



**HAL**  
open science

# Enhancing Your Mental Well-Being and Creativity While Writing: A Crowdsource-Based Approach

Frederica Gonçalves, Pedro Campos

## ► To cite this version:

Frederica Gonçalves, Pedro Campos. Enhancing Your Mental Well-Being and Creativity While Writing: A Crowdsourc-Based Approach. 5th IFIP Working Conference on Human Work Interaction Design (HWID), Aug 2018, Espoo, Finland. pp.17-35, 10.1007/978-3-030-05297-3\_2 . hal-02264614

**HAL Id: hal-02264614**

**<https://inria.hal.science/hal-02264614>**

Submitted on 7 Aug 2019

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

# Enhancing your mental well-being and creativity while writing: a crowdsourcing-based approach

Frederica Gonçalves<sup>1</sup> and Pedro Campos<sup>1</sup>

<sup>1</sup> Madeira-ITI, University of Madeira, Funchal, Portugal  
frederica.goncalves@m-iti.org, pcampos@uma.pt

**Abstract.** We describe a crowdsourcing platform for writing called CreativeWall, where users can preserve their creative writings and share them with the community. By using images, moods and locations we create a more visual perspective of a moment that can bring creativity and mental well-being to the writer. We also present an evaluation of our crowdsourced platform. Our findings suggest that, from a mental well-being perspective, the participants felt more inspired, more focused, more creative and more immersed when using the CreativeWall add-in. Additionally, CreativeWall helps writers to trigger their creativity while writing. We highlight some results triangulating qualitative and quantitative data. Results show that users performing the tasks with CreativeWall lost track of time more often than participants using our baseline. From user interviews, results suggest that the tasks performed with the CreativeWall add-in were more enjoyable and that the users had no issues kickstarting the writing process, which could mean that these tools can help in the initial phase of the creative writing process.

**Keywords:** Creative Writing tools; Human Computer Interaction; Creativity Support Tools; User Interface Design; User Experience Design; Crowdsourcing; MSWord Add-In; Human Work Interaction Design.

## 1 Introduction

As we know, writing is one of the main artistic expressions of humans. In ancient times, images were used as a form of expression, and nowadays we use images as a way of recording a moment that we want to continue or “use” later on. Creative writing often displays imagination or invention. It goes outside the bounds of normal professional or technical forms of literature and can be found in journalism, science fiction, etc. and typically identified through different forms such as prose, poetry and many assorted ways [1]. Writers tend to write using different techniques and they take their creativity from anything. The creative writing process can be divided into six different stages: pre-writing, drafting, revising, editing, evaluating and publishing [2]. But in this process, writers often have one or more creative blocks, and they need creativity for finishing their work. Sometimes writing might not be as easy as it seems, as there are millions of subjects a writer can write about, thousands of ways to spread the same idea, hundreds of tools to use to help them write. Deciding what to write about can sometimes

be surprisingly tricky. Writers often face a common problem known in this area as writer's block [3]. They refer to writer's block as the inability to write, despite the desire and ability to do so. There are different reasons for this situation to happen. Aspects such as stress, fear or simple problems with organization or prioritization can be the cause for it [4]. There are currently some possible solutions [5] [6] [7] [8] [9] to this issue and each writer seems to have its own way to deal with it. Writers need to look for ways to get creative and finish their work.

Search engines like Google can help you find ideas on what to write about but it takes a lot of time to analyze the thousands of results that are presented, even though they are shown in an optimized way. Social networks like Facebook or Pinterest can help you as well, with groups that are created with the objective of helping writers, but they lack categorization and can be really distracting. The best way to gather enough data for such a creativity tool is to take advantage of crowdsourcing. This way one can raise a community who is interested in writing and give them the opportunity to share their creative writings. These writings can then be used by the tool to help other writers with their own work.

In this paper, we present the crowdsource platform called CreativeWall and a Microsoft Word Add-In to enhance the mental well-being and creativity of users in the creative writing process. One of the problems that usually moves writers away from their goals is a condition called writer's block. Writer's block can last for entire days [10] and becomes a real source of frustration when people are anxious about deadlines and really need to get the writing done. One of the methods used to avoid writer's block is the use of writing prompts [11] [8], which consists of a small text that is supposed to help writers to have ideas on what to write. We decided to take this method further and refined it by adding some more components that can help the writer have the creativity he needs. By using images, moods and locations [12] [5] we create a more visual perspective of a moment that can bring creativity and mental well-being to the writer. The remaining of this paper is organized as follows: in the next section, we review related work about crowdsourcing, creative writing, flow theory and supporting creativity theories about mood, emotions and colors. We then present a section describing CreativeWall as well as the CreativeWall's Microsoft Word add-in. Afterwards, we detail the field study of CreativeWall by detailing the participants, methods, procedures, setting and results. Finally, we wrap up with a discussion as well as the overall conclusions and future work.

## **2 Background**

### **2.1 Creativity Support Tools**

New technological developments, such as those in the field of virtual reality, facilitate new forms of creative work. It is a two-way process, the interaction with technology provides fresh possibilities to use it in creative ways, while also leading to the evolution

and sometimes transformation of technologies. Emerging computer-based tools can develop better and more creative solutions to the problems they face whether it's in decision support systems [13] or in simple software systems.

After decades of creativity research there is still no consensus on how to evaluate how well a Creativity Support Tool (CST) supports the creativity of its users [14]. Hedge et al. [15] considers that success during software development, depends on the creativity of software engineers, despite being a conceptually complex, knowledge-intensive activity. We can praise science and engineering, but there is still a paradox about technology that helps us to be more productive, perform our work more rapidly and effectively. Therefore, there is an effort for developing creativity support tools, which enable us to explore, discover, imagine, innovate, compose and collaborate [16]. Joy et al. [17] suggest that people who generate multiple possible solutions are more likely to produce solutions which are less common. Also, they argue that some people are more capable than others of breaking free from the mental set established by their initial ideas, therefore they are more flexible, from a cognitive point of view.

Selker [18] considers that creativity and motivation enhancement can easily be aligned with the design of high-quality human-computer interaction and also that creativity might be viewed as any process which results in a novel and useful product. Sheirderman [19] argues that it is a challenge to construct information technologies that support creativity and the goal of developing new CST can be obtained by building upon an adequate understanding of creative process.

The main goal of CST is to develop improved software and user interfaces that make users become more productive, and more innovative [19]. Search tools based on clustering, self-organizing maps, employing visual maps of semantic relationships are just one example of CSTs. Any user interface or software system that has a focus on improving creativity can be considered a CST: this naturally includes VR-based technology and tools, which show promising potential for effectively addressing the problem of improving creativity levels. Creativity and motivation enhancement can easily be aligned with the design of high-quality human-computer interaction and also creativity might be viewed as any process which results in a novel and useful product, as stated by [18]. Researchers have also targeted other stimuli to support creativity, such as the visual stimuli, images and text [20] [7], increase both originality and diversity of ideas during brainstorming [21] [22]. Other such as Gonçalves et al. studied UI Zen-based themes, composed of sound and images, foster inspiration, focus and immersion on creative writing tasks [8] and also with smell and sound [6].

## 2.2 Crowdsourcing

Crowdsourcing is a concept that, although very powerful and effective, is relatively recent and still doesn't have a solid theoretical knowledge base that allows it to have a clear definition [23]. According to Howe [24] crowdsourcing can be defined as "*the act of taking a task traditionally performed by a designated agent and outsourcing it by making an open call to an undefined but large group of people*". Another example of a definition comes from Brabham [25], who says it can be defined as "*a new web-based*

*business model that harnesses the creative solutions of a distributed network of individuals through what amounts to an open call for proposals*". As for Kleemann et al., [26] crowdsourcing can simply be defined as "*the outsourcing of tasks to the general internet public*". These are all valid definitions but there is no consensus regarding what would be a definitive and complete definition. For the purpose of this work we will only focus on two types of crowdsourcing [26], product design and product rating by consumers and consumer profiling, which are the ones that better suit our needs.

### 2.3 Moods, Emotions and Colors

As Baas et al. [27] states, there are differences between moods and emotions. According to the reference, moods are long lasting while emotions are more related towards a specific stimulus, for example, an emotion would be a person feeling happy because he/she found some money on the ground. This situation forces an emotion onto the person, the emotion of happiness. On the other hand, a mood is something that is more general, for example, a person feeling happy because he/she just feels great. With this we can conclude that there really are differences in terms of intensity of feelings, being that emotion is generally stronger than a mood. Another definition of mood states that moods are the accumulation of emotions and other affective events [28]. Moods can have multiple dimensions, but only three of those dimensions have been proven to be related to creativity. They are hedonic tone, activation level and regulatory focus.

The hedonic tone, or valence, simply put, describes whether the mood is positive or negative [27] [29] (e.g. happiness has a positive tone while anger has a negative tone). This dimension is usually related to creativity as some studies refer [30]. The same studies state that moods with a positive tone help a subject produce more original word associations which means that there might be a boost in creativity.

Activation relates to whether or not the mood can generate active behaviors in the subject (e.g. calm is a deactivating mood while fear is activating). According to De Dreu et al. [29] activation is a necessary precondition for creativity to come by while hedonic tone determines the route through which creative fluency and originality is achieved. They also argue that activating moods are more likely to generate creativity than deactivating moods.

Regulatory focus refers to the motivation an individual has to complete a task. According to studies made in this area, regulatory focus plays an important role in triggering creativity [31]. There are two types of regulatory focus, the promotion focus and prevention focus. Promotion focus comes from the desire of accomplishing something, while prevention focus comes from the will of securing something [27]. A good example of this would be the attackers and goalkeepers in a football game. The objective of the attackers is to score goals and that's their motivation for playing (promotion focus). On the other hand, goalkeepers want to prevent goals, and that's their motivation for playing (prevention focus). Color can lead to feelings, and that have been proved by several studies in this area [32] [33]. An example of this statement is a cloudy day. A cloudy day has a predominant color, which is gray, and gray is related to sadness, so people usually feel sad on cloudy days. If you look outside through a yellow window you can see that a feeling of warmth comes to you and everything feels a bit happier,

as states by Goethe [34]. It's curious to see that the relation between color and emotions (or feelings) was already object of research more than 100 years [34]. Kaya et al. [32] [33], performed user studies in order to be able to map colors to emotions and the result were somewhat similar to the statements made in the [34].

After considering the statements above, a list of moods and a mapping to colors was produced by us. Table 1 shows the mapping between color and emotion. Even though fearful and angry are not considered to be creativity enhancing moods, they were included in the list in order to give users some variety to choose from. As future work an increase to the number of moods should be granted in order to include other creativity enhancing moods.

**Table 1.** Moods mapped into colors

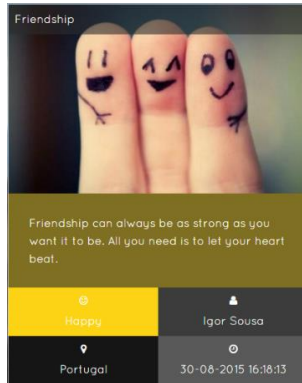
Happy	Yellow	
Hopeful	Green	
Excited	Orange	
Energetic	Light Blue	
Loved	Pink	
Fearful	Black	
Angry	Red	

### 3 CreativeWall Platform

CreativeWall is a crowdsourcing platform where its users can share their creative writings along with images, locations and moods, creating what we call a creative and mental well-being moment. This concept came to life from the idea that people sometimes have ideas for creative writings when they are, for example, walking on the street and see something that triggers their creativity and mental well-being. That is the essence of the creative moment. They have an image that triggers an idea that is described by the text. A certain mood is also associated to that moment and it happens in a certain location, date and time. When brought together, all these aspects generate our creative moment. Figure 1 illustrates how a Creative Moment is shown on the platform.

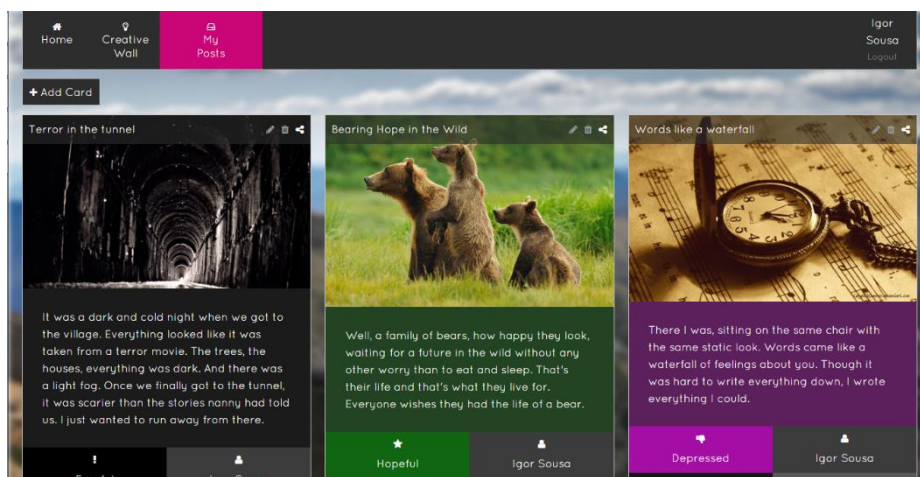
In this case the creative moment was captured in Portugal when the user was Happy. The moment has author, date and time information for a better knowledge about its details and the environment where it happened. With this kind of information, other users can recreate the moment mentally and maybe absorb some kind of creativity from it giving birth to their own ideas based on what they see and feel with the moment recreation.

With this kind of information, other users can recreate the moment mentally and maybe absorb some kind of creativity from it giving birth to their own ideas based on what they see and feel with the moment recreation.



**Fig. 1.** Example of a creative moment

Figure 2 shows the final prototype and how the section My Posts looks. There are two main sections on the platform, the Creative Wall and My Posts.



**Fig. 2.** Final Prototype of CreativeWall

### 3.1 Creative Wall

In this section users can check out creative moments shared by other users. They can also report, flag the moments as well written, or rate them. The first option, the reporting of moments, allows users to report other user's moments for offensive content, copyright violation, etc. As for the second option, the well written flag, it allows users to flag the moments that have a correct syntax and semantics, and with this make them part of the moments that appear when a user selects the well written filter. The last option, the moment rating, allows users to rate a moment from 1 to 5 stars where 1 means very uncreative and 5 means very creative. By doing this users make shared moments more and more relevant. These three options are part of a very important

component of a crowdsourcing platform, the quality control, and can only be accessed by users that are logged in the platform. Below we can see these three options and how the user interacts with it. Figure 3 shows the three options described above.



**Fig. 3.** Top bar of the moment showing the three options available

In this case the moment has already been rated, but is not checked as well written. Figure 4 shows how a user can interact with the system in order to rate a moment.

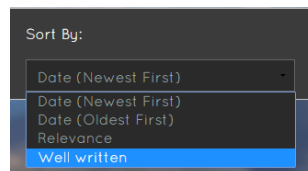


**Fig. 4.** Top bar of the moment showing the rating feature

We can see that the user rated the moment with two stars. This means that the moment was uncreative and should not appear on the top of the relevant moment's list.

Another important feature that was implemented is a filter system where users can insert the conditions that most suits them and the platform will look for the moments that match those conditions. There are three fields on the filters bar, mood, location and tag. These three fields help users categorize their searches for faster finding of the moments they want. Each moment can be associated to a group of tags that can then be used for search purposes. There is also an option for sorting the results for a variety of options. Figure 5 shows the list of options that are available for sorting.

For the first two options, they are self-explanatory. On the relevance option, the moments that are presented first are the ones with a higher average rating. This average is calculated by dividing the sum of all the ratings by the number of ratings assigned to that moment. As for the well written, the first moments that are presented are the ones with a higher count of well written flags. With this feature, it is possible to make sure that only quality content is shown and that the user does not have to pay extra precious attention to error check on moments shared by other users.



**Fig. 5.** Sort feature showing the options available



### 3.2 My Posts

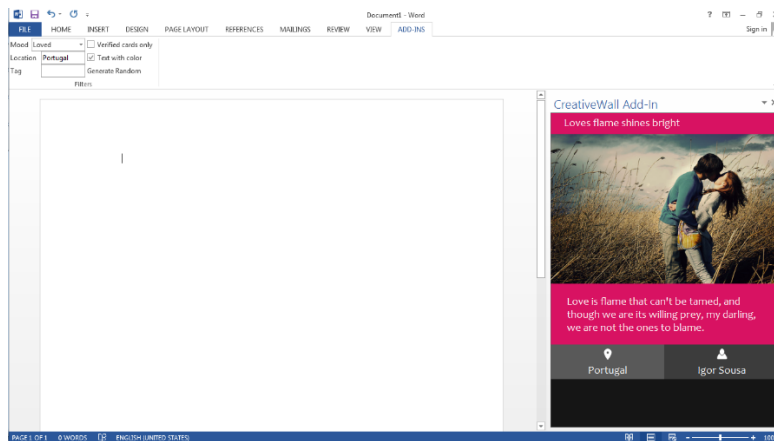
In this second section, users can see all the moments that they have already created, share them, add new ones and edit or remove the existing ones. Users can choose whether or not they want to share their moments. They can use the platform just for saving their moments without making them available for other users to see. To share a moment, users just have to press the share icon and the moment is made available for every user. To edit or delete a moment, users just have to press the according icon.

When a user deletes a moment a confirmation dialog box is presented to make sure that this is the desired action. As referred before, a user can also create a new moment in this section. When the user presses the button to add a new moment, a dialog box is presented with all the fields necessary to create the new moment. Figure 6 shows all the information the user can insert to create the new moment.

 A dark-themed dialog box titled "Card Data" is shown. It contains several input fields: "Title", "Image", "Music", "Location", and "Tag (Copied from by \*)". There is also a "Text" area on the right side. At the bottom, there is a blue "Create" button.

**Fig. 6.** Dialog box showing the possible fields for creating a new moment

The final prototype can be seen in Figure 7 and how the section My Posts looks. The design chosen was achieved and we felt very happy with all the design choices that were made. No specific tests were performed for the crowdsourcing platform as it acts only as a tool to populate the database with data to be used in the MSWord Add-In.

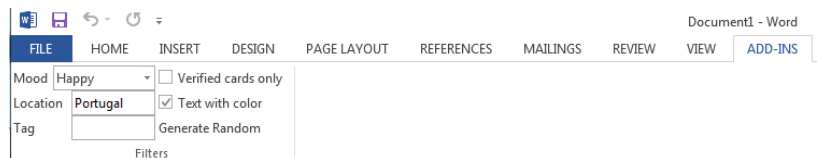


**Fig. 7.** Final Prototype of the Microsoft Add-In.

### 3.3 CreativeWall Microsoft Add-In

CreativeWall MSWord Add-In is a plugin (called Add-In by Microsoft Office) for Microsoft Word that uses the data created in the CreativeWall platform in order to provide users with a way to trigger creativity while writing in the Microsoft Word application.

This plugin requests creative moments from the API according to some filters chosen by the user and then shows those creative moments in Microsoft Word. By doing this, the user can use the creative moments for triggering creativity in the word processor tool itself without having to change applications and search for creative moments in the online platform. The features that were implemented help the user getting what he wants as fast as possible, and that was the main goal of the interface implemented. The plugin has a ribbon that contains a set of buttons and inputs which the user can use to interact with the plugin. As described before, the ribbon contains a set of buttons and inputs that can be used to interact with the plugin. Figure 8 shows the ribbon and the elements available for interaction.



**Fig. 8.** CreativeWall Add-In ribbon with buttons and inputs available

The first three options, mood, location and tag are self-explainable, they apply filters to the results. The checkbox for “Verified cards only” will return cards that have average ratings over 4 stars and at least 5 well-written tags. This helps the user get data that has a minimum of quality and is not just random words with no meaning. This also helps the user getting creative moments that are written correctly. As for the option “Text with color”, it defines if the creative moment should be shown with a gray background or with a background according to the color associated with the mood of the creative moment. The button “Generate Random” generates a random creative moment according to all the filters selected on the other options. If the user inserts a set of filters to which there are no creative moments associated, an error message is displayed. The add-in creative moments interface is basically the same as the one in the CreativeWall web platform, it just has less fields. Each of the creative moments shown have a title, image, text, location and author. Figure 7 shows an example of a creative moment in the add-in.

After all the implementation was done a final prototype (*see Figure 7*), that is to be used in the user study, was achieved. This prototype has all the features described above and they are all usable. It can be used by users after running a setup to install all the registry entries needed to use it on Microsoft Word as an Add-in. This prototype is just one example of an application using the add-in, since it may be used by any other word processor tool that wishes to implement our approach. All they need to do is register for usage of the API and after they set a client id and a client secret, they can start making requests to the API in order to receive the desired data.

In order to build a usable prototype a decision about the architecture of the software was needed. One requirement that was important was the scalability of the whole software structure. It is important, in the context of our approach, to be able to provide data to any word processor plugin or platform that wants to use the data created in our crowdsourcing platform, as long as they have previously applied for it. The solution is to build a client-server architecture. Having a centralized server (in our case the API works as both the server and an abstraction communication layer) it is possible to provide data to as many clients as we need. All connections should be made through HTTPS so the connection data (e.g. tokens or client credentials) is not exposed through package sniffing. For the purposes of this work we won't be making those HTTPS connections because this kind of features has high costs associated to it and it is not relevant for our user studies. This should be considered as future work. All the clients have read-only permissions, except for the crowdsourcing platform that sends data to the API for it to be inserted on the database. Before being able to request any data from the API the clients must be registered and define a client ID and a client secret so they can be authenticated before establishing a connection. This protects the data from being accessed by unauthorized clients.

## 4 Field Study - Pilot Evaluation

We addressed the following research question: *What is the influence of the CreativeWall Add-In UI on the participants' mental well-being and creativity, when compared to the Microsoft Word Simple UI?* The experimental design was based on a within-subjects design in which each individual performed a creative task – writing in the three proposed conditions:

- **Condition A:** Baseline. Using Microsoft Office Word without any kind of add-in related to creativity to write a text based on a given context;
- **Condition B:** Using Microsoft Office Word with the CreativeWall Add-In with a gray background to write a text based on a given context;
- **Condition C:** Using Microsoft Office Word with the CreativeWall Add-In with a colorful background to write a text based on a given context.

To reduce a limitation such as order effect, we counterbalanced the order of each conditions for each participant. The individuals were assigned a random order of tasks in order to guarantee that no knowledge was passed from one task to the other as that would influence the results. As a prerequisite, participants had to have prior writing skills and had to be interested in writing.

### 4.1 Task

Participants were challenged to write a short text using the addressing tool. The time was limited to 10 minutes. Participants were free to finish the task whenever they wanted, under the 10-minute limit. Due to the use of a within-subject design, we defined three different writing tasks of a similar degree of complexity that participants were

equally familiar with. The writing tasks were labeled as task A, B and C, respectively. All participants were presented with a context for each one of the tasks. For task A, the participants were given a context that was not produced by our crowdsourcing platform. This task was considered our baseline. Figure 9 shows the context given on the task A.



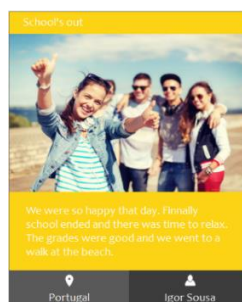
**Fig. 9.** Context given to the user on the first challenge

For task B, participants were given a context created on our crowdsourcing platform. This context is a creative moment that was created and shared by a user who was registered on the CreativeWall. Figure 10 shows the context that was presented for the task B. In order for this context to be presented in grey, the option “Text with color” on the MSWord Add-In has been turned off.



**Fig. 10.** Context given to the user on the second challenge

For task C, participants were given another context created on our crowdsourcing platform. Again, this context is a creative moment that was created by a registered user on the *CreativeWall* platform. Contrary to what happens on the second task, the option “Text with color” was turned on for this task. Figure 11 shows the context used for the task C.



**Fig. 11.** Context given to the user on the third challenge

## 4.2 Participants

A total of 11 individuals (7 males and 4 females) aged between 20 and 32 years old ( $M=25.8$ ;  $SD= 3.5$ ), took part of this study. Every participant was a Software Engineer, and they were recruited through the university mailing list. All participants reported having a normal or corrected visual acuity and none participant was colorblind. We conducted one session per subject.

## 4.3 Measures

Before they started the experiment, participants were asked to fill a very short survey in order to collect some demographic data and they also ranked their own creativity (“*Do you consider yourself a creative person?*”) in a Likert Scale (0-7 values) [35].

After completing each task, participants were asked to fill out self-reported survey. The survey contained some general questions like age, or gender and some Likert scale questions. Also a multiple choice question about how the user felt during the task was included. The Likert scale questions were ranked from 1 (totally disagree) to 7 (totally agree). The Likert scale questions were based on four dimensions of the Flow Theory [36]: 1. Intense and focused concentration on the present moment; 2. Sense of personal control or agency over the situation or activity; 3. Loss of reflective self-consciousness; 4. Distortion of temporal experience. For these dimensions questions such as “*I felt very concentrated during the challenge*” or “*I lost track of time during the challenge*” were included. Finally we collected qualitative data with a semi-structured interview with questions such as: “*Which condition did you enjoy using the most?*” or “*Is there any comment that you would like to add?*”, “*Did time limit your creativity?*” in order to know the participant opinion about the whole experience.

## 4.4 Procedure

Participants were brought individually to a quiet room previously prepared for the experiment. For the examination, we used two laptops computers with a screen size of 13.3 inches and a display resolution of 1920x1080 pixels. When participants entered the room, they were asked to sit and before they started the experience, the experimenter ran the tool and asked them if they wanted to change little things in the environment, such as font size/type or something else. They had a few minutes to know each tool. We did this because we were using different conditions that they could be unfamiliar with as a way to reduce bias or any aversion to a given tool. After that, the writing task was explained. During the task, the participant was left alone in a room with the computer at his disposal. The time was monitored by the person responsible for guiding the participant through the tasks and after it reached the 10 minutes mark the participant was instructed to stop writing. When participants finished the writing task, they were asked to fill out the self-reported survey. Finally, participants were interviewed based on their experience using the tools. The total time per subject including questionnaires, experiment, breaks and semi-structured interviews took over one hour.

## 5 Findings

To inquire the impact of the CreativeWall Add-In UI on user's apparent and experienced creativity, we triangulated different data sources, such as behavioural data, users' verbal accounts during task execution, self-reports using psychometric scales of creativity and data from our exit interviews.

### *Is our sample equally creative?*

Participants self-rated their creativity ( $M=6.18$ ;  $SD= 1.54$ ) in a seven-point Likert Scale before starting the experience. 63.3% of participants considered themselves a creative persons in a seven-point Likert scale. 18.2% of participants considered themselves creative persons in a five-point values, 9.1% in a three-point values and 9.1% in a two-point values.

### *Did CreativeWall Add-In UI lead to increased flow?*

To assess the reliability of our survey, we used Cronbach's alpha as a measure. It was taken into account the polarity of the scale. Table 2 exhibits results of reliability (internal consistency) analyses for questions in each dimension of flow. Results show that the number of test items can be considered with an acceptable consistency in the scale used, from the survey, on seven-point Likert scales.

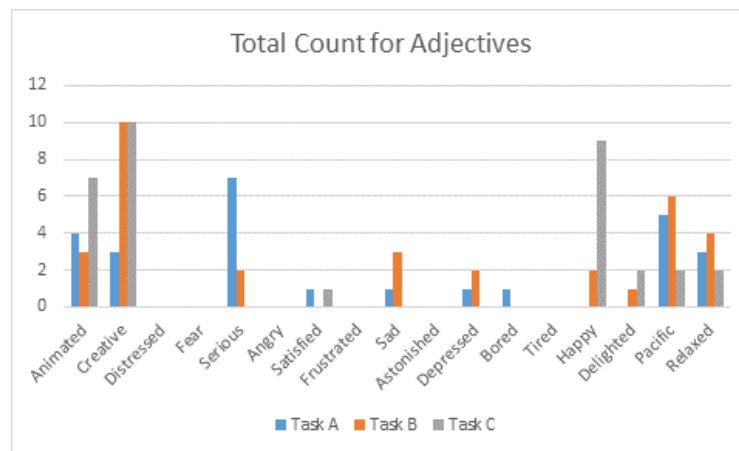
**Table 2.** Cronbach's alpha related to each of the dimensions

Flow Dimensions	Cronbach's Alpha
Concentration	.629
Sense of Control	.797
Lost Self-Consciousness	.672
Lost Track of Time	.633

We proceeded using repeated measures such as Friedman's ANOVA approach to testing differences between each condition. The Flow dimensions Concentration ( $F(2) = 5.20$ ,  $p>.05$ ) and Lost Self-Consciousness ( $F(2) = 1.90$ ,  $p>.05$ ) did not have statistical significance when compared with each condition. For the other dimensions Sense of Control ( $F(2) = 10.21$ ,  $p<.05$ ) and Lost Track of Time ( $F(2) = 17.43$ ,  $p<.05$ ) results were statically significant. Therefore the non-parametric Wilcoxon tests were used to display if there were any differences for each pair or conditions, using Condition A to compare as a baseline.

Results showed that, participants in Condition A, when compared with participants in Condition B ( $T=0$ ,  $z= -2.06$ ,  $p<.025$ ,  $r=-.44$ ), for the dimension Sense of Control were not statistically significant. Also, participants in condition A when compared to participants in Condition C, for the levels of Sense of Control, even though the value is in the border line, it was not statistically significant as well ( $T=0$ ,  $z= -2.23$ ,  $p<.025$ ,  $r=-.48$ ). We applied the effect size that gives us the magnitude of the effect investigated. For the dimension Lost Track of Time, the results showed a significant difference between the participants in Condition A when compared to participants in Condition B ( $T=0$ ,  $z= -2.71$ ,  $p<.025$ ,  $r=-.58$ ). For the same dimension,

the differences between participants in Condition A when compared to participants in Condition C were also statistically significant ( $T=0$ ,  $z=-2.72$ ,  $p<.025$ ,  $r=-.58$ ). To assess the participants mental well-being we asked them to select up to three adjectives from the following list: animated, creative, distressed, fear, serious, angry, satisfied, frustrated, sad, astonished, depressed, bored, tired, happy, delighted, pacific and relaxed. Figure 12 shows the total count for each of the adjectives selected and presented on the above list. The words that were used the most were animated, creative, happy and pacific, being that creative was the most used for Condition B and Condition C, and serious was the most used for Condition A.



**Fig. 12.** Chart relating the tasks with the adjectives used in them

After analyzing the results, we are able to conclude that users who were in Condition B and Condition C report to feel more creative than users in Condition A. The most balanced word counts were relaxed and pacific, as they were selected at least twice for each condition. These aspects might indicate that users felt ease when writing.

#### ***Did CreativeWall Add-In UI lead to increased output?***

We used the Skewness and Kurtosis and Kolmogorov-Smirnov tests ( $p>0.05$ ) to analyze the data normality of the average number of words produced. Results showed that the sampling distribution was normal. T-tests were used to compare the statistical significance of the samples using a 95% level of confidence. Participants in Condition B wrote on average more words ( $M=186.1$ ,  $SD=49.3$ ) than in Condition A ( $M=156.2$ ,  $SD=54.5$ ). For the same condition the difference was statistically significant ( $t(10)=-3.20$ ,  $p<.05$ ). In Condition C, participants wrote on average more words ( $M=185.7$ ,  $SE=65.1$ ) than in Condition A ( $M=156.2$ ,  $SD=54.5$ ). The difference was statistically significant ( $t(10)=-2.23$ ,  $p<.05$ ) for the same condition. Table 3 shows statistics from the time and sequence in which the users completed their writing tasks.

**Table 3.** Statistics from time in minutes spent on each condition.

	Condition A	Condition B	Condition C
<b>Mean</b>	8.73	9.55	9.27
<b>Median</b>	9.00	10.00	9.00
<b>St. Deviation</b>	1.01	0.69	0.79

By statistically results reported in Table 3, we can see that most of the participants did not used the ten minutes for the writing task. When interviewed, 81.8% of participants did not considered the time limit a factor to restrict their creativity in the writing task. This might indicate that even though the conditions used for the experience helped the participants start writing, they are not as effective when it comes to keeping a constant creativity flux and therefore helping only on the first steps of the creative process. Triangulating the results with the semi-structured interviews conducted after the writing task apparently suggest that, by unanimity of the answers registered, Condition A was the less enjoyed condition. 63.6% of participants really liked the Condition C, and 36.4% liked to write in Condition B.

According to some participants (27.7%), the lack of image and texts is important for their creativity to flow, “*Condition A is very limited because it lacks the image, and the image is very important for creativity.*” (P6). Another interesting fact is that, for the majority of participants, color helps but does not influence creativity when they don’t find the text creative, “*Even though color is a very interesting component, the most important ones are the text and image. If the text is not creative then the color won’t make a difference.*” (P4); “*Color helps the user remember of something. For example, the yellow resembles the joy of the summer.*” (P6); “*Color helped, but the most important thing was the text and the image.*” (P8). Some other participants refer to the color as being a source of distraction or did not considered as an important factor, “*Color helps as well but is not as decisive as the text and image. Color can also be a motive for distraction. A less intense color might have been better.*” (P3); “*The color is a little bit distractor.*” (P2). With this we assume that our initial idea that color would help triggering creativity through the emotion it generates on people can’t be applied to every participant. Even though some participants enjoyed having the color together with the image and the text, and stated that it helped their creativity to flow, they are still a minority. “*I think that in this case, color really helped, because the text was about summer and yellow resembles the summer. It did make me feel kind of happy.*” (P7); “*The color and the image encourage creativity. In fact, I felt some ease on Condition C. The image and color helped me idealize some ideas.*” (P1).

## 6 Discussion and Conclusions

The main goals of this work were to investigate if a creative writing support UI could enhance a user's mental well-being and creativity, and to check whether color could influence creativity in any way. Although the number of participants in the tests was limited, it was possible to develop some statistical results and take some conclusions



from them. Even so, as future work, the idea of performing more studies for more solid results should be considered.

As for the results obtained through the user study, we were able to conclude, through statistical evidence that participants performing the tasks with the CreativeWall Add-In (Conditions B and C) lost track of time more often than participants using the simple Microsoft Word UI without any add-ins (Condition A). Another aspect that was statistically relevant was the fact that users using the CreativeWall Add-In were able to produce more words. It must be taken into account that efficiency can't be measured by the number of words alone as this can be misleading. Even so, having significant difference in number of words between different conditions might indicate that their efficiency was affected. Also, taking into account the answers that results from the semi-structured survey performed after each of the sessions, it was clear that the tasks performed with the CreativeWall Add-In were more enjoyable and participants had no problems starting to write, which could mean that these conditions help in the initial phase of the creative writing process. This could also mean, that, by consequence of the previous statements, this approach can be effective when trying to overcome writer's block. The writer's block is a source of frustration and weakness for authors [10] and has been acknowledged as a "*creativity killer*" [37]. It comes up when writers become too judgmental and apprehensive about their writing, resulting in a potential loss of productivity and feelings of self-doubt, which aggravate this state. Huston states that [38] as writers' anxiety levels increase, it becomes more and more difficult to write. About the color, the majority of participants stated that color does not influence their creativity, and can be somewhat distractive. With this kind of statements we can assume that color does not always influence the creativity of users.

One limitation of our study is that it does not consider the long-term usage of CreativeWall platform and add-in. Therefore, conclusions are limited to an incipient (11 participants) usage of the different creative writing tasks using the addressing conditions. However, it is still very useful to have this data. It is a challenge to construct information technologies that support creativity [19] and also to empower users to harness and embrace their creativity through the use of creativity support tools [14].

In summary, in this pilot evaluation of our crowdsourced platform, our findings suggest that, from a mental well-being perspective, it was clear that participants felt more inspired, more focused, more creative and more immersed when using the CreativeWall Add-In. Designing computer systems for people is especially difficult for a number of reasons, but the final goal is always a user interface that provides an intelligent and pleasant tool [39]. The author also suggests that design must be considered as a whole, and not an isolated piece. From a "productivity" perspective, our results suggest that the users using the CreativeWall Add-In were the most efficient. Taking into account, the conclusions made in previous the color feature should be reviewed in order to try and take the most out of it. This includes reviewing the concept and reviewing the color itself. Trying to make color less intense would be one of the solutions for some of the problems presented in the user study, namely the distraction caused by it.

We have addressed these somewhat sensitive issues and tried to empower participants with different user interfaces to help them overcome writer's block and to express themselves in a different way. The current prototype is only a first implementation of

our ongoing work on the concept of creative writing user interfaces and new guidelines to creative support tools in writing. We would like to conduct a long term study, to obtain more results about creativity, and mental well-being of its users. Finally, we considered that it's important to increase the number of moods in order to include other creativity enhancing moods. We are also interested in the strong relationship between the user interfaces for supporting creative writing and the level of creativity of its users.

### ACKNOWLEDGMENTS

We like to thank Igor Sousa, who contributed to the enrichment of this study, mainly in the development of the platform. We also would like to thank the users who participated in this research.

### References

- [1] D. Morley, *The Cambridge Introduction to Creative Writing*, Cambridge: Cambridge University Press, 2007.
- [2] J. H. G. Kroll, *Research Methods in Creative Writing*, Palgrave Macmillan, 2013.
- [3] J. Kroll and G. Harper, *Research Methods in Creative Writing*, Palgrave Macmillan, 2013.
- [4] M. Weiss, "Overcoming Writer's Block, Pennsylvania, 2010.
- [5] P. Campos, F. Gonçalves, M. Martins, M. Campos and P. Freitas, "Second look: combining wearable computing and crowdsourcing to support creative writing," in *Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational*, 2014.
- [6] F. Gonçalves, D. Cabral, P. Campos and J. Schöning, "I Smell Creativity: Exploring The Effects Of Olfactory And Auditory Cues To Support Creative Writing Tasks," in *In Proceedings of INTERACT 2017*, Mumbai, India, 2017.
- [7] F. Gonçalves, A. Caraban, E. Karapanos and P. Campos, "What Shall I Write Next?: Subliminal and Supraliminal Priming as Triggers for Creative Writing," in *Proceedings of the European Conference on Cognitive Ergonomics 2017*, 2017.
- [8] F. Gonçalves, P. Campos, J. Hanna and S. Ashby, "You're the Voice: Evaluating User Interfaces for Encouraging Underserved Youths to express themselves through Creative Writing," in *C&C'15 Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition*, New York, USA, 2015.
- [9] F. Gonçalves and P. Campos, "Mild Place Illusion: A Virtual Reality Factor to Spark Creativity in Writing," in *In Proceedings of ACM European Conference on Cognitive Ergo-nomics, ECCE'18, September 5–7, 2018*, Utrecht, Netherlands, 2018.

- [10] M. Rose, "Writer's Block: The Cognitive Dimension. Studies in Writing & Rhetoric", Southern Illinois University Press: Carbondale, 1984.
- [11] W. Digest, *The Writer's Guide to Creativity*, F+W Media Inc., 2011.
- [12] F. Gonçalves and P. Campos, "Evaluating Creative Writing User Interfaces: I'm Try-ing To Think But Nothing Happens!," *Not published yet*, 2015.
- [13] J. J. Elam and M. Mead, "Can Software Influence Creativity?," *Information Systems Research*, pp. 1-22, 1990.
- [14] E. a. L. C. Carrol, "Triangulating the personal creative experience: self-report, external judgments and physiology.," *In Proceedings the Graphics Interface 2012 (GI'12). Canadian Information Processing Society, Toronto, Ont. Canada.*, pp. 53-60, Canada, 2012.
- [15] R. Hegde and G. Walia, "How to Enhance the Creativity of Software," in *Proceedings of the 26th IEEE International Conference on Software Engineering and Knowledge Engineering*, Vancouver, Canada, 2014.
- [16] B. Shneiderman, "Leonardo's laptop: Human Needs and the New Computing Technologies," *MIT Press, Cambridge*, 2002.
- [17] S. Joy and K. Breed, "Innovation Motivation, Divergent Thinking, and Creative Story Writing: Convergence and Divergence Across the Torrance Tests and TAT," *Imagination, Cognition and Personality*, vol. 32, no. 2, pp. 179-195, 2012.
- [18] T. Selker, "Fostering motivation and creativity for computer users," *International Journal of Human-Computer Studies*, vol. 63, no. 4-5, pp. 410-421, 2005.
- [19] B. Shneiderman, "Creating Creativity: User Interfaces for Supporting Innovation," in *ACM Transactions on Computer-Human Interaction, Vol. 7, N.º 1*, 2000, pp. 114-138.
- [20] F. Gonçalves and P. Campos, "Understanding and Evaluating the User Interface Design for Creative Writing," in *Proceedings of the European Conference on Cognitive Ergonomics 2017*, 2017.
- [21] H. Wang, S. Fussell and D. Cosley, "From diversity to creativity: Stimulating group brainstorming with cultural differences and conversationally-retrieved pictures.," in *InProc. CSCW. ACM*, 2011.
- [22] S. Andolina, K. Klouche, D. Cabral, T. Ruotsalo and G. Jacucci, "InspirationWall: Supporting Idea Generation Through Automatic Information Exploration.," in *In Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition (C&C'15)*, New York, USA, 2015.
- [23] E. Estellés-Arolas and González-Landrón-De-Guevara, ""Towards an integrated crowdsourcing definition"," *J.Inf. Sci.*, Vols. v. 38, n. 2, pp. 189-200, 2012.
- [24] J. Howe, *Crowdsourcing: Why the Power of the Crowd is Driving the Future of Business*, New Work, USA: Crown Publishing Group, 2008.

- [25] D. C. Brabham, "Crowdsourcing as a Model for Problem Solving: An Introduction and Cases", *Convergence: The International Journal of Research into New Media Technologies*, Vols. 14,1, pp. 75-90, 2008.
- [26] F. Kleemann, G. Vob and K. Reider, "Un(der)paid Innovators: The Commercial Utilization of Consumer Work through crowdsourcing", *Science, Technology & Innovation Studies*, Vols. vol.4, n.1, pp. 5-26, 2008.
- [27] M. Baas, C. De Dreu and B. Nijstad, "A Meta-Analysis of 25 Years of Mood-Creativity Research: Hedonic Tone, Activation, or Regulatory Focus?", *Psychological Bulletin*, Vols. vol. 134, n.6, pp. 779-806, 2008.
- [28] A. Rooij and S. Jones, "Mood and Creativity: An Appraisal Tendency Perspective", in *9th ACM Conference on Creativity & Cognition*, Sydney, Australia, 2013.
- [29] C. K. W. De Dreu, M. Baas and B. Nijstad, "Hedonic Tone and Activation Level in the Mood-Creativity Link: Toward a Dual Pathway to Creativity Model", *Journal of Personality and Social Psychology*, Vols. vol.94, n.5, pp. 739-756, 2008.
- [30] Z. Ivcevic, M. Brackett and J. Mayer, "Emotional Intelligence and Emotional Creativity", *Journal of Personality*, Vols. vol. 2, n. 75, pp. 200-236, 2007.
- [31] R. Friedman and J. Forster, "The Effects of Promotion and Prevention Cues on Creativity", *Journal of Personality and Social Psychology*, Vols. vol. 81, n.6, pp. 1001-1013, 2001.
- [32] N. E. H. Kaya, "Relationships between color and emotion: a study of college students", *College Student Journal*, Vols. vol. 38, n.3, pp. 396-405, 2004.
- [33] N. Kaya and H. Epps, "Color-emotion associations: Past experience and personal preference", in *Color and Paints, Interim Meeting of the International Color Association*, Porto Alegre, 2004.
- [34] J. Goethe, *Theory of Colours*, London: MIT Press, 1970.
- [35] P. Silvia, B. Wigert, R. Reiter-Palmon and J. Kaufman, "Assessing Creativity With Self-Report Scales : A Review and Empirical Evaluation", *Psychology Faculty Publications*, 2012.
- [36] M. Csikszentmihalyi, *Flow: The Psychologic of Optimal Experience*, New York: Harper Perennial, 1991.
- [37] D. G. Myers, *The Elephants Teach: Creative Writing since 1880.*, Chicago: University of Chicago Press, 2006.
- [38] P. Huston, "Resolving writer's block.", *Canadian Family Physician*, vol. 44, p. 92, 1998.
- [39] D. Norman and S. Draper, *User Centered Design, Nem Perspectives on Human-Computer Interaction*, L. Erlbaum Associates Inc. , 1986.