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ABSTRACT

The study examines an alternative conceptualization of user acceptance, where acceptance is a function of two modes of thinking: one that is fast, intuitive, and automatic (known as System 1), and one that is slow, more deliberate, and voluntary (known as System 2). Such a conceptualization can accommodate cases of affect substitution, where users rely on System 1 only, without activating System 2. An experiment is conducted (N = 250) in which users are primed for System 1 or System 2. The headline contribution is that, in the context of an unattractive but potentially useful software application, users primed for System 1 show weaker intentions to download the application than those who are primed for System 2 (mean score 5.25 versus 6.30, on a scale of 1 to 7). The difficulty of reconciling this result with traditional frameworks illustrates the relevance of the dual processing model. [1]

Keywords

System 1, System 2, user acceptance, priming, dual-processing theories.

INTRODUCTION

Most conceptual frameworks from user acceptance research place the outcomes of deliberate, thoughtful judgments, such as perceived usefulness, alongside the outcomes of intuitive, affect-based judgments, such as perceived enjoyment (for example, Davis, Bagozzi, & Warshaw, 1992; van der Heijden, 2003; van der Heijden, 2004). The importance of these outcomes for user acceptance is dependent on a variety of factors, many of which have been identified and investigated over the past decade (see Lee, Kozar, & Larsen, 2003 for an overview). It is, for example, well established that the utilitarian or hedonic nature of a software application can alter the weightings of thoughtful and intuitive outcomes in deciding whether to use a software application (van der Heijden, 2004).

Despite many advancements in user acceptance research, the precise role of affect-based outcomes in these frameworks remains somewhat unclear. To some extent, this lack of clarity comes from conceptual confusion around the term affect, which has only recently been addressed (Zhang, 2013). Another reason is that a side-by-side representation gives the impression that intuitive and thoughtful judgments are equal partners: they both occur simultaneously, they both occur inevitably, and they both occur with the same speed. Findings from cognitive psychology research, however, suggest that this impression is incorrect: thoughtful and intuitive thought processes do not necessarily occur at the same time and at the same speed, and, often, the thoughtful evaluation does not take place at all.

An influential framework from cognitive psychology suggest that affect-based evaluations are associated with "fast" thinking, which occurs automatically and involuntarily. In contrast, deliberate evaluations are associated with "slow" thinking, which only occurs after voluntary activation (Kahneman, 2011). Adopting terminology used by Kahneman (2011), these two modes of thinking are said to be originating from System 1 (fast, intuitive thinking) and System 2 (slow, more deliberate thinking). These systems form part of a theoretical viewpoint that is known as the dual-processing perspective on thought.

One insight gained from this fast-slow-conceptualization of thought processes is that affect-based outcomes are often the only outcomes upon which people depend to make decisions. Unlike System 1 judgments, System 2 judgments are voluntary, and by implication, they are not necessarily activated all the time. In certain situations, where System 2 is otherwise engaged (for example, in case of fatigue), System 1 provides opinions without any correction or moderation from System 2. This phenomenon is referred to as the *affect heuristic* (Zajonc, 1980). Affect substitution occurs when users apply this heuristic in user acceptance.

When System 1 and System 2 judgments are in agreement with each other, affect substitution is perhaps not very interesting to study, because the overall outcome will be unaffected by which particular mode of thinking was activated. However, when System 1 and System 2 are not in agreement, affect substitution becomes more interesting, in that long-standing conjectures in user acceptance may be violated. For example, in a case of

[1] The author is grateful to Thomas Acton and three anonymous reviewers for helpful comments on an earlier version of this paper. Approval for the experiment was granted by the institution where the experiment took place.

negative affect but positive usefulness, users applying the affect heuristic would reject the application even if they think it is useful. It follows that perceived usefulness is not the dominant driver for user acceptance, even if the application is utilitarian. Therefore, this study is predominantly occupied with software applications that produce such conflicting responses from System 1 and System 2.

Given that affect substitution can be difficult to detect, a relevant research question becomes whether the affect heuristic can be successfully (i.e., predictably) activated. This study examines one approach to trigger affect substitution: when users are *primed* towards System 1. Primed in this context means that users are unknowingly relying on judgments that originate from that particular mode of thinking. In this paper the hypothesis is tested whether those users who are primed towards System 1 will have materially different intentions to download and use a potentially useful software application. The context of use is a software application designed to evoke fast, negative System 1 responses and slow, positive System 2 responses.

Priming often occurs naturally, when users are preoccupied with recent events or have just experienced something positive or negative. These recent events or experiences shape their thinking in a certain direction. Priming can, however, also be brought about artificially in various ways. The best-known method is to expose research participants to a sequence of words before a judgment is recorded. Depending on the sequence containing, for example, positive or negative words, the judgment is then adjusted accordingly. This study primes participants by asking a sequence of questions to respond to before their intentions to use a particular application are recorded. For example, to prime System 1, questions are used such as: "purely based on *first impression*, do you agree or disagree that the application is *beautiful*?" To prime System 2, questions are used such as: "*thinking carefully* about the advantages and disadvantages of the system, do you agree or disagree that the application is *beneficial*?" These questions not only evoke impressions, but apart from mere exposure they also require the user to engage with that aspect of the evaluation. In doing so, users are primed for affective-based first impressions (System 1) or deliberate, careful thought (System 2). The main research objective of this study then is to test the hypothesis that such priming will trigger affect substitution.

THEORY

This section briefly reviews the literature in user acceptance research relevant to a conceptualization of System 1 and System 2.

System 1 judgments are first impressions of affective cues. They are involuntary and occur immediately (Kahneman, 2011). Two concepts from user acceptance research are related to such an immediate, first impression. The first one is affect, also known as perceived hedonic quality (e.g., Hassenzahl, 2001), perceived affective quality (Zhang & Li, 2004) and perceived enjoyment (e.g., van der Heijden, 2004) and a range of other terms (Zhang, 2013). The second one is visual attractiveness (van der Heijden, 2003), also known as visual aesthetics (Lavie & Tractinsky, 2004).

The role of affect has been of longstanding interest to user acceptance researchers, despite (or perhaps due to) the inconclusive results that affect studies often generate. Such inconclusive results may come about because affective responses occur on many levels and along many dimensions, and it is not always clear how results from different affect studies can be reconciled. Zhang (2013) provides a comprehensive review on the different constructs that represent affect, and usefully categorizes previous affect studies in a taxonomy.[2]

First impressions of a software application naturally lead to an investigation of the visual appearance of the application, and for this reason this appearance is often the first and only cue on which judgments are based. On first impression, users look at visual aspects such as beauty, images, and order (Schenkman & Jonsson, 2000). Visual appeal is formed in less than 17 milliseconds (Lindgaard, Fernandes, Dudek, & Brown, 2006; Tuch, Presslaber, Stocklin, Opwis, & Bargas-Avila, 2012), suggesting that it qualifies as a concept purely applicable to System 1 judgements. Such fast judgements of visual appeal are generally consistent over longer time periods, too (Tractinsky, Cokhavi, Kirschenbaum, & Sharfi, 2006).

System 2 is activated by thinking carefully about the possible benefits of using a certain object; a thought process also referred to as mental accounting. The closest concept from user acceptance research that covers such a benefit analysis is perceived usefulness, well known from the Technology Acceptance Model (Davis, 1989). Perceived usefulness bears close resemblance to similar concepts such as performance expectancy (Venkatesh, Morris, Davis, & Davis, 2003), among others. Perceived usefulness is associated with slower judgments because an assessment about usefulness must be preceded by thinking about a usage context and a particular user goal that the system would satisfy in that context (Matook & van der Heijden, 2013). In developing these contexts, and goals, it is also likely that the user will be relying on memory retrieval to recall past experiences in which the application would have been useful. Such thought processes are voluntary; as a result, they will not take place if the user does not actively engage System 2.

[2] In this taxonomy, the present study is positioned as an outcome-based affective evaluation toward a particular object, the object being the software application (category 5.2).

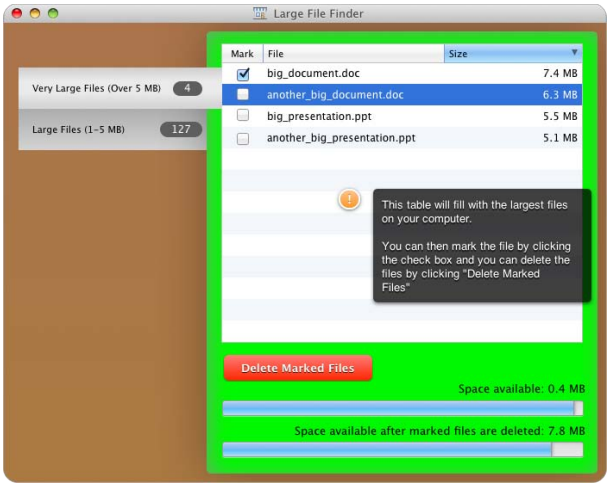

Figure 1. Screenshot used in the experiment

In many circumstances, System 2 does not regulate judgements that originate from System 1 (Kahneman, 2011). In those cases, people are said to apply the affect heuristic (Zajonc, 1980). To detect a case of affect substitution in practice, a situation must arise where System 1 and System 2 judgments are at odds with each other. When outcomes from System 1 align with System 2, it will be difficult to trace back the impact of System 1 in relation to System 2. It follows, therefore, that the conditions to detect affect substitution are best if the System 1 reaction is positive (e.g., the application is beautiful) but the System 2 reaction is negative (e.g., the application is not useful). The opposite also qualifies – the System 1 reaction is negative (the application is not beautiful), but the System 2 reaction is positive (the application is useful).

METHOD

To examine whether System 1 or System 2 priming could influence user acceptance, an experiment was designed in which participants are first shown a short description and a screenshot of a software application. Users then state their intention to download this application, assuming the application was available on an application store suitable to their computer. This setting carries external validity because the leading application stores at the time of study provide short descriptions and screenshots for users to make the decision to download.

System 1 and System 2 questions were developed to prime the users for each system. For reasons of brevity, the development and composition of these questions is not documented here.

Participants were randomly assigned to five groups, with each group priming the respondent in different ways before the download intention questions were asked. These groups include a control group, where no priming takes place. In this control group, the intention to download questions are posed immediately after the description of the application and the screenshot. The other groups are 2) System 1 questions only, 3) System 2, then System 1 questions, 4) System 2 questions only, and 5) System 1, then System 2 questions.

Figure 1 provides the screenshot used in the study, showing an application that detects large files on a computer, and allows for bulk deletion in the case of limited space storage. The screenshot of the software application was built using prototype software, based on similar applications in existing application stores. The visual appearance was meant to evoke a negative System 1 response, and the functionality was meant to evoke a positive System 2 response. This was done to ensure that System 1 and System 2 responses would be at odds with each other, and priming either System 1 or System 2 would therefore be expected to produce differences in intentions to download. A combination of lime green and brown color was selected so as to simultaneously depart from conventional (grey) colors but at the same time not to compromise on readability (see Hall & Hanna, 2004).

The dependent variable, intention, is measured as the response to the question: "Would you intend to download and use this software application if the application was free"? Responses are recorded on a range of 1 to 7, which anchor-points: 1 – Would definitely not download; 4 – would consider downloading; and 7 – would definitely download.

Participants for the experiment were recruited with the help of the online crowd-sourcing platform Mechanical Turk, operated by Amazon. Mechanical Turk (often abbreviated as MTurk) is a platform where participants can perform small tasks, called Human Information Tasks, or HITs, in return for compensation (Mason & Suri, 2012). Such tasks often consist of taking part in online surveys or experiments. A total of 250 MTurk users participated in the experiment. To qualify for participation, users had to be resident in the United States, had to have at least 500 HITs completed, and had to have an approval rating of at least 95%.

RESULTS

The purposefully negative System 1 cue was effective, as evidenced by feedback such as "it's VERY ugly", "the green is obnoxious", and "it almost hurts my eyes a little". Feedback on the System 2 cue was generally positive, but also identified a number of issues, such as the limited need for such an application given the move towards cloud storage.[3] Feedback from some respondents indicated an affect substitution, for example, "This is functional but nothing about it makes me want to

[3] Users questioned whether 5 MB was the right cut-off point to denote very large files, and also pointed out that identifying and deleting large files can easily be done with the standard file management functionality of an operating system.

download it", and "the colors throw me off. I don't think I could take this app seriously."

Table 1 presents the descriptive results of the "intention to download for free" measure.

Group	*Cell size (n)*	*M*	*SD*
Control group (no priming)	51	5.65	1.50
System 1 priming only	51	5.20	1.76
System 2, then System 1 priming	50	5.72	1.64
System 2 priming only	50	6.36	1.24
System 1, then System 2 priming	48	6.00	1.38
Total	250	5.78	1.55

Table 1. Cell sizes, means and standard deviations of "Intention to Download" across five different priming conditions (*N* = 250). The response measure is "Would you intend to download and use this software application if the application was free?". Range is 1 (would definitely not download) to 7 (would definitely download).

Table 2 presents a one-way Anova to detect any statistically significant differences in intention to download across the five groups.

	Sum of Squares	*df*	Mean Square	*F*	*p*
Between groups	37.614	4	9.403	4.061	.003
Within groups	567.286	245	2.315		
Total	604.900	249			

Table 2. One-way Analysis of Variance Summary for Priming Condition

Following on from the omnibus *F*-test, a post-hoc Tukey analysis was conducted to detect statistically significant differences between specific groups. These multiple comparison tests indicate that the difference between System 1 priming (5.20) and System 2 priming (6.36) is statistically significant. These results mean that System 1 or System 2 priming influence user acceptance. Priming for System 1 lowers a user's intention to download a software application. In other words, affect substitution materializes when users are primed for System 1.

Psychometric properties for the System 1 and System 2 priming questions were acceptable, but for reasons of brevity they are not documented in this paper.

DISCUSSION AND CONCLUSION

This study set out to examine whether priming users for System 1 or System 2 would influence user acceptance. The experiment provides empirical evidence that priming does indeed have an effect. The headline result is that users who are asked about their first impressions show weaker intentions to download the application than those who were asked to think carefully about the benefits (mean score 5.25 versus 6.30, on a scale of 1 to 7). This difference is statistically significant. The hypothesis that priming influences user acceptance is thereby supported.

The result implies that priming is a useful vehicle to trigger affect substitution. The setting was designed to produce a negative System 1 response and a positive System 2 response. Only when users where primed for System 1 did they exhibit weaker intentions to download the application. Although priming was induced in a relatively artificial, laboratory setting, the relevance of the work is wider because priming often occurs naturally. Users will arrive at decisions to download and use applications at various levels of readiness to engage with System 2. In practice, therefore, a considerable proportion of users will be primed for System 1, often without realizing.

The research opens up a number of further research questions. Some of these relate to the inherent limitations of the experiment. For example, there was no manipulation of the screenshot. There was only one, fixed screenshot designed to elicit conflicting System 1 and System 2 responses. An interesting research question relates to the manipulation of the cues of the screenshot. More specifically, how visually unattractive must the application become before affect substitution is triggered? Would there be a point on the aesthetics scale at which no further System 1 priming is needed? This would be an interesting extension of the study.

The second avenue for further research is to look at other conditions in which affect substitution can take place. The experiment used priming to "push back" System 2 and bring about affect substitution. There are, however, other conditions under which System 2 is not activated, specifically to do with moods and states that users may find themselves in. Fatigue is one example. It would be an interesting extension of the study to examine users in various states of fatigue and examine whether this also influences affect substitution.

The wider implication for theory is the relevance of recasting traditional user acceptance frameworks into frameworks that rely on fast, uncontrolled System 1 thinking and slow, controlled System 2 thinking. It is difficult to reconcile the results from this experiment with traditional frameworks: the difference between first impressions and careful thinking does not feature in these frameworks, and accordingly, putting special emphasis on first impressions or careful thinking ought not to have made a difference. The wider theoretical contribution of

this paper is to show how the results from the experiment can be better explained with a dual processing perspective on user acceptance.

Finally, it is worth reflecting on the results from the viewpoint of System 2. An (imaginary) advocate of System 2 could have rejected the bias in the paper towards System 1 and could have claimed a contribution for System 2. The argument would be that System 2 priming triggers "careful thinking substitution" in equal measure. Such an interpretation would be correct, and would not contradict the empirical evidence, but the results are perhaps more relevant from the viewpoint of System 1. The reason is that much user acceptance research is already likely to be biased toward System 2. Many settings in which academic researchers investigate user acceptance may have led to implicit priming of System 2, because these settings tend to be formal and "serious" – consequently, users who respond to questions from academics may have had an implicit desire to respond carefully and deliberately. It is worth exploring whether user acceptance research in more informal, less controlled settings would capture more impulsive reactions, and whether research in such environments is more likely to detect affect substitution.

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