The influence of liking and disliking on creative expression in digital photos

ten Brink, M.; Nack, F.; Schouten, B.A.M.

DOI
10.1145/3001773.3001775

Publication date
2016

Document Version
Final published version

Published in
ACE 2016

License
Article 25fa Dutch Copyright Act (https://www.openaccess.nl/en/in-the-netherlands/you-share-we-take-care)

Citation for published version (APA):
The influence of liking and disliking on creative expression in digital photos

Marije ten Brink  
University of Applied Science  
Amsterdam, the Netherlands  
m.ten.brink@hva.nl

Frank Nack  
University of Amsterdam  
Amsterdam, the Netherlands  
nack@uva.nl

Ben A.M. Schouten  
University of Applied Science  
Amsterdam, the Netherlands  
b.a.m.schouten@hva.nl

ABSTRACT
Since the Like-button was introduced in 2009 by Facebook, its use increased rapidly. Liking became an important part of our daily routines on the internet since we are able to like almost any creative expression, such as photos and videos. Little is known about the effects of liking (and disliking) on these creative expressions. This paper investigates how the (dis)liking feature influences creativity. We conducted an experiment with a photo-application for mobile phones and provided different combinations of liking and disliking to two research groups and a control group. Our findings suggest that providing a liking feature is beneficial to creativity in terms of the production of creative content and results in higher amounts of photos. Providing a disliking feature as well is beneficial to creativity in terms of quality and results in higher rates for the photos.

ACM Classification Keywords
H5.2. Information interfaces and presentation: User Interfaces.: H1.2 Information Systems: User/Machine Systems: Software Psychology

Author Keywords
Liking; disliking; creativity; visual thinking; association; social; evaluation; reflection; Creativity Support Tools

INTRODUCTION
On the internet, millions of users upload creative expressions, such as videos and photos. Little is known about the effects of liking and disliking, as we know it from social networks such as Facebook, on those creative expressions. In this study we will elaborate on three circumstances that influence creativity: the assumed positive influence of feeling related [18] [7], the assumed negative influence of being evaluated [1] and the assumed positive influence of being supported to reflect [7] [15]. We will project these three influencers on the liking and disliking feature:

1. The social aspect of liking potentially offers users a sense of relatedness, the feeling of being part of a network of people. This is, according to the Self Determination Theory, beneficial to creativity [18]. We want to find out if users feel (more) related if a liking and disliking feature is provided and if this influences creativity positively.

2. The evaluative aspect of liking and disliking is expected to have a detrimental effect on creative expression [1]. Although a like is perhaps the least deep form of a customer review, it still is a signal allowing for evaluation of creative expressions of other users in the network [22]. It is our aim to explore if users perceive the (dis)like- button as evaluative and how this affects creativity.

3. Liking and disliking can be considered ‘reflection supportive’ if it makes users think harder about meaning and context of creative content, compared to a situation without a (dis)liking feature. We want to find out if the liking and disliking feature is used as a tool for reflection and if this is beneficial to creativity.

We conducted an experiment with the custom-made, social, mobile photo-app Snappthis and three groups of students at the University of Applied Science in Amsterdam (HvA). We presented different combinations of liking and disliking in the app to two groups and a control group, to investigate how the social, evaluative and reflection supportive aspects of liking and disliking relate to creative expression in digital photos.

INFLUENCING CREATIVITY
Creativity drives innovation and economic growth, transforms knowledge and provokes new experiences [24]. Mendelson [14] frames associative- and creative thinking as a process of reflection and contextualizing that extends visual literacy and understanding, ultimately helping us to make sense of the world around us. Being able to think creatively is therefore a desired skill in peoples working- and personal life and finding out how to influence creativity a promising topic of research. People who excel in creative ideas use divergent as well as convergent thinking. Where convergent thinking can be measured in IQ tests by answering problems that have one answer, divergent thinking leads to uncoordinated solutions [7] and involves reasoning about contexts that are novel and ambiguous [9], which can be hard to measure. Our approach in this study is to measure creativity in terms of quality: one expression can be perceived more creative than another one. We will also measure creativity in terms of quantity. Although
quantity of expressions does not necessarily demonstrate creativity we believe it is valid to use quantity as a measure in our research, because we do not deal with unrelated quantities of expressions. On the contrary: the tool we use in our research provides a context, a conceptual space (a structured style of thought) as described by Boden [5]. Boden states that anyone who comes up with an idea within a conceptual space is being creative in an exploratory style. The conceptual space in our research is framed by (1) the context of a textual theme and (2) the social context of a group to share photos with, making contributions purposeful. Also: Shah [20] proposes 4 metrics for measuring ideation effectiveness of which quantity is one. The rationale is that generating more ideas increases the chance of better ideas.

**Effect of feeling related on creativity**
Specific circumstances are conducive or not conducive to creativity. The Self-Determination Theory [18] states that in contexts characterized by a sense of relatedness, intrinsic motivation is more likely to flourish. It also states that intrinsic motivated people have a tendency toward creativity, suggesting that being part of a context characterized by a sense of relatedness is conducive to creativity. This is in line with the statement of Csikszentmihalyi [7] that creativity does not happen inside people’s heads, but in the interaction between a person’s thoughts and a sociocultural context.

**Effect of being evaluated on creativity**
Teresa M. Amabile [1] states that the expectation of being evaluated has a negative effect on creativity. In a study designed to test this effect, an experimental-group was told beforehand that their task in the test (to make a paper collage) would be evaluated while a control-group was told nothing about evaluation. The results supported the hypothesis that the expectation of being evaluated is detrimental to creativity. The experimental-group produced collages that were judged significantly lower on creativity than those produced by the control-group.

**Effect of reflection supportive complexity on creativity**
Reflection involves making sensible judgements, recognizing similarities across different categories, using induction and logical reasoning. Creative individuals improve (or at least stabilize) their ability for reflection [7], implicating that environments supporting or training the ability for reflection are conducive to creativity. Findings of Nack et al. [15] confirm this; their research shows that adding reflection supportive complexity, by offering a way to tag photos on denotative and connotative meaning, stimulates creativity.

**Liking as a social feature**
In 2009 Facebook introduced liking and the accompanying Like-button. It was put forward as a social activity and a shortcut to replace short affective comments like ‘Awesome’ and ‘Congrats!’ [10]. It plays an important role in Facebook’s strategy of ‘building a web where the default is social’ (Zuckerberg, Facebook F8 conference, San Francisco 2010) and aims on creating and visualizing expanding networks of people. As stated in paragraph 2.1 an increased sense of relatedness through the practice of liking should be beneficial to creativity. This is supported by research of Aragon [3] who states that distributed affect and carefully designed affective interfaces are at the heart of the collaborative creative process. We want to find out if liking is in fact an affective interface element and how the adding of a Dislike-button is of influence.

**Liking as a tool to evaluate**
Although the Like-button is put forward as a social feature, it also offers a (rather shallow) form of evaluation of creative expressions of other users in the network [22]. Liking and disliking could therefore potentially be detrimental to creativity, because of the expectation of being evaluated (see paragraph 2.2). A recent study on creative expression on Pinterest [12] shows the opposite. The research indicates that users do not perceive Pinterest as a social platform, but rather a ‘just for me’ workspace. At the same time, to have a Pin repined is perceived as a motivational textit like; it provides outside validation of one’s ideas. We want to find out when liking and disliking is perceived as evaluative and if this affects users’ creativity positively or negatively.

**Liking as a tool for reflection**
If a like is an expression of appreciation (although shallow), what does it exactly appreciate? No meaning is revealed explicitly, making its ability to stimulate reflection rather shallow as well. According to Gerlitz [10], the ‘Like economy’ is facilitating a web of positive sentiment in which users are constantly prompted to like, enjoy, recommend and buy as opposed to discuss or critique. And, according to a study on voting patterns at the news aggregating site Reddit, liking behavior is influenced by other users: people use previous liking decisions of others to guide their own liking decisions [16]. So what does this mean for reflective behavior? We are interested to find out how we can use liking to support reflection and if the adding of a Dislike-button is of influence.

**The Dislike-button**
A study on how Facebook’s Like-button influences the way people reflect upon quality of products states that likes are in fact a signal of quality [22]. However, allowing for likes and dislikes actually improves people’s quality expectations. This counter-intuitive finding is explained with theory on signaling [17]. Signaling builds on credibility; exposure to dislikes creates credibility, strengthening the positive effects of likes. It suggests that dislikes have two diametrical effects: (1) it exerts a direct negative effect on people’s quality expectations and (2) it amplifies the influence of likes by adding credibility. The founder of Facebook, Mark Zuckerberg, says he does not provide a Dislike-button because it might be used to shame others.
Snappthis is a photo-application for mobile phones, aiming at visual thinking and creativity. With Snappthis one can send out a concept (a word or a short sentence) to a group of people at a specific moment. This can be repeated over time with different concepts. Group members receive the concept on their smartphones and are prompted to make a photo of something that they associate with the concept, within the specified time frame. All photos of all group members are shown together on one page. Members can view, like and dislike each other’s photos. See figure 1.

The initiator of the group invites group members via the app. He/she adds concepts to a calendar. Snappthis will deliver a notification indicating the concept according to this planning. The photos added by the group do not mix with the photos of another group. Users are forced to create a new photo on the spot; they cannot upload an existing photo from their photo roll.

Users can see the identity (nickname) of the users in their group. They can see the amount of (dis)likes a photo has received, including their own, but they cannot see who used the (dis)liking feature and in what way. Users create their own nickname; therefore they can choose to be unrecognizable in the app. Because we wanted to find out more about the reflection process when (dis)liking a photo, we enabled users to express differentiated qualities of the photos: on aesthetic qualities (pretty and ugly) and on conceptual qualities (smart and lame). See figure 2. We focused on reflection by users who give the likes and dislikes, and to a lesser extent on reflection by receivers of likes and dislikes.

We were interested in finding out if students make use of conceptual labels more than aesthetic labels. If so this would indicate that students recognize and reflect upon the connotative meaning of the topic in the photo based on relationships with broader concepts and constructed by means of associative thinking as stated by Mendelson [14], more than on the photo as an unrelated artifact. In hindsight, we think that the terms can be problematic, mainly due to difficulties with the language - English labels presented to a Dutch population. It might have been more straightforward to use stupid opposite to smart, but we felt at the time of the study design that stupid was a too negative and stigmatizing label.

1. When tapping the like-button (Thumbs up) two interpretations of liking are presented to the user: (A) smart to express appreciation for the conceptual quality and (B) pretty to express appreciation for the aesthetic quality of the photo.

2. When tapping the dislike-button (Thumbs down) two interpretations of disliking are presented to the user: (A) lame to express disapproval for the conceptual quality and (B) ugly to express disapproval for the aesthetic quality of the photo.

3. A user can select one option (smart) or two options (smart and pretty or smart and ugly), as long as these two are not both conceptual or both aesthetic (selecting both smart and lame is not possible). Users cannot (dis)like their own photos.

4. The page showing all photos of a word can be sorted in ranking order, with the highest valued photo in the upper left corner.
We designed and conducted an experiment to find out if the app Snappthis is explicitly designed to support creative- and visual thinking by means of photos. Features, such as the notifications and the time limitation, make Snappthis an active tool, where Flickr remains a more passive photo-platform. According to the Gamification theory [8] these features motivate users and invite them to make meaningful choices (choosing what to capture in a photo) in the pursuance of interestingly hard goals (find it in your surrounding, within a specific time frame). The second reason to use the custom-made app Snappthis is its link to Creativity Support Tools. Digital and interactive Creativity Support Tools is a relatively new research topic. Ben Shneiderman et al. [21] reported on Creativity Support Tools, with the intention to develop improved software and user interfaces that empower users to be not only more productive but also more innovative. Findings in our study can contribute to this research.

**DESIGN OF THE EXPERIMENT**

We decided to use Snappthis for this research and not an existing photo sharing platform, such as Flickr (www.flickr.com), for two reasons. First because Flickr is a generic photo sharing and storing tool, while Snappthis is explicitly designed to support creative- and visual thinking by means of photos. Features, such as the notifications and the time limitation, make Snappthis an active tool, where Flickr remains a more passive photo-platform. According to the Gamification theory [8] these features motivate users and invite them to make meaningful choices (choosing what to capture in a photo) in the pursuance of interestingly hard goals (find it in your surrounding, within a specific time frame). The second reason to use the custom-made app Snappthis is its link to Creativity Support Tools. Digital and interactive Creativity Support Tools is a relatively new research topic. Ben Shneiderman et al. [21] reported on Creativity Support Tools, with the intention to develop improved software and user interfaces that empower users to be not only more productive but also more innovative. Findings in our study can contribute to this research.

A research population of 3rd year students at Communication & Multimedia Design (CMD) at the University of Applied Science (HvA) used Snappthis in the Design for Interaction mandatory course in December 2014 and January 2015. The group consisted of 79 students, of which 61 participated in the experiment (see figure 4), divided in two groups and a control group (A, B and C) following the same course from November 2014 until January 2015. The groups were predominantly male. The lecturer was the sender of the words and the students were the receivers of the words and the creators of the photos. Students were told that their participation in the app was desired but voluntary and that the lecturer would grade neither quantity nor quality of the photos. Research circumstances were the same for all students:

- The students used Snappthis for a period of 10 days in December 2014 and 3 days in January 2015.
- To avoid immediate exchange of ideas between groups, the 3 groups received the words on the same moment of the day but on different days.
- The specified time frame for the creation of a photo is the same for all students: 2 hours.

The specified time frame for the creation of a photo is the same for all students: 2 hours. Findings from Bennet et al [4] indicate that a high degree of alignment between the educational topics and the tasks performed in the tool motivates students to engage in the tool. We arranged this by composing a set of words directly related to the curriculum of the course: 1. persuasive, 2. playful, 3. feedback, 4. self-expression, 5. motivation, 6. reputation, 7. reward, 8. order, 9. flow, 10. sequence, 11. filter. Two words (‘happy 2015!’ and ‘intention’) were sent out purely for motivational reasons. They are not included in the results because they were not intended to stimulate creativity and therefore outside the scope of this study.

We investigated the quantitative effects of liking and disliking on creative expression by measuring the amount of photos per group and per topic. These measurements are drawn from the database with logged data of the use of Snappthis.

We investigated the qualitative effects of (dis)liking on creative expression by measuring the amount of likes (group A and B) and dislikes (group A) on photos as a value of creative quality perceived by the students themselves and compared this with the opinion of seven experts (2 male, 5 female). These experts, all creative professionals in the field of design, were asked to assess the creative quality of the photos (afterwards, all photos at once) by using the same coding schema (smart / pretty / lame / ugly) as the students, in order to compare scores per group and topic.

At the end of the research period we distributed a multi-item questionnaire among the students, to measure the theoretical concepts of relatedness, being evaluated and supporting reflection. Responses of students remained anonymous. To minimize the effect of satisficing [11] we supplied an All-or-none endorsement scale [13] by means of ‘I agree’ and ‘I don’t agree’ without the use of a midpoint (‘I don’t know’ or ‘neutral’). We felt it was appropriate to avoid the ‘undecisive’ midpoint, because the items we supplied investigate students experience related to the use of the app (anonymously) rather
than questioning deeper personal values or opinions. The questionnaire was filled in by the students in class during course hours via their laptops.

RESULTS AND INTERPRETATION
This section addresses the differences in creative expression between the three groups using different versions of Snappthis.

Amount of photos per group
When investigating creative expression in terms of amount of photos made per group, Group B scores highest. The total amount as well as the average photo per user is highest for Group B, followed by Group A. Group C has the lowest amount (see figure 4). Figure 5 shows the amount of photos uploaded per group per topic. When investigating the results of the questionnaire (n=61, all students), we see significant differences between Group A (n=19), Group B (n=20) and C (n=22). In the following paragraphs we present the results. Note that one student of Group B indicated wrongly being part of Group C, hence the deflected distribution of students compared to the actual participating research population.

Relatedness
(See figure 6 Relatedness) Investigating the answers on the statements on relatedness we find that the average of all students values using the app as part of a group (89%, n=61). The majority checks photos of other group members with interest (64%). They don’t mind their photos being recognized as theirs (93%) and the majority didn’t choose a nickname that hides their identity (74%). On the contrary: the majority feels rather positive about the fact that others can see which photos are created by them (77%). The groups don’t differ significantly on these statements.

Significant differences emerge when asking students about their interest in the identity of the creators of the photos and about the frequency of checking on other group members’ photos. When responding to the statement ‘I hardly watched the photos of others’ only 26% of Group A and 25% of Group B agree, compared to a small majority of Group C (55%). Also significant are the differences in the answers to the statement ‘I find it interesting to check out who created the photo’. The vast majority of group A (84%) and Group B (90%) agree, compared to only 55% of Group C. This is in line with the differences in answering the statement ‘I don’t care who made the photo; it is the image that counts’: a majority of Group C (64%) agrees with this statement, contrasting with a minority of Group A (47%) and B (30%). These findings suggest that the (dis)liking feature (liking more than liking and disliking) has a positive effect on the feeling of relatedness between the group members, demonstrated by a higher frequency of checking other photos as well as more interest in the identity of the creator of these photos. It also suggests that this increased interest in each other has its downside: the photo itself becomes less important.

When we investigate the importance for students of knowing the other group members personally (like in this research setting) we find that almost half of all students (49%) agree with the statement ‘It is motivating to use the app because I know the group members’. The differences between Group A (42%), Group B (65%) and Group C (41%) are not significant. Significant differences show in the answers to the statement ‘It doesn’t matter to me if I know the other group members or not’, between Group B (only 40% agrees) and C (a vast majority of 82% agrees). This suggests a lower feeling of relatedness when no (dis)liking feature is provided, especially compared to a situation with only a liking feature (more than compared to a situation with liking and disliking).

Being evaluated
(See figure 6 Being evaluated) A liking and/or disliking feature is an appreciated feature for all groups. The vast majority (Group A: 89%, n=19, Group B: 90%, n=20) of the students do not agree with the statement ‘I’d rather not have a (dis)liking feature’. Asking the control group C if they would have preferred a liking feature, a majority responses affirmative (73%, n=22). A majority of Group A (average 71%) and Group B (average 78%) are positive about others being able to see if their photos are appreciated or not appreciated.

A majority of Group A (average 68%) and Group B (average 65%) feel that the liking and disliking feature adds a pleasant competitiveness to the experience of using the app, which indicates that they perceive the liking and disliking feature as evaluative. The significant different answers of the three groups to the statement ‘I am curious to find out what other group members think of my photos’ (Group B agrees convincingly with 80%, followed by 58% of Group A and 50% of Group C) indicate that interest in the evaluation of others is manifest when a liking feature is provided, more than without a liking feature and (to a lesser extent) more than when a liking and disliking feature is provided.

When investigating the results on statements about receiving likes and dislikes, we see that the majority of Group A (68%) and B (60%) feel that receiving likes is an acknowledgement of the quality of the photo. This is in line with the finding that a large majority of Group A (84%) and Group B (80%) do not agree with the statement ‘Receiving a like is meaningless, I
### Relatedness

<table>
<thead>
<tr>
<th></th>
<th>% Agree per group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>I value using the app as part of a group</td>
<td>84</td>
<td>90</td>
</tr>
<tr>
<td>I check photos of other group members with interest</td>
<td>68</td>
<td>65</td>
</tr>
<tr>
<td>I don’t mind other group members recognizing my photos</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>I chose a nickname that hides my identity</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>I like it that others can see which photos are created by me</td>
<td>68</td>
<td>85</td>
</tr>
<tr>
<td>I hardly watched the photos of others</td>
<td>26</td>
<td>25</td>
</tr>
<tr>
<td>I find it interesting to check out who created the photo</td>
<td>84</td>
<td>90</td>
</tr>
<tr>
<td>I don’t care who made the photo, it is the image that counts</td>
<td>47</td>
<td>30</td>
</tr>
<tr>
<td>It is motivating to use the app because I know the group members</td>
<td>42</td>
<td>65</td>
</tr>
<tr>
<td>It doesn’t matter to me if I know the other group members or not</td>
<td>58</td>
<td>40</td>
</tr>
</tbody>
</table>

### Being evaluated

<table>
<thead>
<tr>
<th></th>
<th>% Agree per group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>I’d rather not have a (dis)liking feature</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>I would have preferred it if others were able to like my photos</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>I like it that others can see how my photos are appreciated</td>
<td>68</td>
<td>75</td>
</tr>
<tr>
<td>I don’t like it that others can see that my photos are not appreciated</td>
<td>26</td>
<td>20</td>
</tr>
<tr>
<td>The (dis)liking feature adds a pleasant competitiveness to the app</td>
<td>63</td>
<td>55</td>
</tr>
<tr>
<td>(Dis)liking is an unpleasant competitive feature</td>
<td>26</td>
<td>25</td>
</tr>
<tr>
<td>I am curious to find out what other group members think of my photos</td>
<td>58</td>
<td>80</td>
</tr>
<tr>
<td>Receiving likes is an acknowledgement of the quality of the photo</td>
<td>68</td>
<td>60</td>
</tr>
<tr>
<td>Receiving a like is meaningless, I don’t care much about it</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>I am proud of the likes I received</td>
<td>83</td>
<td>50</td>
</tr>
<tr>
<td>The likes I received are generally well deserved</td>
<td>75</td>
<td>56</td>
</tr>
<tr>
<td>I feel extra motivated to upload photos after the reception of a like</td>
<td>58</td>
<td>56</td>
</tr>
<tr>
<td>Receiving dislikes is an indication of failure</td>
<td>26</td>
<td>n.a.</td>
</tr>
<tr>
<td>Receiving dislikes is only a lark and does not mean anything</td>
<td>53</td>
<td>n.a.</td>
</tr>
<tr>
<td>I don’t like receiving dislikes</td>
<td>43</td>
<td>n.a.</td>
</tr>
<tr>
<td>The dislikes I received are generally well deserved</td>
<td>14</td>
<td>n.a.</td>
</tr>
<tr>
<td>I don’t feel like making photos anymore after receiving dislikes</td>
<td>43</td>
<td>n.a.</td>
</tr>
<tr>
<td>I feel challenged when receiving a dislike</td>
<td>43</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

### Supporting reflection

<table>
<thead>
<tr>
<th></th>
<th>% Agree per group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>The (dis)liking feature is a suitable way to distinguish qualitative photos</td>
<td>53</td>
<td>60</td>
</tr>
<tr>
<td>I understand the differentiated options of liking and disliking</td>
<td>63</td>
<td>65</td>
</tr>
<tr>
<td>I don’t find it hard to choose between the differentiated options</td>
<td>68</td>
<td>65</td>
</tr>
<tr>
<td>The usage of (dis)liking helps me to reflect upon the words and photos</td>
<td>16</td>
<td>35</td>
</tr>
<tr>
<td>The differentiated options of the (dis)liking feature are useful</td>
<td>47</td>
<td>40</td>
</tr>
<tr>
<td>I pay closer attention to a photo when this photo received likes</td>
<td>42</td>
<td>65</td>
</tr>
<tr>
<td>If a photo already received likes, I often give one as well</td>
<td>27</td>
<td>12</td>
</tr>
<tr>
<td>If I see a photo already received dislikes, I am inclined to do the same</td>
<td>17</td>
<td>n.a.</td>
</tr>
<tr>
<td>I do not always understand why I received a like for a photo</td>
<td>58</td>
<td>50</td>
</tr>
<tr>
<td>I do not always understand why I received a dislike for a photo</td>
<td>71</td>
<td>n.a.</td>
</tr>
<tr>
<td>If a photo receives a dislike I would like to understand why</td>
<td>89</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

$m = \text{male} \quad f = \text{female} \quad \bullet \ p \text{-value} \leq 0.05 \quad \bullet \ 0.2 \geq p \text{-value} > 0.05$

Figure 6. Questionnaire statements, comparison of p-values Group A/B/C
don’t care much about it’. Looking at the students in Group A and B who actually received likes for their photos, we see that the majority of Group A (83%, n=12) is proud of the received likes compared to only half of Group B (50%, n=16). Group A might be more proud than Group B of received likes, because they know they could also have received dislikes. 75% of Group A (n=12) and 56% of Group B (n=16) feel that likes they received are well deserved. An average of 58% of Group A and 56% of Group B feel extra motivated to upload photos after the reception of a like. However, when asking Group A about the reception of dislikes in general, the majority (74%, n=19) does not agree with the statement ‘Receiving dislikes is an indication of failure’ and 53% agrees with ‘Receiving dislikes is only a lark and does not mean anything’. We can conclude that students do not have a consistent perception of the (dis)liking feature as evaluative; where receiving likes is perceived as an acknowledgement of quality and has some motivating effects, receiving dislikes is not acknowledged as an indication of failure.

Looking at the students in Group A who actually received dislikes for their photos (n=7) we find that 57% doesn’t agree with the statement ‘I find it unpleasant to receive dislikes’. A majority of 86% does not feel that the dislikes they received were well deserved. 57% does not agree with the statements ‘I don’t feel like making photos anymore after receiving dislikes’ and ‘I feel challenged when receiving a dislike’. These results suggest that the disliking feature has an effect on (some) students, despite of the general perception of the disliking feature as not being evaluative. In paragraph 6.5 and 7.1 we will elaborate further on the (dis)liking feature in relation to quality.

Supporting reflection
(See figure 6 Supporting reflection) Does giving likes and dislikes supports reflection, which could be beneficial to creativity? When investigating the results of the questionnaire we do not get a convincing outcome. There are no significant differences between Group A and B. A small majority of Group A (53%, n=19) and Group B (60%, n=20) think of the (dis)liking feature as a suitable way to distinguish qualitative photos from less qualitative ones. A modest majority understands the different options of (dis)liking (63% of Group A and 65% of Group B) and doesn’t find it hard to choose between them (68% of Group A and 65% of Group B). Statements about possible positive effects of the liking and disliking feature on reflective behavior are answered negatively: 84% of Group A and 65% of Group B do not agree with ‘The usage of (dis)liking helps me to reflect upon the meaning of the words and photos’. 53% of Group A and 60% of Group B do not agree with ‘The differentiated options of the (dis)liking feature are useful’. A minority of Group A (42%) and a small majority of Group B (65%) pay closer attention to a photo when this photo received likes.

Does the (dis)liking feature stimulate critical thinking or are students inclined to follow earlier (dis)likes? Students are outspoken in their answers to the corresponding statements ‘If a photo already received likes, I often give one as well’ and ‘If I see a photo already received dislikes, I am inclined to do the same’. 73% of Group A (n=15) and 88% of Group B (n=17) do not agree with the former and 83% (Group A, n=6) does not agree with the latter statement. This suggests that the liking and disliking feature does not provoke students to just follow an already established liking pattern. Further research is required to find out if this self assessment is supported by the assessment of experts and if so: if this is stimulating critical thinking, a condition beneficial to creativity.

From the perspective of users receiving likes and dislikes: students indicate that they understand the differentiated options in the liking and disliking feature, but they do not always understand the likes and dislikes they receive for their own photos. 58% of Group A (n=12) and 50% of Group B (n=16) do not understand why they received a like for a photo and 71% of Group A (n=7) do not understand why they received a dislike. Since 89% of this group indicate that they would like to understand why a photo receives a dislike, we conclude that in order to work for the receivers of (dis)likes the reflection supportive complexity offered by means of the differentiated (dis)liking feature requires more sophisticated options for expression of quality. Reflection might also be improved by investing in a shared understanding of the use of the (dis)liking feature over time.

Quality of photos
Until now we have concluded that Group B is the most creative in terms of quantity; members of Group B uploaded the highest amount of photos. When it comes to the effects of the influencers on creativity as laid out in the previous paragraphs we conclude that members of Group B feel most related (followed by Group A and Group C). Group A more than Group
B is proud of likes they receive for their photos, suggesting that they perceive the liking feature as evaluative (but they do not perceive the disliking feature as evaluative). From these findings we expect Group B to be the most creative also in terms of quality, because of (1) high relatedness and (2) lower expectation of being evaluated. The opinion of the experts can either confirm this prognosis or reveal effects that are unrecognized by the students.

In this paragraph we will look at the quality of the photos, perceived by the students themselves and by seven experts. The experts evaluated the photos of the three groups by using the same coding schema as the students: smart, pretty, lame, and ugly. All 311 photos received a scoring by all 7 experts, except 1 photo (6 experts) and 1 photo (5 experts). The liking and disliking activity of the students shows that 37% of all photos of Group A received likes and dislikes and 42% of all photos of Group B received likes. The photos of Group A received an average of 0.85 likes and dislikes and the photos of Group B received an average of 0.78 likes per photo. We present the total, relative scores of the three groups in graphs, in chronological order (see figure 7).

All three graphs show a higher relative score of smart compared to pretty and a higher score of lame compared to ugly, indicating that associative, connotative meaning in photos is recognized and valued above aesthetic qualities. We also see that Group A, more than Group B and C, shows higher or equal relative smart scores compared to pretty, lame and ugly (10 out of 11 times). When we add all positive scores (smart + pretty) and compare them to the negative scores (lame + ugly) per topic per group we see that according to the experts Group A scores better than Group B and C: 7 out of 11 topics score predominantly positive (smart + pretty is > 50%). Group B has the lowest score (see figure 8).

We compare the expert evaluation with the evaluation of the students in two graphs showing the absolute measures of likes (smart + pretty) and dislikes (lame + ugly). The graph of Group A (figure 9) shows that students use smart and pretty more than lame and ugly to evaluate the photos of group members. It also shows that liking activities become less over time, and disliking is absent 7 out of 11 topics and dies out completely after the 7th day. When we inspect the scoring of Group A by the experts we see that it becomes more consistent over time, with less high peaks and low dips in later topics. Disliking decreases, resulting in an overall better score over time. According to the experts the quality of the photos of Group A increases.

The graph of Group B (figure 10) shows modest but consistent liking activities by the students. Until the last 2 topics, disliking by experts dominates liking, therefore no clear indication of an improving overall score is visible. The scoring by the experts does not become more consistent over time. The bouncing patterns in Group A of the liking scores by the students (figure 9) and the amount of photos uploaded per topic (figure 5) gave us reason to investigate if there is a relation between the two. In figure 11 we show the results. After receiving an overall high score of likes ([smart+pretty] - [lame+ugly]) the amount of photos uploaded drops the next
Figure 11. Group A: pattern of high overall liking score followed by dropping amount of photos

Figure 12. Group B: the bouncing pattern as seen in Group A (figure 11) is absent

Figure 13. Absolute total liking score \([\text{smart} + \text{pretty}] - [\text{lame} + \text{ugly}]\) of students who received dislikes.

Students are not consistent in their perception of the liking and disliking feature as evaluative. Also here the notion arises that the liking and disliking feature is perceived as a social more than as an evaluative feature.

Then, when we investigate the quantitative measurements, we see that Group B has the highest score of creative expression in terms of total amount of photos uploaded. However, the qualitative evaluation by the experts shows a more consistent and overall better score of Group A. These findings suggest that liking has a positive effect on creative expression in terms of the production of creative content (the amount of photos), but liking and disliking has a positive effect on creative expression in terms of quality of the photos. This is in line with our findings that some students (3 out of 5), after receiving dislikes, upload a photo that receives only likes or no (dis)likes at all. We do also notice that the other 2 students do not upload a photo at all the next time(s), but still manage to not receive dislikes later on (figure 13). These findings suggest that although students do not perceive the (dis)liking feature as evaluative (see paragraph 6.3) they are nevertheless affected by receiving dislikes for their own photo; by trying harder or give it a pass the next time. More research with larger groups is needed to verify these results.

Ultimately, our findings contribute to research on Creativity Support Tools and the way they empower users to be not only more productive but also more innovative [21]. Creativity Support Tools are often promoted merely on testimonials, with little scientific study. In this present study the assumptive negative effects of being evaluated versus the positive effects of being related by means of (dis)liking are elaborated.

**DISCUSSION**

Our results show that the design and implementation of liking and disliking affects creative expression in digital photos and we are able to explain psychological processes that drive these effects.

**Theoretical implications**

This study suggests that former research findings on the assumptive negative effects of ‘being evaluated’ on creative expression should be revised in light of evaluative, interactive features in digital information systems.

First of all, the results of the questionnaire suggest that the liking and disliking feature is experienced as a social feature more than as an evaluative feature. Statements on the topic of relatedness show significant differences between the groups with the liking and/or disliking feature (high relatedness) and the control group (low relatedness). This is caused predominantly by group B, with only liking. The effects of feeling evaluated by the liking and disliking feature are less significant.

**Practical implications**

The results of this study may be of use to researchers and designers in the field of HCI, helping them to optimize the use of liking and disliking to stimulate (creative) activity amongst potential users of their products. This study suggests that giving the opportunity to like creative content of other group members stimulates the production of creative content in terms of quantity. If the goal is to stimulate higher quality of creative content and to prefer quality over quantity, then the addition of a dislike feature could be considered.
Limitations
Differences in group dynamics can be of influence on the study results; some groups show more interest and involvement with study materials and subjects, indicating a higher level of motivation to perform well and therefore try harder to make better photos. Other groups show a natural relatedness to each other that could be beneficial to creative expression. It is hard to determine if this was the case in our study. The uneven distribution of gender is another factor of influence on the results. As mentioned, our research population was predominantly male (see figure 4).

To improve external validity we could replicate the study in different contexts, for example with a different student group following the same course in an other field of interest (e.g. economics or psychology) or with participants who are more experienced in associative and visual thinking, e.g. designers, photographers and other creative professionals. It could be that the latter are less influenced by dislikes, resulting in smaller differences between group A and B in the amount as well as the creative quality of photos. We expect the differences between group C and A/B, in terms of quantity, to persist.

The scoring is of importance for the results. Students and experts used the same coding, but the students used it over a time period of weeks and had time to become familiar with it. The experts scored the photos all at once, therefore having less time to internalize the coding. We could eliminate this difference by having the expert scoring the photos in the same time period as the students.

Future research
Interesting aspects for further research came up in the course of this study. We could zoom in on the liking and disliking feature and focus on the individual (dis)liking patterns that occur. Who (dis)likes whom? Is there a specific percentage of participants needed with active liking behavior to enhance creativity of the group as a whole? Are students affected by the reception of (dis)likes for their own photos and what is typical behavior resulting from that (see paragraph 7.1)? Why do amounts of photo upload drop after high overall liking scores (see paragraph 6.5)? Are students inclined to use the liking and disliking feature in favor of their friends in the group? Some insights on the phenomenon of nepotism were revealed in this study (part of the questionnaire, not included in figure 6): both Group A (73%) and B (82%) indicate that they don’t give likes to friends because they are friends. Both groups (both 100%) indicate they do not refrain friends from dislikes because they are friends. What would happen if we indicate not only the amount of (dis)likes for photos per topic. Users are forced to be more selective and reserve their (dis)likes for photos that deserve special recognition. It would be interesting to find out if this more qualitative use of (dis)liking is beneficial to reflection and understanding and therefore to creativity.

Researching cultural differences in coping with the reception of dislikes or in strategies for giving (dis)likes to avoid hurting other people’s feelings can be an interesting way to proceed this research, as are the differences in giving socially acceptable answers in a survey run by a lecturer or other authority.

Other interesting aspects for further research come up when we zoom out from the liking and disliking feature and try to understand in broader terms how creative expression by means of shared digital photos can be supported and improved. It would be interesting to find out why students indicate being influenced BY others but do not see themselves as influencers OF others. Our findings show that 59% of all students agree with the statement ‘Photos uploaded by other group members I use as inspiration for my own photo’ (Group A: 58%, Group B: 60% and Group C: 59%), where only 32% of Group A, 15% of Group B and 23% of Group C agree to the statement ‘I notice that my photos inspire other group members’. In addition, according to Webb and Kerne [24], a photo mosaic can help the user to reflect on the combination and synthesis of ideas, and Linder [12] states that assembling digital objects creates new contexts. Researching this process of reflection-in-action in relation to the photo collections in Snappthis is an interesting way to proceed. The qualitative and generative research method concept-mapping [23] can be used for this purpose, focusing on the experience of the student with the content of snappthis and the association process.

CONCLUSION
Does liking and disliking influence creative expression? We presented an experiment with three combinations of liking and disliking in the mobile photo-app Snappthis used by a test group of 61 students in higher education. The students used the app for a period of 11 days. All photos they uploaded were logged and stored in a database. We conducted a questionnaire and consulted 7 creative professionals to rate the creative quality of the photos uploaded by the students.

We found that liking has a positive effect on creative expression in terms of quantity; the student group with the liking feature enabled and the disliking feature disabled uploaded significantly more photos. This research also suggests that liking combined with disliking has a positive effect on creative expression in terms of quality: according to the experts the student group exposed to liking and disliking produced photos of significantly higher quality.

REFERENCES