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BRINGING STIMULATED IDEATION IN A WEB ENVIRONMENT: STUDENTS' EVALUATIONS OF A BASIC SOFTWARE RELEASE

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Abstract: Previous studies have demonstrated that creative design activities benefit from stimuli and that textual prompts might extend the exploration of the design space. However, the number of stimuli to conduct a wide exploration is large and the support of an ICT platform results necessary to manage a creative task effectively because of the presumably large number of generated ideas. Within a project named *Startled*, a very simple first release of a web application has been developed that supports ideation activities by means of stimuli. Dozens of students enrolled in different courses and Universities have tested the platform and answered a questionnaire, which aimed to elucidate their self-efficacy, perceived workload, ease of use and utility of the present version of the web application. The outcomes show, beyond few differences between students with diverse backgrounds, a majority of neutral and slightly positive answers. The results are not fully satisfying and the authors intend to make the ICT-supported creative tool more guided, user-friendly and intuitive.

Keywords: *stimulated ideation, web application, questionnaires, new product benefits*

1. Introduction and background

The way creativity is fostered is a relevant research issue. Suitable means need to be developed for supporting the design process adequately. In this paper, the starting point is that, according to the literature, sources of inspiration range among the most common strategies designers use in creative activities. This inspiration process might happen "naturally" based on expertise, knowledge and memory (Goldschmidt and Smolkov, 2006; Gonçalves et al., 2014) or be supported by external prompts, triggers or stimuli. For instance, the effect delivered by the provision of patent information on creativity is currently a hot topic (Parvin et al., 2017; Venkataraman et al., 2017). In the residual of the paper, the term "stimuli" will be used to generalize objects meant as potential sources of inspiration to enhance creativity.

Stimuli are overall seen as a substantial contribution to creativity, especially by limiting people's fixation. Many aspects concerning stimuli affect design outcomes and manifold studies are ongoing. By considering a meaningful, but still not all-encompassing, sample of similar design experiments, Vasconcelos and Crilly (2016) individuated 14 conditions that have been leveraged in stimulation tests. Therefore, a large number of factors is likely to affect the capability of stimuli to positively impact on creativity. Moreover, certain treatments result in improvements with regard to some creativity metrics, but tend to cause drawbacks according to other criteria. The factors that can be manipulated include the ways of interaction between the designer and the employed design tool. Computer systems that implement design methods, including stimulation methods, can be deemed critical in terms of favouring a positive user interaction with consequent repercussions on creativity.
The present contribution investigates the effectiveness of the computer implementation of a positively tested stimulation method, previously developed by some of the authors (Bacciotti et al., 2016a). The method administers textual stimuli, which are expected to boost ideation performance by mainly enlarging the design space in the Fuzzy Front End. Textual stimuli represent a possible form of inspiration sources; although different indications emerge from the literature, their effectiveness equals or outperforms prompts provided in a graphical format in some experiments (Goldschmidt and Sever, 2011; Gonçalves et al., 2013). The stimuli that are concerned in the mentioned proposal intend to make explore a large range of product development directions or opportunities without reference to any particular artefact or industry. Accordingly, they are featured by an abstract terminology. However, more specific articulations of the stimuli are available as well. The hierarchical organization of the stimuli is further explained in Section 2, as it represents an implementation requirement for the ICT system. In addition, it is useful to specify that the stimuli belong to four different spheres, aimed to browse the kind of benefits a product can deliver, as well as the stakeholder, the timing and the system hierarchies that can be involved.
As the support to creativity of such a stimulation method has been already verified, the paper concerns studying utility and usability of a bespoke ICT tool (named *Startled*), which implements the recalled method. More specifically, it presents a specific test performed to verify if *Startled*, in which just basic requirements have been deliberately implemented, is deemed adequate to manage computer-aided creative sessions. The results contribute to the knowledge of the level of accuracy and sophistication that is required to implement design methods into ICT tools, which is a clear tendency in design (Bacciotti et al., 2016b).
The content of the paper is organized as follows. Section 2 presents *Startled* and describes its fundamental characteristics. The specific objective of the testing activity, the followed research method, the performed experiments and the achieved results are deeply described in Section 3 and discussed in Section 4. Eventually, Section 5 summarizes the research activity and its main findings, by focusing on their relevance within design creativity.

2. Design of an ICT platform for stimulated ideation

The previous section has documented the opportunity of using stimuli as a means to boost ideation. Some issues are however unsolved, at least with respect to the reference methodology (Bacciotti et al., 2016a). On the one hand, the expected great number of generated ideas represents a concern from the perspective of the subsequent selection for the next phases of product development and calls for measures for a more appropriate management of said new ideas. On the other hand, the way stimuli are organized and proposed to the user is deemed critical, as individual and confidential reports have highlighted that the introduced method is valuable, but the administration of large numbers of text strings results boring – the authors believe that this problem can be present also for other methods targeting quantity of ideas. In this sense, the project *Startled* (see the acknowledgements for details) tackles these problems by creating a web platform that proposes stimuli in a hierarchical way, collects and manages the generated ideas. However, the paper deals directly with the second issues only.
The developed application is freely available online at startled.inf.unibz.it. Indeed, the tool has been developed as a web application to allow anyone to use it from any browser, independently from the used operating system. More specifically, the developers opted to use Drupal, one of the most

important web content management systems, as a core for the web application. The decision was based on the large availability of plug-ins for customizing it and for the support of expected frequent changes that would have resulted in a major effort in case of developing a stand-alone application.
Indeed, the design approach of the platform has foreseen a first reference framework in which just the basic functions have been implemented. The improvements to be made in order to reach an optimum will be decided based on continuous feedback on releases. This allows the developers to introduce what users expect without introducing useless functions that could be perceived just as frills. In other words, the development started with a Minimum Viable Product (MVP). The term MVP is referred to a product that makes it possible to collect the maximum amount of validated learning about potential users with the least effort (Ries, 2011; Taibi and Lenarduzzi, 2016).
The basic implemented functions are described below.
Not registered on not logged-in visitors of the website can visualize static pages with the introduction of the website, credits, rough description of the method. Logged-in users are allowed to create projects concerning the product or service for which creative idea generation is performed. They can insert and modify (one or more) ideas associated to the stimulus that has represented their source of inspiration. Consistently with the database of prompts available in (Bacciotti et al., 2016a), stimuli are organized in hierarchical levels. The presented platform has made it possible to connect the various hierarchies by means of text linkers in natural language, thus forming increasingly specific sources of inspiration, for instance:

- Level 1: *New benefit*
- Level 2: *New benefit in terms of Aesthetics / style / ethics*
- Level 3: *New benefit in terms of Aesthetics / style / ethics or, more in particular, environmental sustainability*.

More and more specific stimuli can be accessed by clicking linkers, like those in blue in Figure 1. The four presented linkers address the subdivision of stimuli in four main spheres, which has been recalled in Section 1. Beyond ideas, users can include labels, i.e. tags, potentially useful to connect ideas sharing targets or potentially consistent in a new value proposition. The use of this function is illustrated (it is intended to deal with the introduced issue about exceeding quantity of ideas), but no analysis will be made in the present paper to this respect. Eventually, *Startled* developers, who manage the platform, can visualize the projects and the ideas introduced by all the users. This enables post-processing of data.
More details about the way *Startled* is employed can be inferred through the description of the experimental activity.

3. Description of the experimental activity

The present section describes how the authors have organized the test of the *Startled* platform and the subsequent gathering of feedback from volunteer users.
The test has been carried in two stages in order to involve a large number of participants. This has required paying attention to specific conditions to be met in both the test sessions, as better specified in the followings. The two sessions have involved 20 students following the course “Introduction to Management Engineering”, Bachelor in Computer Science at the Free University of Bozen-Bolzano (Bolzano, Italy) and 76 students following the course “Technical and Functional Analysis of Industrial Products”, Bachelor in Industrial Design at the Università degli Studi di Firenze (Florence, Italy), respectively. Both the courses are held at the first year of the corresponding Bachelor Degree programs.
The students have been requested to use the *Startled* application in order to identify new ideas for the future development of an existing product. The allowed duration of the task has been 90 minutes, preceded by a 60-minute class tutorial held by the first author and a description of the activity to be performed. The product new ideas should be individuated for, i.e. a baby outfit, has been used in previous authors’ experiments (Borgianni et al., 2017) and proved to fit alike creativity sessions. In particular, its suitability can be motivated by widespread knowledge, despite poor experience in using it for the majority of University students (at least in authors’ country), and concrete opportunities for

the identification of new functionalities and attributes. The testers were requested to write down ideas that are deemed new in the box corresponding to the stimulus that has supported the identification of a new concept. The students were also supposed to include ideas emerged without using any prompt, like by means of an individual brainstorming, and to arrange them in the box corresponding to "New Benefit", which is displayed above the provided stimuli. Although the creativity support tool is supposed to aid designers in the Product Planning phase and, hence, ideas are expectedly in the form of abstract benefits, any kind of idea description was accepted on condition that it resulted unprecedented to the experimenter. Indeed, the students have not been trained about engineering design cycles; therefore, such a level of consistence with the task the *Startled* platform supports could not be requested to the participants. The use of the boxes corresponding to labels were indicated as optional, as they should mostly benefit actual product developers in the investigated field. Figure 2 shows an excerpt of a test example, in which the various fields have been actually filled in.

In order to acquire information about participants' experience in using the platform, a bespoke 19-question survey was prepared and administered to all the testers. It can be accessed through http://www.taibi.it/publications/ICDC-2018. The whole set of questions is also achievable from Table 1, top row. Gathered feedback concerns:

- The acceptance of the proposed instrument in its present form, by benefitting from the hints and factors traditionally included in the Technology Acceptance Model (TAM) (Venkatesh and Bala, 2008) – questions 01-13.
- The perceived performance of the testers with specific reference to the use of the proposed ICT tool for the task to be carried out – question 14, which asks if the user feels like the number of generated ideas would have not emerged without *Startled*.
- The feasibility of and workload required for the task, by exploiting the structure suggested by the NASA Task Load Index (NASA-TLX) model – questions 15-19. The question concerning the overall performance, typically included in this survey method, was omitted, because this aspect should be actually evaluated with established creativity metrics (Shah et al., 2013).

TAM is commonly used in the software engineering field, because of its capability of capturing the likelihood of adoption of a technology, a tool or a technique. It provides a set of structured questions to assess the perceived utility, ease of use, the intention to use and the usage behaviour. TAM has been validated and adopted in several studies (Jung et al., 2013; Mouaffo et al., 2014; Taibi et al., 2017) aimed to assess chances of adoption and acceptance of a specific technique. The chance of benefitting from TAM and its fundamentals is surfacing in the design field (Paetzold and Höfner, 2014; Alamäki, 2017), but its use is not established yet.

NASA-TLX, developed by the US Space Agency, is intended to assess various dimensions of the demand required by a human in order to perform a given task. Workload-related factors have been investigated as human interaction with a technology, a method or a system is to be considered critical for the willingness to repeat an experience or a task in a certain manner. Within design, its use is common when cognitive aspects concerning the relationship between a designer and a design tool are investigated, especially when computerized systems are introduced (Dorta et al., 2008; Barnawal et al., 2017).

As the questions from the two acknowledged models usually employ different scales, a common one was established (1 to 5), where the lowest value 1 (5) stands for the least (most) satisfactory answer and the value 3 for a neutral answer.

4. Results

The answers to the questionnaire make it possible to assess the degree of the achievement of the objectives posed when the *Startled* platform is introduced through a variety of usability and utility metrics (see questions 1-19). Moreover, the following information can be inferred.

1. The possible differences between the two groups of participants, which can be due to their background and study interests.
2. The relationships across the different usability, performance and human demand factors that have been investigated.

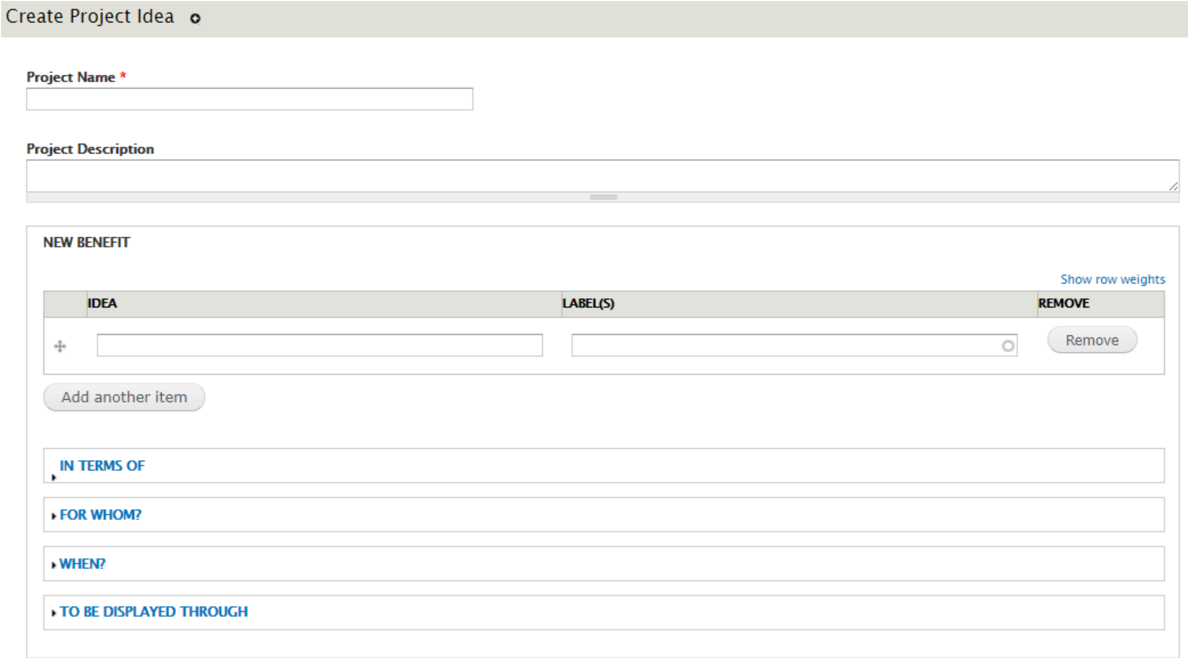

Figure 1. Starting page of the *Startled* platform. The links in blue enable the exploration of stimuli articulated according to kinds of attributes, involved stakeholders, lifecycle phases and product hierarchies, respectively

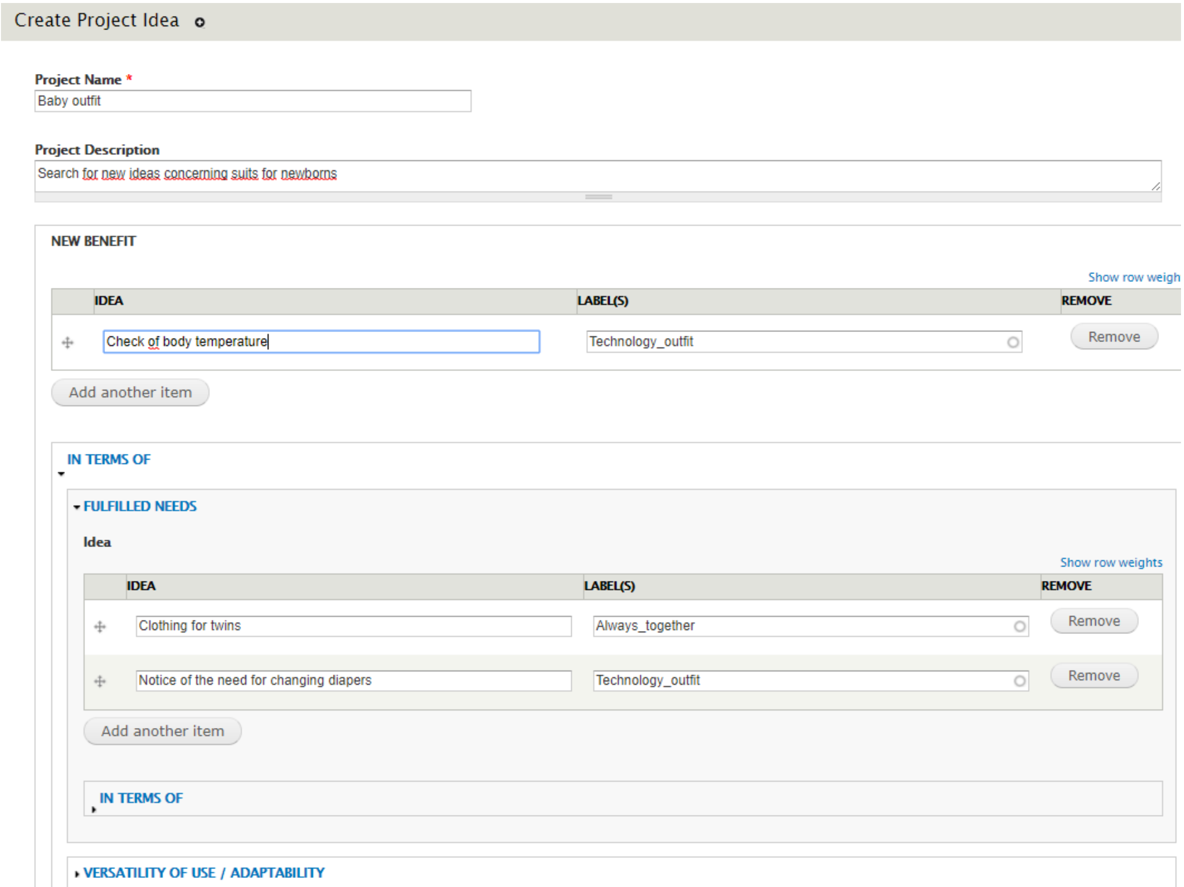

Figure 2. Screenshot of a test performed during the tests, in which the user has benefitted from both the fields "Idea" and "Label", besides the command "Add another item". A comparison with Figure 1 allows readers to understand which fields can be filled by the users of the ICT tool

As for the usability and utility metrics, it is possible to claim that the objectives have been partially pursued. Answers tend to be positive, but not fully satisfactory – neutral evaluations are diffused. The questionnaire outputs in terms of numbers from 1 to 5, despite being ordinal variables, are here considered as interval data for practical reasons. Means and standard deviations are calculated accordingly and reported in Table 1 for all the 19 questions. The mean values for all the answers range in the interval 2.9-3.6 with the unique exception of the Q16, which, by reporting an average of roughly 4.2, demonstrates that the task was not physically challenging. With regards to Q14, the one evaluating the perceived performance, the kind of instrument and task have supported creativity in 43 cases out of 96, based on the number of answers being "agree" (4) or "strongly agree" (5).

Table 1. Outcomes of the 19 questions forming the survey: means, standard deviation and Spearman correlation coefficients among the distributions of answers

	Q01: The *Startled* platform helped me to generate new ideas	Q02: It was easy for me to use the *Startled* platform	Q03. The *Startled* platform was easy to use	Q04: The methodology to generate new ideas based on stimuli is clear and understandable	Q05: It was easy for me to work with the methodology	Q06: I find the methodology easy to use	Q07: Learning to use *Startled* was easy for me	Q08: Using *Startled* is a good idea	Q09: *Startled* made work more interesting	Q10: Using *Startled* is fun	Q11: I like using *Startled*	Q12: I would find *Startled* useful in my work	Q13: Using *Startled* enables me to accomplish tasks quickly	Q14: If I hadn't used *Startled* the generated ideas would be less numerous	Q15: How mentally demanding was the task?	Q16: How physically demanding was the task?	Q17: How hurried or rushed was the pace of the task?	Q18: How hard did you have to work to accomplish your level of performance?	Q19: How insecure, discouraged, irritated, stressed and annoyed were you?
Mean	3.52	3.31	3.28	3.31	3.20	3.29	3.49	3.60	3.46	3.01	3.10	3.45	3.39	3.19	3.16	4.26	2.90	3.07	3.41
Std.	0.81	1.02	1.00	0.93	0.91	0.88	0.92	0.81	0.85	0.86	0.74	0.88	0.88	1.02	0.74	0.94	0.70	0.64	1.14
Q01	1.00																		
Q02	0.14	1.00																	
Q03	0.18	0.78	1.00																
Q04	0.32	0.24	0.35	1.00															
Q05	0.37	0.47	0.51	0.39	1.00														
Q06	0.28	0.41	0.45	0.34	0.68	1.00													
Q07	0.09	0.55	0.40	0.19	0.45	0.45	1.00												
Q08	0.38	0.28	0.27	0.17	0.23	0.26	0.06	1.00											
Q09	0.37	0.07	0.05	0.26	0.13	0.12	-0.07	0.47	1.00										
Q10	0.25	0.17	0.14	0.15	0.20	0.15	0.04	0.38	0.43	1.00									
Q11	0.41	0.26	0.35	0.23	0.40	0.28	0.07	0.51	0.41	0.47	1.00								
Q12	0.35	0.06	0.03	0.05	0.14	0.13	0.13	0.34	0.36	0.21	0.26	1.00							
Q13	0.24	0.24	0.15	0.08	0.16	0.21	0.09	0.36	0.22	0.05	0.29	0.36	1.00						
Q14	0.43	0.11	0.06	0.15	0.20	0.05	0.04	0.27	0.31	0.17	0.35	0.26	0.26	1.00					
Q15	0.05	0.27	0.15	0.02	0.01	0.15	0.24	0.14	-0.16	0.13	-0.09	0.12	0.10	0.07	1.00				
Q16	0.05	0.24	0.12	-0.06	0.01	0.10	0.24	0.04	0.08	0.26	-0.01	0.29	0.14	-0.13	0.29	1.00			
Q17	-0.09	-0.05	-0.05	-0.08	-0.04	-0.03	-0.04	0.01	-0.05	-0.19	-0.11	-0.14	0.00	0.13	0.13	0.04	1.00		
Q18	0.10	0.14	0.02	-0.04	0.16	0.07	0.27	0.04	-0.05	0.20	-0.02	0.17	0.10	-0.04	0.36	0.24	0.13	1.00	
Q19	0.32	0.33	0.17	0.29	0.25	0.24	0.34	0.32	0.35	0.41	0.11	0.35	0.23	0.09	0.31	0.37	-0.14	0.32	1.00

As for point 1, ordinal logistic regressions were carried out for all the replies to the questions, the only regressor being a dummy variable (0/1), where the value 1 stands for the respondent's belongingness to the group of students in Industrial Design. The outcomes of the regression include the regression coefficient and the corresponding p-value associated to the dummy variable. The results show that the studied discipline affects the outcomes of the survey ($p<0.05$, as a common rule of thumb) for a few

questions. Students in Industrial Design are more likely to provide positive evaluations with reference to Questions 08, 09, 12 and 13.
As for point 2, the outcomes are presented at the bottom part of Table 1, where Spearman correlation coefficients among all answers are reported. This statistic is considered appropriate for ordinal variables. The colours of the cells indicate the strength of the agreement; the common interpretation of correlation coefficients introduced by Landis and Koch (1977) is used. Negative correlation values (in red) are to be interpreted as poor correlation; values in the intervals 0-0.2 (light yellow), 0.2-0.4 (dark yellow), 0.4-0.6 (light green) and 0.6-0.8 (dark green) are proxies of slight, fair, moderate and substantial agreement, respectively.

5. Discussion, conclusions and future work

The present paper investigates the adequateness in supporting ideation sessions of a trivial stimulation ICT tool, introduced by the authors' research group. A contribution of the illustrated work indeed stands in the attempt to follow a design approach, such as starting from a MVP, for the development of a web platform that aims to enhance creativity in the early product development phases. The focus is to acquire indications about necessary development steps rather than to assess creative outcomes based on acknowledged criteria, e.g. (Shah et al., 2003), also because the effectiveness of the underpinning methodology has been verified to this respect. A further contribution of the paper is to check the usability of an ICT tool for supporting idea generation in design, developed according to the MVP paradigm. Further considerations will stress the poor utility of measuring creativity at this stage.
In order to achieve an understanding about the usability and the perceived utility of *Startled*, an articulated evaluation procedure has been developed. It originally integrates items from standard questionnaires aimed to evaluate technology readiness (such as TAM, widely used for ICT- tools) and cognitive efforts (such as NASA-TLX) in order to provide further hints about individuals' comfort when performing a typical ideation task with the proposed tool. The evaluation procedure involved a sample of students, which accomplished an ideation task with the use of *Startled*. Although students are not skilled designers, they faced a design activity that required creative aptitudes. Therefore, in reference to the objectives of the paper, the involvement of students in the experiment, instead of skilled designers, is compliant with the task of verifying whether a tool like *Startled*, developed according to the MVP paradigm, is capable of stimulating and managing the creative process. According to the authors' reading, the main findings follow, which are mainly based on the results illustrated in Section 4.
The evaluation of the tool and the way the method is implemented has given rise to mixed feelings. Many answers are neutral; positive replies outnumber negative ones, but the results are not fully satisfactory at this stage. Utility and usability of the described ideation instrument have been not clearly stated, as well as strengths and weaknesses are not explicit, since many questions have been rated similarly. As usability and utility are still questionable, the evaluation of creativity seems superfluous – designers would not employ the proposed tool, even if outcomes were positive. Moreover, very few differences emerge between the two groups of experimenters, distinguished according to their background. Interestingly, a poor relationship was found between usability factors (addressed through the TAM) and cognitive load (investigated by means of TLX-NASA). This suggests addressing the two phenomena separately when developing instruments and designing corresponding tasks. Overall, the outcomes address trivial implementation frameworks' inability to support the creative process. More specifically, the outcomes of such an experience suggest that a creative tool developed according to the MVP paradigm, although grounded on a proven stimulation method, does not provide the expected benefits in terms of utility and usability, showing thus non-negligible lacks in the management of creative ideation sessions. With a specific reference to the *Startled* platform, it can be inferred that major guidance of the task, interactivity and more user-friendly interfaces may benefit creative design tasks. Another hypothesis is the inability of textual stimuli to cater attention, although deemed useful to boost ideation, even by means of an organized and manageable ICT framework. To this regard, the introduction of matching pictorial stimuli is planned, also based on a study conducted in parallel (Borgianni et al., 2017).

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References

Alamäki, A. A conceptual model for knowledge dimensions and processes in design and technology projects. *International Journal of Technology and Design Education*, in press.

Bacciotti, D., Borgianni, Y., & Rotini, F. (2016a). An original design approach for stimulating the ideation of new product features. *Computers in industry*, 75, 80-100.

Bacciotti, D., Borgianni, Y., Cascini, G., & Rotini, F. (2016b). Product Planning techniques: investigating the differences between research trajectories and industry expectations. *Research in Engineering Design*, 27(4), 367-389.

Barnawal, P., Dorneich, M., Frank, M. C., & Peters, F. (2017). Evaluation of Design Feedback Modality in Design for Manufacturability. *Journal of Mechanical Design*, 139(9), 094503.

Borgianni, Y., Rotini, F., & Tomassini, M. (2017). Fostering ideation in the very early design phases: How textual, pictorial and combined stimuli affect creativity. In *DS 87-8 Proceedings of the 21st International Conference on Engineering Design (ICED 17) Vol 8: Human Behaviour in Design*.

Dorta, T., Perez, E., & Lesage, A. (2008). The ideation gap: hybrid tools, design flow and practice. *Design Studies*, 29(2), 121-141.

Goldschmidt, G., & Sever, A. L. (2011). Inspiring design ideas with texts. *Design Studies*, 32(2), 139-155.

Goldschmidt, G., & Smolkov, M. (2006). Variances in the impact of visual stimuli on design problem solving performance. *Design Studies*, 27(5), 549-569.

Gonçalves, M., Cardoso, C., & Badke-Schaub, P. (2013). Inspiration peak: Exploring the semantic distance between design problem and textual inspirational stimuli. *International Journal of Design Creativity and Innovation*, 1(4), 215-232.

Gonçalves, M., Cardoso, C., & Badke-Schaub, P. (2014). What inspires designers? Preferences on inspirational approaches during idea generation. *Design studies*, 35(1), 29-53.

Jung, J., Hoefig, K., Domis, D., Jedlitschka, A., & Hiller, M. (2013, October). Experimental comparison of two safety analysis methods and its replication. In *2013 ACM/IEEE International Symposium on Empirical Software Engineering and Measurement*, (pp. 223-232). IEEE.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 33(1), 159-174.

Mouaffo, A., Taibi, D., & Jamboti, K. (2014). Controlled experiments comparing fault-tree-based safety analysis techniques. In *18th International Conference on Evaluation and Assessment in Software Engineering*.

Paetzold, K., & Höfner, B. (2014). A contribution to assess the usefulness of products. In *Proceedings of the 10th International Workshop on Integrated Design Engineering*.

Parvin, M., Cascini, G., & Becattini, N. (2017). Information extracted from patents as creative stimuli for product innovation. In *DS 87-6 Proceedings of the 21st International Conference on Engineering Design (ICED 17) Vol 6: Design Information and Knowledge*.

Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. Crown Books.

Shah, J. J., Smith, S. M., & Vargas-Hernandez, N. (2003). Metrics for measuring ideation effectiveness. *Design Studies*, 24(2), 111-134.

Taibi, D., & Lenarduzzi, V. (2016). MVP explained: a systematic mapping on the definition of minimum viable product. In *42th Euromicro Conference on Software Engineering and Advanced Applications*.

Taibi, D., Lenarduzzi, V., Diebold, P., & Lunesu, I. (2017). Operationalizing the Experience Factory for Effort Estimation in Agile Processes. In *21th International Conference on Evaluation and Assessment in Software Engineeering* (pp. 31-40). ACM.

Vasconcelos, L. A., & Crilly, N. (2016). Inspiration and fixation: Questions, methods, findings, and challenges. *Design Studies*, 42, 1-32.

Venkataraman, S., Song, B., Luo, J., Subburaj, K., Elara, M. R., Blessing, L., & Wood, K. (2017). Investigating effects of stimuli on ideation outcomes. In *DS 87-8 Proceedings of the 21st International Conference on Engineering Design (ICED 17) Vol 8: Human Behaviour in Design*.

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision sciences*, 39(2), 273-315.