although it might sometimes be useful for users to follow peer ratings (Bikhchandani et al. 1992), extant research has by and large established that the influence of others' ratings diminishes the wisdom of the crowd effect and, thus, can lower assessment accuracy of evaluation processes (Lorenz et al. 2011). However, it is not clear which underlying factors drive people to follow their peers' ratings and how specifically the direction/tendency of such peer ratings affects overall assessment accuracy.

Based on findings from prior research (Duan et al. 2009; Salganik et al. 2006; Salganik and Watts 2009), we suggest that peer rating availability does affect assessment accuracy, as benchmarked by an expert panel evaluation (Blohm et al. 2011, 2016; Klein and Garcia 2015; Riedl et al. 2013). Our assumption is rooted in the elaboration likelihood model (Petty and Cacioppo 1986) and social proof heuristic (Cialdini 1993). Moreover, in line with a long tradition of research in psychology and economics (Agarwal and Prasad 1998; Goldberg 1981), we argue that the relation between peer ratings and assessment accuracy is moderated by the individual's personality (Margetts et al. 2015). We incorporate these aspects in a structural research model (see Figure 1). In order to underpin this model, we draw upon research from the fields of crowdsourcing and decision-making in idea evaluation processes. As individual decision-making is subject to personality traits, we also build on research from social psychology on personality in behaviour.

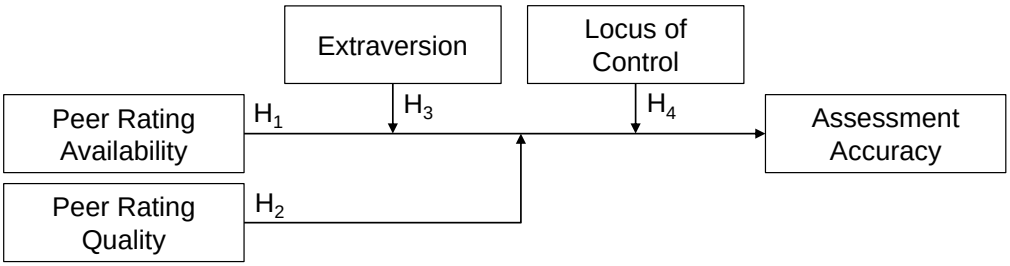


*Figure 1. Research Model.*

## 2.1 Crowdsourcing & Decision-Making

Crowdsourcing can be understood as a means for organisers to motivate a large number of users to propose innovative problem solutions, or to identify problems in the first place (Adamczyk et al. 2012). Prior research established that such user-generated suggestions are able to compete with proposals from R&D departments and consulting professionals (Leimeister 2010; Poetz and Schreier 2012; Riedl et al. 2010). However, because crowds typically create vast numbers of ideas and proposals, separating the wheat from the chaff becomes difficult. In fact, previous studies established that user-generated idea collections can be highly redundant and exhibit large variance in terms of quality (Blohm et al. 2010; Di Gangi and Wasko 2009; Poetz and Schreier 2012; Riedl et al. 2013). Research in IS suggests that only 10-30% of the ideas are of high quality, while the rest is either medium or low quality (Blohm et al. 2010; Klein and Garcia 2015; Riedl et al. 2013). As the evaluation process can become very costly, facilitators turn towards the participants themselves to rate the ideas using various rating techniques (Blohm et al. 2016). However, the goals of organizers and users are often misaligned. Facilitators want the users to *thoroughly* evaluate many ideas, while users generally have less information on the facilitator's situation and are not willing to spend much time on the evaluation (Riedl et al. 2010). Feldmann et al. (2014), in this regard, reported that a large proportion of users in an enterprise crowdfunding

process assessed (and subsequently funded) highly complex IT-related proposals within less than a minute. Thus, users rely on heuristics and other cues to shortcut the evaluation process.

The elaboration likelihood model (Petty and Cacioppo 1986) suggests that there are two main routes of social cognition. First, via the central route, individuals process information systematically, logically, and diligently. For a message to be processed on this route, people need to be mentally motivated. Second, in contrast, the peripheral route is triggered if individuals process information without much attention, leading them to employ evaluation heuristics and reliance on cues (Blasio and Milani 2008; Rao et al. 2001). This reasoning is in line with another major social psychology theory, namely dual processing theory (Kahneman and Tversky 1979). One commonly debated heuristic in this regard is social proof, which describes people behaving in accordance with how they perceive others to behave in their environment (Cialdini 1993). In effect, people sometimes imitate the behaviours of others because they assume it to be appropriate (Salganik and Watts 2009). In this sense, in electronic and retail markets, people assume that their peers' choices can serve as an indicator of product quality (Goldstein and Gigerenzer 2002; Salganik and Watts 2009). The IS literature relates users' trust in their peers' judgement to social presence (Cyr et al. 2007; Gefen and Straub 2004; Hassanein and Head 2007; Hawlitschek et al. 2016; Hess et al. 2009; Teubner et al. 2014), a feeling of a personal and sociable human contact as conveyed by a communication medium (Short et al. 1976). Moreover, the social proof heuristic is most influential if the individual (1) is uncertain about the decision at hand, and (2) is able to observe the direct behaviour of similar others (Rao et al. 2001). Arguably, these conditions are all present in crowdsourced idea evaluations processes. Moreover, the social proof heuristic's effect is strengthened by the model of information cascades according to which "the adoption of one alternative becomes more likely the more others have made the same choice" (Rao et al., 2001, p. 505). Mathematical and simulation models trying to predict the influence of information cascades suggest a highly skewed distribution of outcomes (Barabási and Albert 1999; DiPrete and Eirich 2006).

In practise, studies in various settings have proven that (readily available) peer ratings influence users in cultural markets (Lee et al. 2015; Salganik et al. 2006), software adoption (Duan et al. 2009), and political settings (Margetts et al. 2015). While it may sometimes be beneficial for users to follow the ratings of their peers – for instance, in product adoption – studies suggest that users sometimes wrongfully reject more efficient technologies (Abrahamson 1991; Bikhchandani et al. 1998; Duan et al. 2009; Katz and Shapiro 1994). Furthermore, already a mild influence of peer choices can undermine the wisdom of the crowd effect (Lorenz et al. 2011), because users are not unbiased anymore. Accordingly, for the context of crowd-based idea evaluation processes, we hypothesize that:

**$H_1$**: *Peer rating availability decreases overall assessment accuracy.*

However, there may occur situations in which peer ratings are worth considering, even worth following (Bikhchandani et al. 1992). This could be the case when the leading peers are indeed more knowledgeable, guiding less knowledgeable individuals to take better decisions by taking into account their peers' assessments. Thus, we hypothesize that the (potentially) negative effect of peer rating availability on assessment accuracy is mitigated by peer rating quality (that is, the degree of correlation between the displayed ratings and actual idea quality as established by a highly knowledgeable expert panel) (Blohm et al. 2011, 2016; Klein and Garcia 2015; Riedl et al. 2013). Formally:

**$H_2$:** *Higher peer rating quality mitigates the impact of peer ratings on assessment accuracy.*

## 2.2 Personality & Behaviour

Following a long tradition in both psychology and economics, the IS literature has recognised the importance of personality traits for human behaviour. Personality factors influence the adoption and acceptance of information technology (Agarwal and Prasad 1998; Bariff and Lusk 1977). Arguably, extraversion as one of the "Big Five" personality dimensions (Goldberg 1981) has been shown to be one of the most influential factors in social interactions (Hess et al. 2009; Margetts et al. 2015). Extraverted individuals are usually considered to be social, outgoing, and enthusiastic, whereas introverted people

are commonly perceived as inward-directed, unrevealing, and shy (Trapnell and Wiggins 1990). Moreover, extraverted persons are typically more likely to take part in social interactions with others (Eysenck et al. 1985), including participation in group-oriented tasks (Gerber et al. 2011). Extraversion is highly correlated with people acting self-confident, proactive, and being perceived as leaders (Judge et al. 2002). Extraverts also tend to believe to be self-effective in their actions (Ng et al. 2008). In this line, a recent study on the evaluation of policy proposals demonstrated that extroverted people tend to take action based on their own judgements rather than following those of their peers (Margetts et al. 2015). We suggest that this property extends to open innovation. Our third hypothesis reads:

**$H_3$**: *Higher extraversion mitigates the effect of peer rating availability on assessment accuracy.*

Another typology of personality that is commonly associated with self-confidence is the internal locus of control. It describes the extent to which people believe that an event is contingent upon an individual's own behaviour (Rotter 1966, p. 1). That is, so-called "internals" perceive the consequences of actions to be determined by themselves, rather than "externals" who assume to have less control over their environment and are hence rather guided by external forces. Internals are more likely to influence the behaviour of others, as demonstrated in prisoner's dilemma games, whereas externals behave much less strategically (Boone et al. 1999). Similar to extraverts, internals are also perceived as leaders (Judge et al. 2002; Spector 1982). Research in IS also demonstrated that internals adopt new technology early, and tend to take higher risks (Beaudry and Pinsonneault 2005). Studies suggested that internals exert active control over their environment, rather than to follow others (Margetts et al. 2015; Ng et al. 2006). Hence, we hypothesize that:

**$H_4$**: *Higher locus of control mitigates the effect of peer rating availability on assessment accuracy*.

# 3 Study Design

Research in crowdsourcing settings regularly faces the challenge of isolating effects such as word-of-mouth, network externalities, as well as corporate marketing activities (Lee et al. 2015). In order to test our research model in an adequate and reliable manner, we hence propose the following study design. As this research is located in the realm of idea evaluation, we suggest to employ a scenario-based survey approach, in which participants take on the role of members of an organization, who are prompted to evaluate a set of user-generated idea proposals. Importantly, our main target variable is *assessment accuracy*, that is, how accurate individuals (and the crowd as a whole) achieve to assess the ideas' quality. Of course, such quality can be highly subjective and there may not always exist a clear structure of right/wrong or good/bad. To objectify the ideas' quality nonetheless, and following the approach of established scholars (Blohm et al. 2011, 2016; Klein and Garcia 2015; Riedl et al. 2013), the assessments of a panel of experts in a Delphi-like consensual assessment serves as a ground truth benchmark, against which the survey participants' assessments are contrasted.

## 3.1 Treatment Design

As illustrated in Figure 1, our research model is based on two main treatment variables: *peer rating availability* and *peer rating quality*, defined as the peer ratings' correlation with the experts' assessment of idea quality (i.e., the ground truth quality), whereas of course the correlation measure only applies if peer ratings are available. In any condition, participants face a set of ideas which they are supposed to rate in terms of quality on a 5-point Likert scale, ranging from 1 ("very bad idea") to 5 ("excellent idea"). In the *no peer rating* condition, the survey participants do not see any indication of idea quality. In the *peer rating* condition, in contrast, they see a pre-defined rating associated with each idea, indicating an average score (e.g., 4.2 on a scale from 1 to 5) as well as the number of ratings this score is based on (e.g., 12). These average scores and numbers are meant to represent the current picture of the hypothetical crowd-based ideation process, which is openly communicated to the survey participants. The average scores and numbers are allocated to the ideas pseudo-randomly, where we systematically vary the degree of correlation between the displayed scores and the ideas' actual quality scores as established by

the expert panel. Thus, our main research objective is to analyse to what extent participants in the "peer rating" treatment follow the pseudo-randomly distributed information on idea quality and whether this affects the assessment quality overall, depending on the level of correlation between the information displayed and the expert rating. In both treatments, the participants are free to rate as many ideas as they want. An illustration of the main treatment conditions is provided in Figure 2.

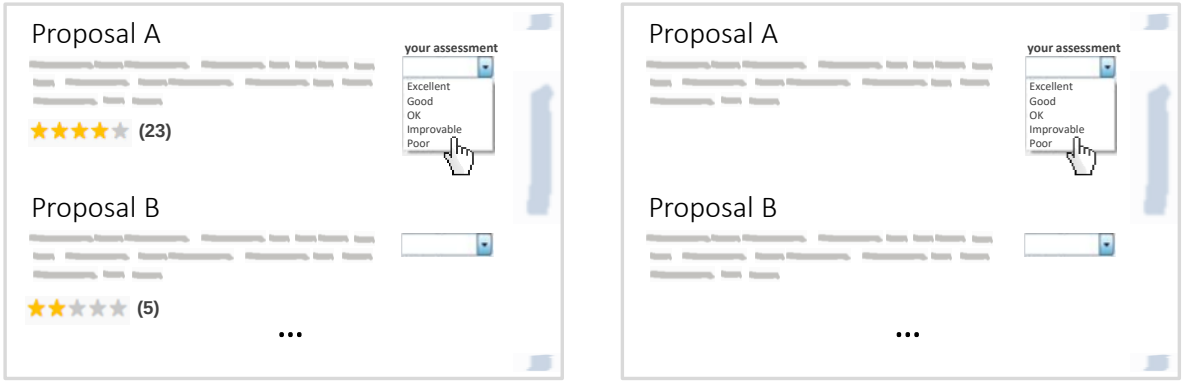


*Figure 2. Schematic treatment conditions: "peer rating" (left) and "no peer rating" (right).*

## 3.2 Stimuli Material

The basis of this study is a set of idea propositions from an institutional open innovation campaign of a German private-public research institute (Wagenknecht et al. 2017b). The institute invited its 280 employees to propose ideas on "how it could become a better employer." The process yielded a total of 42 ideas. In order to comply with privacy agreements at the institute, original names and revealing references are replaced with artificial, yet realistic ones. Except for these changes, all texts are retained without any changes. To further the understanding of the situation of the institute for participants, we also provide detailed information on the organization, its business model, staff structure, and offices. As the assessment of the expert panel is of high importance, we recruit experts that are knowledgeable in terms of both the routines and history of the organization engaged in the crowdsourcing exercise as well as with regard to the idea proposals. Thus, we seek to include both internal (e.g., managing directors and employee representatives) and external experts (e.g., HR consultants or higher education managers).

## 3.3 Measures

The main target variable of this study is *assessment accuracy*. On an individual level, we define this measure as the correlation between the ratings an individual allocates to the ideas and the respective ideas' ratings provided by the expert panel. To illustrate this measure, consider the following simple example with only six proposals. A participant provides a rating vector of (2, 1, 4, –, –, 5), that is, rates proposals 1, 2, 3, and 6 but not 4 and 5. The corresponding expert vector could be (2.1, 1.9, 3.4, 3.4, 2.8, 4.9). The correlation coefficient, based on the four values would be .961.

After the main task of idea assessment, participants take part in a short survey, addressing several demographic control variables as well as the personality-related traits specified in our research model. Whenever possible, to ensure content validity, established and validated scales are used. We adopt the measures for locus of control on the basis of the "Rotter Score" (Rotter 1966) used in Margetts et al. (2015). We also measure participants' personality based on the five factor model of personality, which – among others – includes measures on extraversion and agreeableness (Goldberg 1990). We operationalize all constructs by items on 5-point Likert scales. Furthermore, we track the participants' attitude toward the rating scale (Riedl et al. 2013) and task completion time. We also control for the participant's level of involvement with an idea (Petty and Cacioppo 1986).

### 3.4 Procedure

Once conducted, we evaluate our research model by means of structural equation modelling (SEM). This allows us to statistically validate our interrelated hypotheses in one systematic manner (Gefen et al. 2000). Due to its robustness, we seek to employ partial least squares (PLS) modelling (Chin 2010; Gefen et al. 2000).

## 4 Discussion and Conclusion

As outlined in Section 2, we expect to observe behavioural differences in view of assessment quality due to i) the availability of peer ratings, ii) the quality of those displayed peer ratings compared to the "actual" quality (as established by an expert panel), and iii) the users' personality traits in terms of extraversion and locus of control. For providers of (enterprise) social networks and other digital platforms, our results will inform their mechanism and design choices where several options are conceivable. First, they can offer peer ratings all along the process, potentially biasing the wisdom of the crowd but also providing anchors with potential beneficial effects for perceived ease of use and enjoyment (Blohm et al. 2016; Venkatesh et al. 2003; Venkatesh and Bala 2008). In contrast, anonymizing the whole process might be a more viable option in view of assessment quality. Yet, this may decrease user motivation as it does not provide any clues on whether and how the platform is actively used by others (Gerber and Hui 2013; Venkatesh 1999). Thus, a mixed approach in which proposals are submitted and assessed anonymously for a while, and peer ratings only revealed in a later stage might be interesting. Moreover, higher-level employees or evidentially knowledgeable users could be granted access in advance others would follow later on (Feldmann et al. 2014). Practically, this could mean that open innovation processes within a research and development unit might display peer ratings from the beginning, while it could be less useful to do so in an open innovation process involving an unexperienced crowd which is asked to deal with a highly specific problem.

In effect, this research has a number of theoretical and practical implications. This study could provide valuable insights into how the influence of peer ratings (and hence the eventual outcome) depends on the first users' accuracy and which role personality factors play within this process. This would significantly further our understanding of information cascades and the impact of peer ratings (Duan et al. 2009; Lee et al. 2015; Salganik et al. 2006; Salganik and Watts 2009). Furthermore, this research would also contribute to the cumulative knowledge building in the IS literature (Gregor and Jones 2007). In particular, we contribute to the strand of IS studies investigating the perception and effectiveness of rating scales (Klein and Garcia 2015; Riedl et al. 2010), where data was hitherto collected in the explicit absence of peer ratings. Regarding practical implications, our results could guide the design of crowdsourcing platforms in general, and ideation processes in particular. We propose a unique study design that rigorously varies the level peer rating quality by changing the correlation of peer ratings and actual quality, which allows us to provide detailed implications on when peer ratings should be displayed. For instance, if peer ratings in fact influence assessment accuracy, facilitators might want to grant well-informed users a head start in the evaluation process, so that followers are "guided" into the right direction.

In conclusion, we propose a research model that builds on social proof heuristic – according to which users tend to follow prior evaluation decisions. We suggest that it is important to account for the peer ratings' direction when considering how peer rating availability affects assessment accuracy. Specifically, we assume that positive correlation (i.e., "guiding clues") between peer ratings and actual quality will mitigate potential negative effects of peer rating availability on assessment accuracy or even improve it. Likewise, when peer ratings correlate negatively with quality (i.e., "misleading clues"), assessment accuracy should be decreased even more. Third, we expect significant differences in the propensity to follow peer ratings based on personality. Users with high levels of extraversion and internal locus of control will rather rely on their own judgement, discarding information from prior peer ratings. In effect, this would lower the (potentially detrimental) effect of peer rating availability on assessment accuracy.

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