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Gamification and social comparison processes in electronic brainstorming

ABSTRACT

Gamification can be seen as the intentional use of game design elements in non-game tasks, in order to produce psychological outcomes likely to influence behaviour and/or performance. In this respect, we hypothesize that gamification would produce measurable effects on user performance, that this positive impact would be mediated by specific motivational and attentional processes such as flow and that gamification would moderate the social comparison process. In three experimental studies, we examine the effects of gamified electronic brainstorming interfaces on fluency, uniqueness and flow. The first study mainly focuses on time pressure, the second on performance standard and the third one introduces social comparison. The results highlight some effects of the gamified conditions on brainstorming

KEYWORDS

electronic brainstorming
flow
fluency
gamification
social comparison
time pressure
uniqueness

performance, but no or negative effects on flow. All three studies are congruent in that gamification did not occur as a psychological process, which questions popular design trends observed in a number of sectors.

Gamification, although a trending topic, is still in search of its conceptual underpinnings. Some scholars and practitioners consider it as a design framework consisting in introducing game design elements in non-game contexts (Deterding et al. 2011). Such a definition focuses on elemental graphical/situational building blocks of gamification, disregarding user experience resulting from their introduction (Sailer et al. 2017). Other researchers view gamification as a process, thereby focusing on the resulting experience of gamefulness (Werbach 2014) or value created for users (Huotari and Hamari 2012). In this respect, introducing game design elements is not considered sufficient: gamification would occur only in the event of psychological and behavioural effects emerging in users' experience. Defining gamification as a process leads to highlighting its goals and potential benefits, such as improving user experience, increasing engagement (Dominguez et al. 2013) and more generally impacting cognitive, emotional and social processes (Lee and Hammer 2011). Seaborn and Fels integrate both the design and experiential views and define gamification as 'the intentional use of game elements for a gameful experience of non-game tasks and contexts' (2015: 17). In the present article, we view gamification as a whole process introducing game design elements as input, in order to induce psychological processes (e.g. cognitive and social processes), resulting in experiential (e.g. fun and absorption) and behavioural (i.e. engagement and performance) outcomes.

The pioneering sectors that developed gamified designs of activities and tools were education and healthcare, and it is of growing interest in many other application fields (Hamari 2013; Hanus and Fox 2015; Richter et al. 2015; Koivisto and Hamari 2019), including corporate applications in order to increase productivity, organizational change, innovation (Raftopoulos 2014) or employees' engagement (Prasad and Mangipudi 2021). However, the benefits of these design efforts to user experience and performance were seldom evaluated, and several authors underline the lack of laboratory studies and empirical evidence addressing the cognitive and behavioural effects of gamification as a process (Hamari et al. 2014; Dicheva et al. 2015; Seaborn and Fels 2015). The vast majority of empirical studies on applied gamification do not refer to any theoretical framework – according to Seaborn and Fels' meta-analysis in 2015, this was the case for 87% of applied gamification research at that time. This 'gap between theory and practice – where theory is empirically unexamined and applied work lacks reference to theory' (Seaborn and Fels 2015: 27) is a major shortcoming of gamification research. Furthermore, experimental studies suffer many methodological flaws such as a lack of control condition, valid measurements or reliable statistical treatments (see meta-analyses from Hamari et al. 2014; Seaborn and Fels 2015; Dicheva et al. 2015; Koivisto and Hamari 2019). Therefore, many reported effects of gamification (either positive or negative) remain questionable. All in all, in their recent literature review, Koivisto and Hamari (2019) report that 28.7% of controlled experimental quantitative studies on the effects of gamification reveal positive findings, the other 71.3% bringing mixed results, i.e. negative or inconclusive.

The literature providing a conceptual elaboration of the notion of gamification predominantly relies on the theoretical framework of self-determination theory (Deci and Ryan 2000), which focuses on motivational processes based on three overarching needs, namely autonomy, competence and relatedness. Game mechanics, which introduce extrinsic motivators in the activity, are assumed to become internalized as intrinsic motivators (Zichermann and Linder 2010) and therefore increase users' intrinsic motivation for the target activity (Koivisto and Hamari 2019). Games mechanics are also called 'motivational affordances' (Hamari et al. 2014) and can be related to the three motivational dimensions of self-determination theory (e.g. Aparicio et al. 2012).

The flow theory (Csikszentmihalyi 2008) is often referred to in game design research (Cowley et al. 2008) as well as in gamification research (Eickhoff et al. 2012; Hamari and Koivisto 2014; Koivisto and Hamari 2019). Flow corresponds to a state of optimal experience and maximal concentration, when people act at the peak of their capacity. It may lead to high levels of performance, creativity and pleasure. Encompassing specificities of various domains, a large variety of enjoyable human activities share the same flow characteristics (Csikszentmihalyi 1994). Flow is mostly experienced during challenging activities where individual skills and concentration are important, such as in music, sports and games (Anonymized for review). In our view, flow may offer a wider understanding of the processes at play in gamification process, as it includes, but is not limited to, intrinsic motivation. Flow was modelled as relying both on motivational and attentional processes (Abuhamdeh and Csikszentmihalyi 2012; Dietrich 2004; Simlesa et al. 2018). Furthermore, the resulting flow experience also inherently includes positive affective states as well as task achievement. Flow theory, therefore, conceptualizes an optimal experience gathering attentional, motivational, affective and productive considerations that all seem relevant to analyse the effects of gamification. Therefore, in the present research, we consider a mediation model of gamification relying mostly on the flow process as a cognitive means (i.e. mediator) of generating beneficial experiential and behavioural outcomes resulting from the introduction of game mechanics.

The most popular game mechanics used in gamification studies are points, badges and leader boards (Hamari et al. 2014; Seaborn and Fels 2015), sometimes referred to as PBL triad (Sailer et al. 2017) or the blueprint triad of gamification (Koivisto and Hamari 2019). They typically provide a real-time feedback and performance standard to users (Jung et al. 2010), meant to be perceived as rewards and incentives (Richter et al. 2015; Kyewski and Krämer 2018), individually or aggregated as team scores (Le Hénaff et al. 2015). In line with a gamification-as-a-process view, these design elements are intended to trigger sociocognitive processes, producing psychological as well as behavioural outcomes (Hamari et al. 2014; Koivisto and Hamari 2019). From a theoretical viewpoint, points and badges are directly related to the competence dimension of self-determination theory. They also implement two major preconditions of flow, namely the skill/challenge balance and the immediate feedback requirement (Simlesa et al. 2018). Leader boards, which enable players or users to compare their performance with their peers, clearly introduce a social dimension that is not self-evident in either flow theory or self-determination theory. Flow was conceptualized as an individual process in which absorption in the task eventually prevents the subject from paying attention to the (social) environment. Self-determination theory, which includes a social dimension through the need for relatedness, refers to processes such as social facilitation, attachment and benevolent relationships (Deci and Ryan 2000). In gamification studies, the need for social relatedness has been addressed through the introduction of teammates, meaningful stories (Sailer et al. 2017), social networking services and team-based activities (Koivisto and Hamari 2019). However, understanding the potential effects of introducing leader boards, which promote a sense of competition, may require a specific theoretical framework, beyond self-determination theory. In particular, social comparison processes (Festinger 1954) may be useful to shed a complementary light on game mechanics involving coaction and/or competition in gamified systems.

Social comparison theory (Festinger 1954) suggests that performance and self-evaluation are impacted by comparison with others. In particular, the presence of coactors influences performance through two forces: a unidirectional drive upward (Huguet et al. 1999; Seta 1982; Seta et al. 1991) and a pressure towards uniformity (e.g. Festinger 1954, Huguet et al. 2001). Drive upward can be explained by the existence, at least in western societies, of a social desirability for personal achievement, leading people to give the best possible performance. Besides, pressure towards uniformity corresponds to a need for reducing performance discrepancies between oneself and others. Comparisons with someone performing better (i.e. upward social comparison [USC]) result in performance increase because it satisfies the drive upward and also reduces discrepancies with the performance of superior others. However, the social comparison target should remain attainable because strongly upward comparison does not facilitate performance (Huguet et al. 1999). Conversely, comparisons with someone performing lower (i.e. downward social comparison [DSC]) classically result in steady performance. Mirroring these principles, a series of studies (Seta 1982) showed that the performance of the participants in a pressing button task was better when placed in comparison with a slightly superior coactor. Moreover, participant's performance was not impacted by a coactor whose performance was inferior, identical or strongly superior to that of the participant.

Studying social comparison in a gamified context is particularly interesting for two reasons. Firstly, a gamified context may foster competition between users, which is known to increase the unidirectional drive upward (Garcia et al. 2006). Moreover, such contexts may also counter pressure to uniformity and rather promote large performance gaps between the winner and the others. Indeed, a gamified context could lead to local gaming norms that maximize the differences between self and other performances, even in DSC. Although speculative, this assumption echoes existing classical game features such as finishing a race with a lap ahead in Mario Kart or winning by 'Perfect' in *Street Fighter*. Hence one may expect that gamification could strengthen the impact of social comparison processes on performance.

The goals of the present research are to figure out: (1) whether gamification produces measurable effects in user performance; (2) whether this positive impact on performance is mediated by specific motivational and attentional processes that can be captured through the measure of flow; and (3) whether gamification moderates social comparison process. To address this challenge, we report on three experimental studies exploring the impact of gamification applied to an Electronic Brainstorming System (EBS). The aim of Study 1 was to investigate the impact of gamification (including performance feedback, performance standard, time pressure and a fantasy context) on creative performance and flow. Study 2 was conducted as a control experiment to remove the effect of time pressure. Finally, Study 3 aimed to analyse the effects of such gamified design of electronic brainstorming in a social/multiplayer context.

STUDY 1

EBS (e.g. DeRosa et al. 2007) consist in having brainstorming participants who generate ideas on computers, either alone or in group (Dennis and Williams 2002), in synchronous (Dugosh and Paulus 2005) or asynchronous mode (Michinov and Primois 2005). EBS repeatedly proved to be an effective medium for brainstorming (Dennis and Valacich 1993; Gallupe et al. 1994; Kerr and Murthy 2004; Valacich et al. 1994) and their interfaces can include features aimed to enhance creative performance, for example automatic feedback on idea content (de Rooij et al. 2017).

For the present study, we developed an EBS for nominal brainstorming and followed gamification guidelines (Marache-Francisco and Brangier 2015) to implement a gamified version. This resulted in an EBS interface with a fairy-tale atmosphere featuring a princess threatened by a dragon and running to a fortress. While the dragon progresses regularly with time, the princess progresses with each idea keyed by the brainstorming participant: the distance to the fortress and progress of the princess, therefore, constitute a performance standard for the brainstorming task. The fairy-tale atmosphere was chosen in reference to the most popular video games like Nintendo's *Mario Bros* (with a fortress at the end of the level, a princess and a villain). This kind of intergenerational video game has the potential to hit all age segments, as Mario franchise remains the most sold ever (767.93 million copies to date). We designed a minimalist version of this genre adapted to EBS. The minimalism was intended to allow for a better control of the experimental manipulation and limit potential interferences between too many design features. With regard to Koivisto and Hamari's (2019) classification of motivational affordances, our design includes achievement/progression-oriented affordances as well as immersion-oriented affordances (use of stories, narratives, avatars, etc.). The effects of this gamified design on creative performance and flow were compared to a non-gamified one. We hypothesize that: (H1) the creative performance (quantity and originality of ideas) will be improved in the gamified condition, (H2) the level of flow experienced by participants will be higher in the gamified condition and (H3) the performance increase will be mediated by flow.

Participants

Fifty-six students (18F), aged 18–26 (M=21.96, SD=2.04), participated in the study, including sixteen students for a pre-test to set the performance standard and 40 students for the experiment.

Procedure

Participants were placed in individual laboratory cubicles to complete a computerized French version of Torrance's cardboard box task (Torrance 1966), which consists in imagining unusual uses of boxes for ten minutes. In the pre-test (N=16) and the non-gamified condition (N=20), participants had to enter their ideas through an EBS interface with a minimal graphical theme (Figure 1). In the experimental condition (N=20), they did so through the gamified interface. In both conditions, the ideas entered by the user were numbered and displayed as a scrollable list above the text field, which provided a real-time performance feedback to the user. In the gamified interface, the performance standard was set on the basis of fluency scores of the pre-test (i.e. the number of non-redundant ideas generated by pre-test participants), which amounted to *M*=19.75, SD=13.41. To ensure a sufficient challenge, the performance standard was set to the third quartile of pre-test fluency (Q3=29 ideas). The princess has three lives in the beginning of the task: when the dragon catches up with her, the participant loses one life but must continue idea generation (and the dragon steps back). When the princess reaches the fortress after 29 ideas, the participant gains an additional life but has to continue idea generation to achieve the ten-minute session.

In the gamified and non-gamified conditions, we assessed creative performance through fluency and uniqueness. Fluency corresponds to the number of ideas generated by each participant after removing duplicates from his/her own production. Uniqueness is an assessment of originality corresponding to

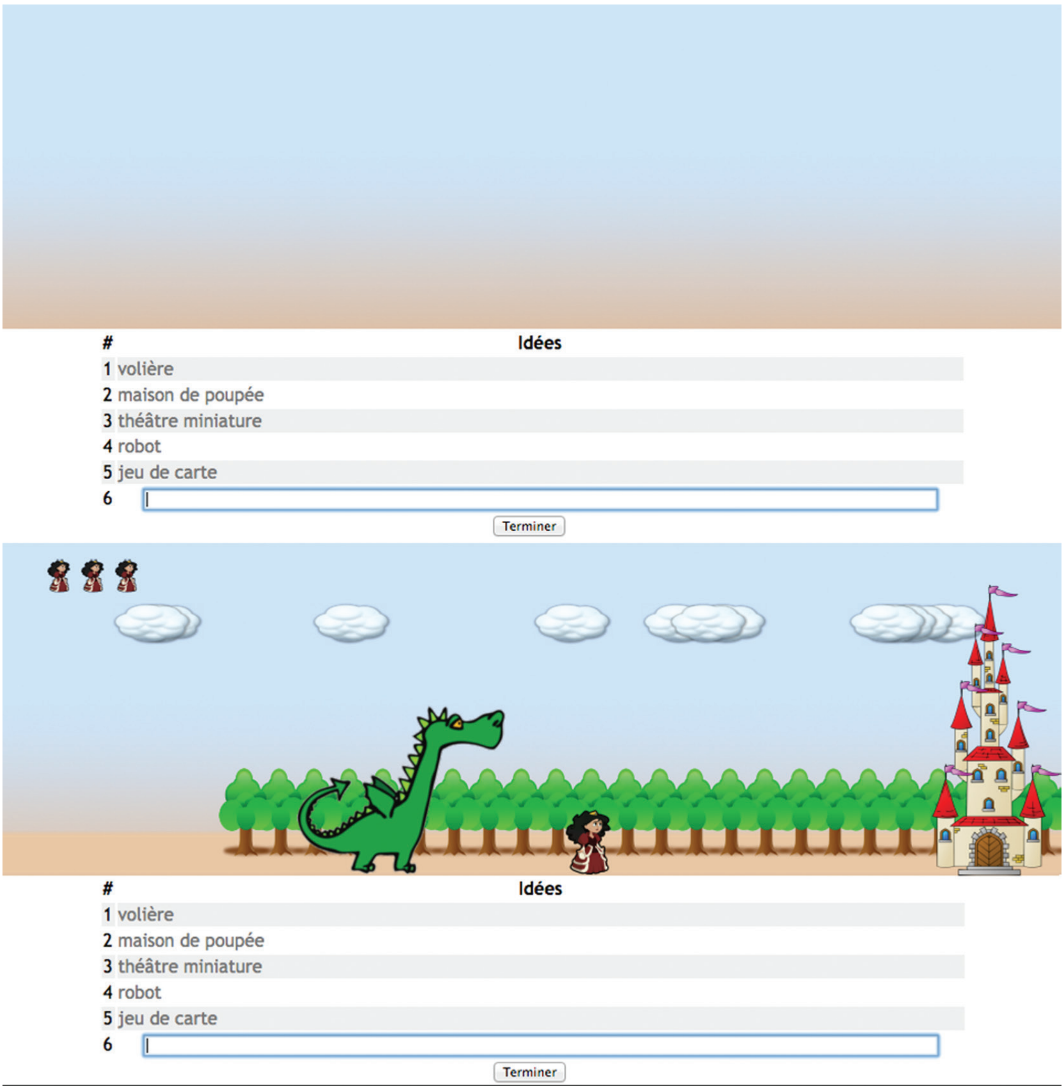

Figure 1: Screenshots of the non-gamified (top) and gamified (bottom) conditions.

the number of unique ideas with regard to all the ideas proposed by all the participants. This is a classical measure of divergent thinking (Torrance 1966; Wallach and Kogan 1965). Flow was evaluated through a scale combining items from existing measures (Bakker 2008; Ghani 1995; Ghani et al. 1991; Webster et al. 1994), which were aggregated (α=0.70).

Given the gender connotations potentially associated to the fairy-tale context, sex was processed as a covariate in subsequent analyses.

Results

The variables collected were analysed by means of ANalysis of COVAriances (ANCOVAs) with the condition (non-gamified vs. gamified) as between-subject variable and sex as a covariate. Fluency proved to increase significantly in the gamified compared with the non-gamified condition (see Table 1 and Figure 2). Uniqueness was also higher in the gamified than non-gamified condition. These results are in line with H1.

However, flow did not vary significantly between the gamified and non-gamified conditions, which invalidates H2. With the indirect effect of gamification through flow (controlling for condition and sex) being non-significant on fluency (Z=0.54, p=0.59) and on uniqueness (Z=0.67, p=0.50), H3 mediation is not verified either.

Discussion

This study showed that the participants in the gamified condition exhibited higher creative performance, both in terms of idea fluency and idea uniqueness. However, the brainstorming participants did not experience more flow in the gamified condition. The fact that our experimental manipulation produced only behavioural effects challenges the gamification framework: to

Table 1: Detailed values for the conditions examined and the ANCOVA results.

	Non-gamified		**Gamified**		**ANCOVA results**			
	M	**SD**	***M***	**SD**	**df**	***F***	***p***	**$\eta^2 p$**
Fluency	22.20	15.97	33.10	14.85	1,37	5.34	<0.05	0.126
Uniqueness	3.3	3.84	6.2	5.16	1,37	4.14	<0.05	0.101
Flow	5.24	0.86	5.54	0.90	1,37	1.132	0.294	0.03

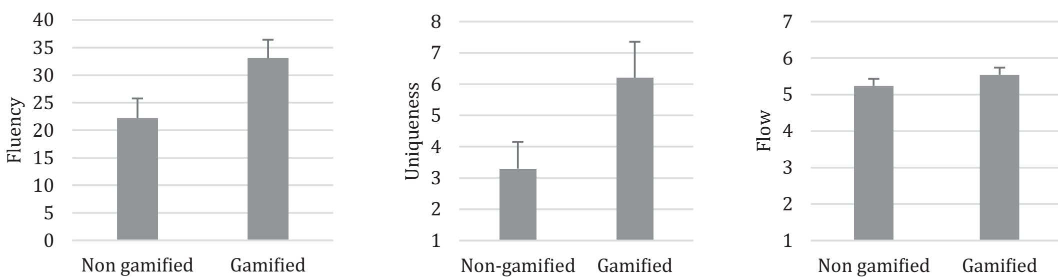

Figure 2: Means and standard errors of fluency, uniqueness and flow as a function of the condition.

consider the observed behavioural effect as a direct consequence of gamification, it should be associated to psychological effects such as an increase in gameful experience, an increase in motivation or an increase in flow. As such psychological effects were not observed in this study, we assume that the behavioural effect (increase in creative performance) might be due to the introduction of a performance standard and a real-time feedback with regard to this standard. Besides, informal discussion during post-experiment debriefing suggested that the time pressure introduced by the dragon was a major driver for performance. Time pressure in electronic brainstorming was previously shown to increase performance without impacting satisfaction or fun (Schmitt et al. 2012), which rules out an interpretation in terms of gamification. In our design, time pressure may also have been reinforced by the explicit way of losing (be eaten by a dragon). To understand which process (performance standard, or time pressure) exerted a greater impact on performance, and to further investigate a potential specific effect of gamification, we designed Study 2 as a control experiment and designed a gamified EBS interface without a dragon.

STUDY 2

Participants

Fifty students (38F) aged 18–31 (*M*=20.62, SD=2.64) participated in the experiment.

Procedure

Participants were placed in individual laboratory cubicles. We used the same task as in Study 1 and the same minimal EBS interface for the non-gamified condition (*N*=25). In the gamified condition (*N*=25), the participants used an interface featuring only the princess progressing to the fortress with each idea entered. The performance standard was the same as in Study 1.

We collected fluency and uniqueness and assessed flow through Ghani et al.'s (1991) scale measuring three dimensions: enjoyment (α=0.78), concentration (α=0.93) and control (α=0.61). These dimensions were aggregated as a single composite flow score (α=0.88).

In line with a gamification approach, we hypothesized that: (H1) the creative performance (fluency and uniqueness) would be higher in the gamified condition, (H2) the level of flow experienced by participants would be higher in the gamified condition and (H3) the behavioural effect (creative performance) would be mediated by the psychological effect (flow experienced).

Results

The variables collected were analysed by means of ANCOVAs with the condition (non-gamified vs. gamified) as between-subject variable and sex as a covariate. The results show that fluency did not significantly vary between the non-gamified and gamified conditions (see Table 2 and Figure 3). Uniqueness did not vary either. These results invalidate H1. In the same way, there were no significant differences between the two conditions regarding flow and H2 was not verified. Finally, the indirect effect of gamification through flow (controlling for condition and sex) was significant neither on fluency (Z=0.07, p=0.94), nor on uniqueness (Z=0.15, p=0.88), showing the absence of mediation effects and invalidation of H3.

Table 2: Detailed values for the conditions examined and the ANCOVA results.

	Non-gamified		Gamified		ANCOVA results			
	M	**SD**	***M***	**SD**	**df**	***F***	***p***	η^2p
Fluency	19.16	11.53	23.52	10.45	1,47	2.28	0.137	0.046
Uniqueness	2.20	1.91	2.36	1.70	1,47	0.10	0.75	0.002
Flow	4.96	1.07	4.89	0.98	1,47	0.12	0.73	0.003

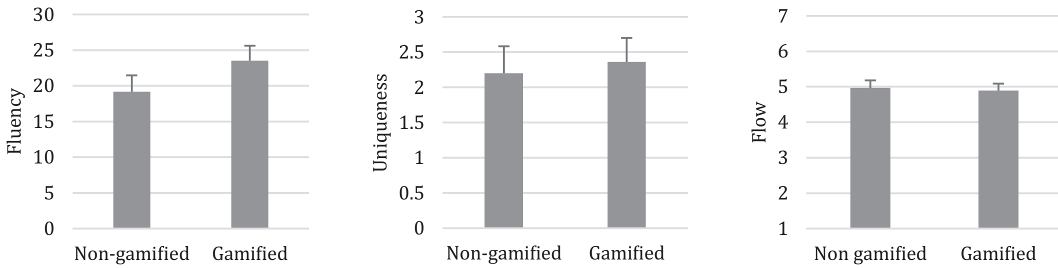

Figure 3: Means and standard errors of fluency, uniqueness and flow as a function of the condition.

Discussion

This study shows that a minimal gamified design (fairy-tale atmosphere, performance standard) did not influence behavioural or psychological dependent measures. Furthermore, fluency in this minimal gamified condition was significantly lower than in Study 1 gamified condition with the dragon (M=33.1, SD=14.85 in Study 1 gamified condition; M=23.52, SD=10.45 in Study 2 gamified condition; $t(38)=2.205$, $p<0.05$). The increase in creative performance in Study 1 can therefore be more confidently attributed to the pressure exerted by the dragon (time and potential fear of losing). We may conclude that gamification in itself did not operate as expected (i.e. as a psychological process generating behavioural outcomes from the introduction of game design elements).

Neither Study 1 nor Study 2, which were implemented as single-player brainstorming activities, showed any benefit of the gamified design in terms of psychological effect. However, given the potential influence of multiplayer settings on enjoyment and motivation in video games (e.g. Peng and Crouse 2013), gamification may be more impactful in a social context. This issue is examined in Study 3.

STUDY 3

Through the implementation of an EBS in a social setting, Study 3 aimed to investigate the impact of gamification on social comparison processes. The analysis of social comparison in the context of a creative task was previously shown to be a valuable means of improving performance. For example, in the context of brainstorming tasks, it was shown that USC improves fluency (Dugosh and Paulus 2005; Paulus and Dzindolet 1993) and originality of ideas (Michinov et al. 2015). As specified in the introductory section, the social comparison target should nonetheless remain attainable (Huguet et al. 1999). For this reason, we chose to implement a slightly upward realistic social comparison target. We then hypothesized that: (H1) in line with classical literature on social comparison, participants' creative performance (in terms of fluency and uniqueness) should be higher in upward than in DSC condition; (H2) the creative performance should be higher in the gamified than in the non-gamified condition; (H3) the level of flow experienced by participants should also be higher in the gamified condition; and (H4) gamification should moderate social comparison effects through a reduction of pressure to uniformity: the difference between USC and DSC conditions should be reduced with the gamified interface. To test these hypotheses, we developed a new EBS interface including a confederate princess on the path to the fortress in addition to the princess representing the participant.

Participants

One hundred students (68F), aged 18–40 (M=20.46, SD=2.92) participated in the experiment.

Procedure

We designed a 2 (gamification: with vs. without) × 2 (social comparison: USC vs. DSC) between-subject factorial design. In all cases, each participant was placed in individual laboratory cubicles, but was led to believe that she/he would brainstorm at the same time as a remote coactor. However, the coactor was a computerized confederate simulated by the system. In the gamified condition (N=50), its presence was represented by a second princess, which adds a social-oriented motivational affordance to our gamified design. In the non-gamified interface (N=50), the princesses were replaced by horizontal running messages to provide feedback each time the participant or the computerized confederate entered an idea (Figure 4). The participants were placed either in USC (N=50) or in DSC (N=50). To this end, the system simulated either a highly fluent confederate (USC, 32 ideas) or a lowly fluent one (DSC, ten ideas), these values being extracted from Study 2 (USC=M+SD; DSC=M–SD). To set the timing of idea generation for the confederate, we extracted the behaviour of two participants from Study 2 who matched most closely our USC and DSC target values. The participants had no access to the confederate's idea content in any condition.

As in previous studies, we collected fluency and uniqueness and assessed flow through Ghani et al.'s (1991) scale including enjoyment (α=0.88), concentration (α=0.88) and control (α=0.62), which were aggregated into a composite flow score (α=0.87). We also introduced two items as manipulation checks for the social comparison conditions: 'I did well in this activity, compared to the other participant; I was skilled at this activity, compared to the other participant' (r=0.87, p<0.001).

Results

The variables collected (manipulation check, fluency, uniqueness and flow) were analysed by means of ANCOVAs with condition (non-gamified vs. gamified) and social comparison (USC vs. DSC) as between-subject variables and sex as a covariate. The manipulation check confirms that self-rated performance with regard to the confederate was higher in the DSC than in the USC condition (see Table 3). The manipulation check also showed a significant main effect of gamification with higher scores in the gamified than in the non-gamified condition.

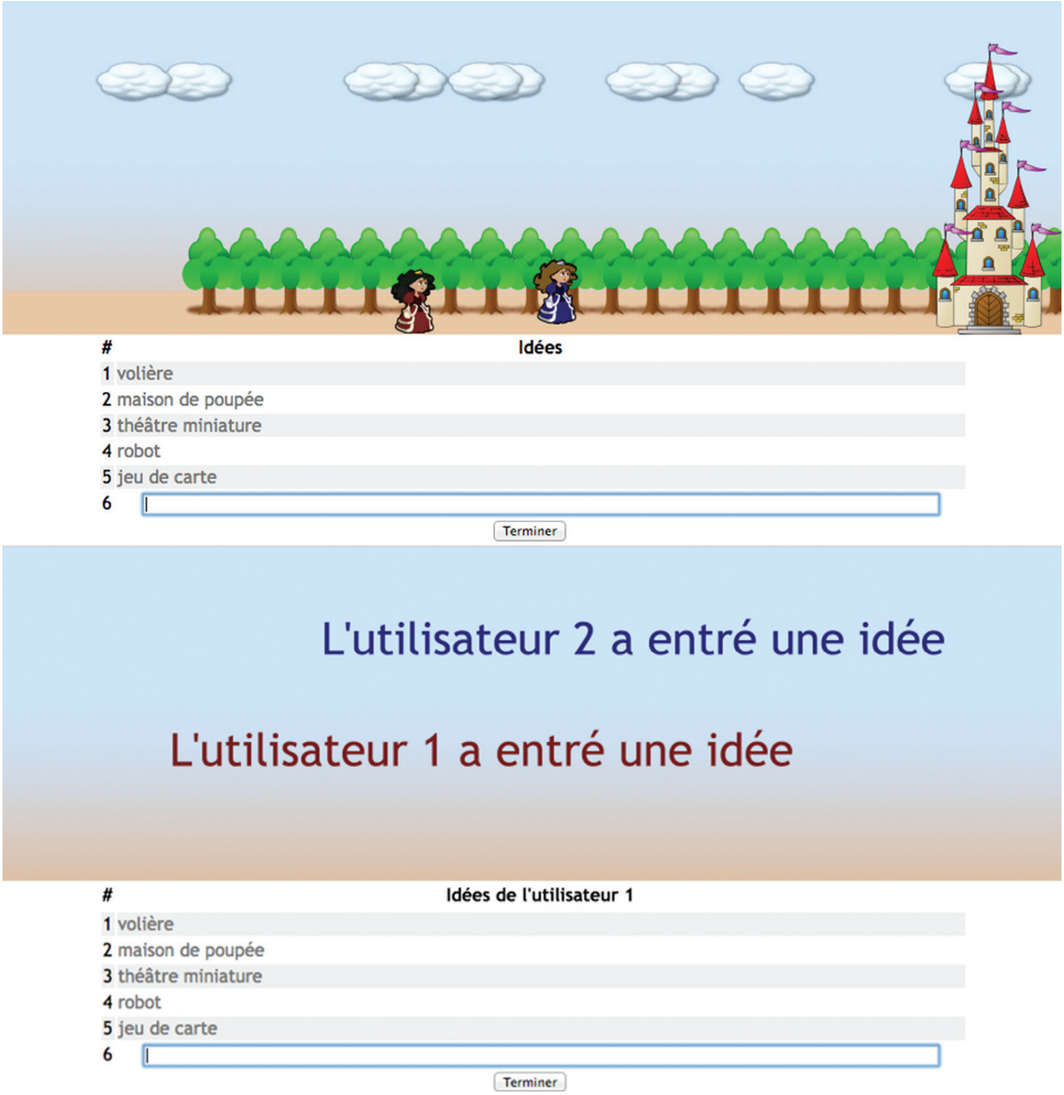

Figure 4: Screenshots of the gamified (top) and non-gamified (bottom) EBS interfaces for inducing social comparison.

In line with H1, fluency scores showed a significant main effect of social comparison with an increased fluency in the USC condition with regard to the DSC condition (see Figure 5). The main effect of social comparison was also found on uniqueness with more unique ideas in USC than in DSC.

Regarding H2, a significant main effect of gamification appeared with higher fluency in the gamified condition (see Figure 6). However, the main effect of gamification proved non-significant for uniqueness. H2 appears partially validated.

Contrary to H3, flow scores showed a significant main effect of gamification with higher flow scores in the non-gamified than in the gamified condition (see Figure 7).

Table 3: Detailed values for the conditions examined and the ANCOVA results.

	M	SD	*M*	SD	df	*F*	*p*	η^2p
	Non-gamified		**Gamified**		**ANCOVA results**			
Self-rated performance	3.45	1.37	4.11	1.67	1,95	4.92	<0.05	0.049
Fluency	23.80	11.85	28.74	12.60	1,95	4.72	<0.05	0.047
Uniqueness	1.66	3.26	2.14	2.91	1,95	0.522	0.472	0.005
Flow	5.44	0.79	5.03	1.05	1,95	4.61	<0.05	0.046
	DSC		**USC**		**ANCOVA results**			
Self-rated performance	4.28	1.51	3.28	1.46	1,95	11.59	<0.001	0.109
Fluency	21.66	9.15	30.88	13.58	1,95	16.23	<0.001	0.146
Uniqueness	1.24	1.77	2.56	3.9	1,95	4.78	<0.05	0.048

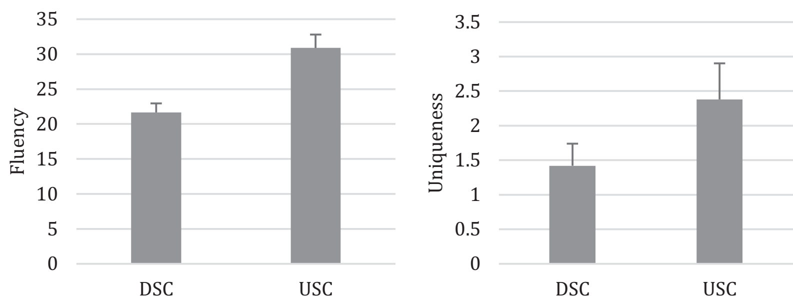

Figure 5: Means and standard errors of fluency and uniqueness as a function of the condition.

Finally, to test H4, we examined the interaction effects between social comparison and gamification on creative performance. The interaction effect proved non-significant on fluency (F(1,95)=0.69, *p*=0.41, η2*p*=0.007) as well as on uniqueness (F(1,95)=0.178, *p*=0.674, η2*p*=0.002, see Figure 8).

Discussion

This study reproduces the classical social comparison effect, with an increased performance in USC and a steady performance in DSC. Unexpectedly, this effect was not moderated by gamification. The gamified condition proved to increase fluency, but this effect was associated to lower scores of flow, although the gamification framework would have predicted the contrary. The main effect of gamification on manipulation checks suggests that participants in the gamified condition could assess more accurately their position with regard to the confederate (persistent feedback on princesses' progress). The fluency increase in the gamified condition might therefore be due to more salient cues for social comparison, which is in line with previous literature on the influence of feedback frequency on coactors' performance (Beck and Seta 1980). However, the negative effect of the gamified condition on flow creates

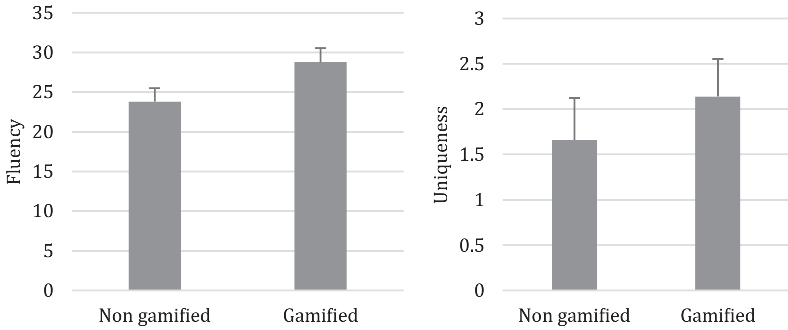

Figure 6: Means and standard errors of fluency and uniqueness as a function of the condition.

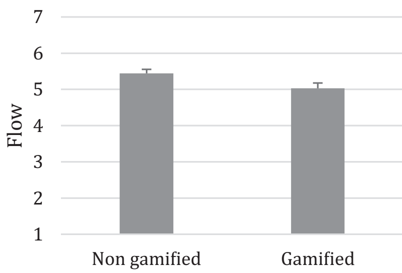

Figure 7: Means and standard errors of flow as a function of the condition.

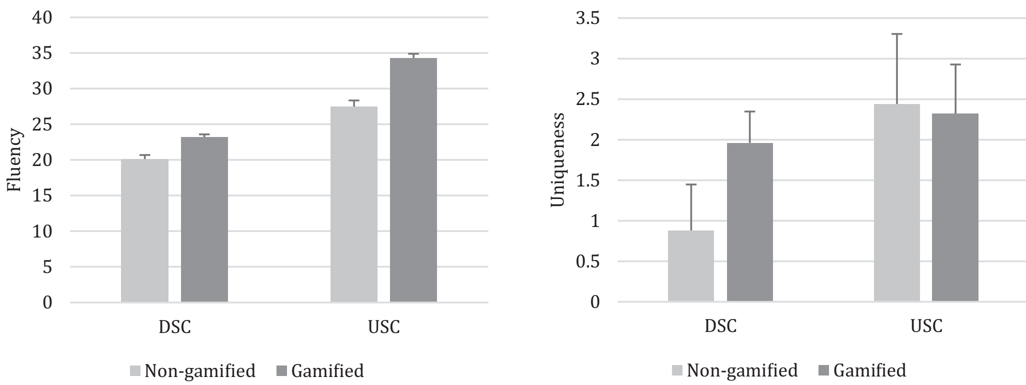

Figure 8: Means and standard errors of fluency and uniqueness as a function of the conditions.

a puzzling pattern of results and casts further doubt on an interpretation in terms of gamification. Gamification viewed as a process consisting in introducing game elements to create a gameful experience cannot account for the results observed in this study, either in terms of behavioural outcomes (creative performance) or psychological outcomes (flow).

CONCLUSION

Our goal was to understand more clearly the effects of game design elements on psychological (flow) and behavioural outcomes (creative performance) in an electronic brainstorming task. Our results show that our intended gamified design managed, in some respect, to increase performance (through time pressure and social comparison), but failed to produce any or relevant psychological effect, as the impact on Flow was either absent or negative. Current views on gamification as a process not only require that psychological outcomes are produced, but also that those psychological effects, in turn, should induce the behavioural outcomes (see Koivisto and Hamari 2019). Our pattern of results does not support this mediation model of gamification. Moreover, regarding the influence gamification may have on the social comparison process, our hypothesis was also invalidated as we observed no moderating influence of the gamified design on the classical effect of social comparison. We may conclude from this series of experiments that either gamification did not occur as a psychological process, or that we failed to induce it with the design we implemented.

The present series of studies holds several limitations, and notably the fact that the profile of participants in terms of gaming experience and preferences was not controlled. Moreover, we investigated a single type of gamified atmosphere, namely a fairy tale one, whereas more or less realistic or dreamlike designs could have different impacts on user experience. One could also study other game mechanics (e.g. exploration, rewards, discovery and battle mechanics) and different types of multiplayer interaction (e.g. cooperation vs. competition). All in all, the global picture appears particularly complex and would require to accurately disentangle these design factors to assess their respective impact in the short and long run. What makes the study of gamification even more complex is that the sociocognitive processes potentially involved are non-specific to gamification and can be easily triggered in non-gamified contexts (presence of a coactor, characteristics of the coactor, time pressure, etc.). Despite the growing popularity of this design trend, gamifying a situation while mastering the processes and subsequent impacts on user experience and performance remains a challenge in the current scientific understanding. Therefore, gamification demands should be treated with caution, unless the positive and negative impacts are properly evaluated before being implemented in contexts of interest.

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