The UIPC-Monitor tool for augmenting idea maturity with proofs of Utility, Innovation, Profitability and Concept

Bernard Yannou, Romain Farel, François Cluzel

The UIPC-Monitor tool for augmenting idea maturity with proofs of Utility, Innovation, Profitability and Concept

Bernard Yannou[1], Romain Farel[2] and François Cluzel[1]*

[1] Ecole Centrale Paris, Laboratoire Genie Industriel, Chatenay-Malabry, France

[2] Paris Saclay Efficacité Énergétique (PS2E), Saclay, France

Abstract: A lot of work is done on ideation metrics but less is done for innovation metrics, i.e. monitoring an ideation process with the goal of augmenting idea maturity and increasing likelihood for the idea to be transformed into an innovation success on the market. To that aim, metrics of utility, profitability and proof of concept (feasibility) are considered along with innovation (novelty). This set of four metrics is used to dynamically investigate the probability of ideas to get high impacts on Utility, Innovation, Profitability and Concept (UIPC). The collection of new arguments is driven by the search of a sufficient certainty to get a satisfactory UIPC impact. Idea maturation process may be justified and traced, and idea selection facilitated and accelerated. This process is applied for developing an innovative smartphone application that can monitor health parameters.

Keywords: ideation metrics, innovation metrics, idea maturity, process monitoring, innovation process

1. Introduction

1.1. Ideation versus innovation metrics

Recently, numerous proposals have been made for measuring qualities of ideation task (Maher & Fisher, 2012). Several models exist to measure the efficiency of this ideation process. Shah et al. (Shah & Vargas-Hernandez, 2003) proposed four separate effectiveness measures: *novelty*, *variety*, *quality* and *quantity*. Novelty measures how unusual or unexpected an idea is as compared to other ideas. Variety is a size measure of the explored solution space. Quality is a measure of the feasibility of an idea and how close it comes to meeting design specifications. Quantity is the total number of ideas generated. Sarkar and Chakrabarti (Sarkar & Chakrabarti, 2011) addressed methods for assessing innovation in such a way as to integrate the notion of development deadlines and degree of creativity, two factors they found missing in Shah's metrics. They also highlighted the need to define the degree of creativity of products where creativity is considered a function of novelty and usefulness. The SAPPhIRE model, developed by Chakrabarti et al. (Chakrabarti, Sarkar, et al., 2005) aims at proposing a framework for design to encourage novelty. With linkography principle (G. Goldschmidt, 1990), Goldschmidt and Tatsa (G. Goldschmidt & Tatsa, 2005) determine if and how selected "good" ideas are related to other ideas presented during the idea generation process. Kan and Gero showed how to compute novelty with linkographs (Kan & Gero, 2008). Recently, Grace et al. (Grace, Maher, et al., 2014) proposed a way to compute the surprise effect of a product using a distance metrics of the attributes of a supposed creative product with the ones of comparable product in the recent past.

Literature in marketing has more explored innovation than creativity. They already consider for a long time that an innovation is a combination of a certain degree of value-add and a certain degree of newness (Wright, 2012). A value-add is an utility from the perspective of the end-user at the time the product is launched on the market. And this utility cannot be measured by

[*] **Contact author**
E-mail: bernard.yannou@ecp.fr

the sole designers and is hard to automate apart in modeling preferences of end-users or customers, in the context of competing offers and with the consciousness of jobs-to-be-done (Christensen, 2003, 2011).

1.1. Research history: our investigation-centred RID methodology and UIPC model

Recently, the authors started to compute utility indicators (Bekhradi, Yannou, et al., 2014) by usage segmentation techniques and measuring the degree of dominance of a product or an idea by summation on all usage segments:

- of the effectivity of the product/idea weighted by the size of the usage segment. This is the notion of usage coverage indicators (Yannou, Yvars, et al., 2013),
- or of the utility dominance compared to existing offers (Bekhradi, Yannou, et al., 2014).

Other authors start to consider that "quantity breeds quality" is not a good principle for several reasons. Kazakci et al. (Kazakci, Gillier, et al., 2014) experimented on practical ideation situations and came up with the fact that (in abstract, page 199) "*Results lead to the rejection of the classical 'quantity breeds quality' hypothesis. Rather, we observe that successful groups are the ones who produce a few original propositions that hold great value for users while looking for ways to make those propositions feasible.*" Feasibility, which can also be called proof-of-concept, may perhaps be in designer mind a constraint leading to better idea selections and inspiration. In addition, the authors showed that we cannot separate the question of ideation measurements with the one of the pertinency of exploration-exploitation of the adopted innovation process. Indeed, the authors developed a *Radical Innovation Design* (RID) methodology (Yannou, Jankovic, et al., 2013) whose aim is to generate few solution or conceptual ideas because a systematic exploration of *value bucket* opportunities is made in an early problem-setting stage which is the front end of innovation (see (Yannou, Farel, et al., 2015)). The principle is here "*Let us investigate the problem setting, focusing on a small number of value buckets that are the starting points of focused innovations*".

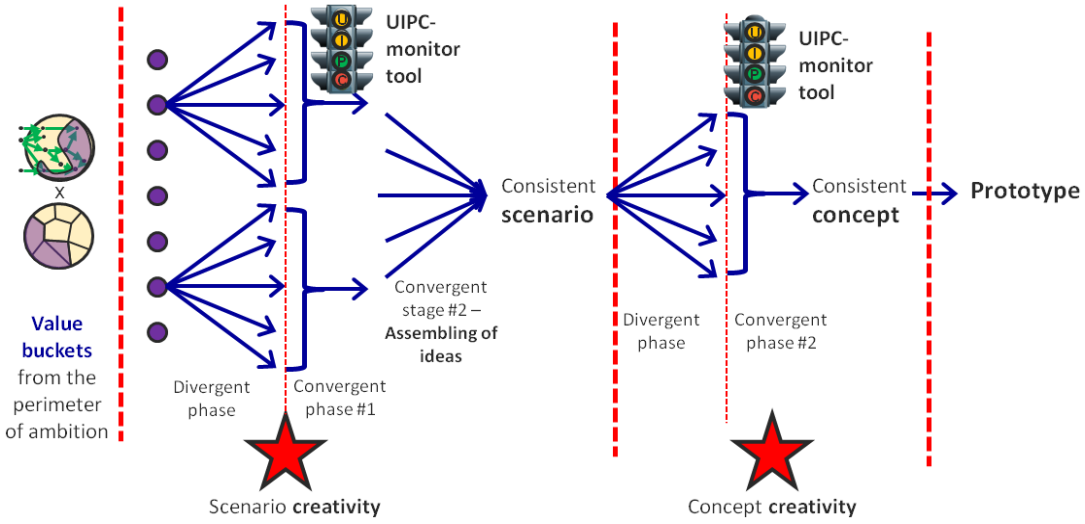

Figure 1 The two-stage ideation process proposed

The more value buckets are identified, the highest likelihood for creative ideas to become successful innovations on the market because of the immediate perceived utility and novelty. A two-stage ideation process is followed as shown in Figure 1 made of *(n+1)* brainstorming sessions (*n* being the number of value buckets) along a scenario creativity stage to come up with one or several dreamt service scenario, and a concept creativity stage where this scenario is embodied in a conceptual product-service solution.

For summary, *feasibility* is proved to be important to assess in ideas to augment the probability to lead to successful innovation on the market (Kazakci, Gillier, et al., 2014). In addition measuring the perceived *value-add* of *utility* of ideas/products is of the utmost importance for also guaranteeing success on the market; this is even the principle of the blue ocean strategy

(Kim & Mauborgne, 2005). In RID methodology, ideation starting with value buckets is a guarantee to come up with blue ocean innovations. Finally, after working on many innovation projects in companies, the authors are convinced that any innovation must prove to be *profitable* for both the company and the end-users in terms of global lifecycle cost, so as for the innovation to be successful. This crierion of *profitability* is never used in ideation metrics (probably too marketing oriented) whereas in practice it quickly becomes crucial.

Table 1. Definition of the Utility-Innovation-Profitability-Concept proofs

Proof type	Definition
Proofs of **Utility (U)**	Coverage of usage and needs situations of users / stakeholders for which important needs are covered, suffering alleviated and / or malfunctions of existing systems improved
Proofs of **Innovation (I)**	Real innovation, claimable, protectable, perceived and valued by users and customers
Proofs of **Profitability (P)**	Expected profitability for the company and customers. Tendency to improve brand image, to increase the average revenue per user, to conquer new markets or to make more fidel clients (re-purchasing)
Proofs of **Concept (C)**	The conceptual solution or prototype functions effectively and efficiently in expected situations. Technological and industrial feasibility

For these reasons, the authors have proposed a new set of minimal metrics for innovation (not ideation): the UIPC model (Yannou, Zimmer, et al., 2013), standing for *Utility-Innovation-Profitability-Concept*. The definitions of the four metrics are provided in Table 1. The metrics are called *proofs* (of value) and are supposed to be assessed by expert designers or innovation jurys at different stages of the ideation and innovation process. This naming of *proofs* is coherent with the fact that RID methodology considers the innovation process as a probabilistic process which attempts to come up with the highest value creation for end-users (as do Thompson and Paredis for Rational Design Theory (Thompson & Paredis, 2010)). This probabilistic view of design makes a proof be assessed with a probability (*certainty*) to get a more or less high value (*impact*).

In (Yannou, Zimmer, et al., 2013), the UIPC model has been proved useful and relevant to monitor innovation emergence a first time in the context of an innovation cluster to select, grant and incubate the most promising innovative ideas or projects. It has been clearly showed that the selected projects have almost been the best rated by the aggregate indicator UIPC (*U*+*I*+*P*+*C*) averaged on the jury members carefully chosen to be complementary in 3 expert bodies. The UIPC model has been used successfully a second time in the framework of delivering the final grade to innovation projects in an engineering department. We found a remarkable correlation between the aggregate indicator UIPC (*U*+*I*+*P*+*C*) averaged on the jury members for each project and the average grade assigned to the project by the company representatives and which was assumed to "*assess at best the potential of the given innovation to be successful in the market*".

In this paper, we propose a process to monitor the probability of value creation within an elementary ideation process (see Figure 1), adopting the UIPC set of metrics. After CK-theory (Hatchuel & Weil, 2003), an ideation process is a transformation of a piece of knowledge or concept into something more evolved in terms of truth value. We prefer the notion of augmenting an idea maturity, maturity being widely used in companies to monitor development processes (e.g., TRLs maturity indicators).

Table 2. Rating scales of certainty and impact of UIPC proofs

Impact of an UIPC Pro/Con proof	Rating scale
Null	0
Weak	+- 1
Average	+- 2
Strong	+- 3

Certainty of an UIPC proof	Rating scale	Icon
Absent	0 %	
Some elements	25%	
Serious elements – Presumptions	50%	
Much probable - Credible	75%	
Undeniable and complete	100%	

2. The case study of an e-healthcare application

The UIPC-monitor method and tool are presented along with a true innovation project performed for XXcompany (anonymized name) which has led to a prototype and further to a commercial product (see Figure 2). Following a RID process, the design team starts with the following inital idea "*XXcompany uses to develop devices and smartphone applications that can monitor health parameters like weight, heart rate, physical activity and sleep. Let us explore a new usage context*...". During the problem setting stage, an observation is made: "*The increased presence of social networks in the relations between people tends to reinforce motivations to exercise*". A value bucket is finally expressed with: "*To increase motivation of individuals having different age, gender and occupation to exercise regularly through networking emulation*." The issue expressed for starting creativity is slightly modified into: "*How to make an exercise application more motivational through social networks?*".

Figure 2. The prototype result of the innovation project of an e-healthcare application for XXcompany

The brainstorming session led to three ideas:

- **Idea A**: (Video gaming) This idea is inspired from video-games. The user gains levels according to the degree of completion of their fitness goals. The user is awarded points and trophies as he/she advances. These points can be redeemed against gifts.
- **Idea B**: (Community concept) This idea involves social networking. The user shares his/her profile and progress with a vast network of people who are their friends or other users of Withings applications. Such an exchange between users in a group can be a source of motivation. It gives the user a personalized space by which they can interact with like-minded people and the people who matter to them.
- **Idea C**: (Fun and community concept) This idea is an amalgamation of the first two ideas and includes both fun and community. The users are divided into appropriate teams and they can compete among themselves. The competitive spirit can be a great motivator.

3. The UIPC monitoring process for idea maturation

The UIPC monitoring process for idea maturation is the following (see Figure 3):

1. Start from a value bucket, generate a set of ideas, describe each of them succinctly.
   For each idea:
2. Proceed to a SWOT analysis. Under Strengthts and Opportunities, list *arguments* in favor of UIPC proofs. Under Weaknesses and Threats, list *arguments* in disfavor of UIPC proofs.
   For each argument:
3. The design team members assess both *impact* and *certainty* of each argument. An argument of S or O type has a positive impact (between 0 and 3, see Table 2). An argument of W or T type has a negative impact (between -3 and 0). The impact is the importance or magnitude of the argument for robustifying the proof.
4. For each idea, an idea *UIPC impact vector* is automatically calculated as the average of argument impacts under each U, I, P or C proof.
5. For each idea, an idea UIPC certainty vector is updated by the design team, each new argument brought in U, I, P or C category is assumed to maintain or increase the certainty.
6. Creativity is pursued for finding U, I, P or C pros & cons arguments and, for each new argument, the process loops to step 4 until
   a. Certainty is high for one of the U, I, P or C proof and the corrspeonding impact is lower than an admissible threshold → it leads to the idea abandonment.
   b. The certainty is high for all U, I, P and C proofs with impacts greater than minimal thresholds → It leads to the idea selection.
   c.

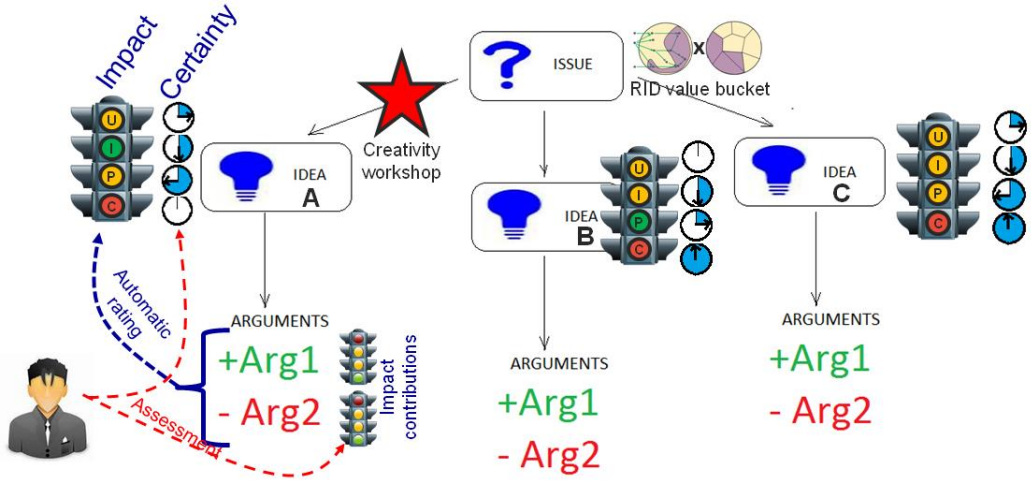

Figure 3. The prototype result of the innovation project of an e-healthcare application for XXcompany

The SWOT analysis for idea A led to 12 arguments (4 for U, 4 for I, 3 for P, 1 for C) given in Table 3. Nine of them are positive in terms of *impact* and three of them negative, leading to an idea *impact vector* of (U=0.5, I=0.58, P=0.33, C=1.00). Certainty is 100% for U and C, meaning that we are sure that proof of *utility* is average and proof of *concept* is high. For innovation and profitability there are *serious elements* or *presomptions* (certainty is 50%) that *innovation* is average and *profitability* weak. But there is still hope that, looking for more arguments, one could improve the certainty for better impacts. Brainstorming must then be pursued. A graphical interface has been developed to manage the ideas rating, see Figure 4 for Idea A. Similar arguments are found and assessed for idea B (Table 4) and idea C (Table 5).

Table 3. UIPC impact and certainty vectors for idea A

Impact Certainty	**U** Utility	**0.5**	**I** Innovation	**0.58**	**P** Profitability	**0.33**	**C** Concept	**1.0**
	Brings novelty in daily life	+2	Monitors more params than competitors	+3	Low price	+2	Software application runs on all smartphones	+3
	Motivates in a fun way	+3	Interface is made interesting for people of different gender, age and occupation	+3	Usable by people of different age, gender and occupation	+3		
	Provides extrinsic motivation	+3	Multiple language support	+3	Prostects of gifts is not profitable	-2		
	Possibility of cheating	-2	Not stimulating for people who do not want to play	-2				

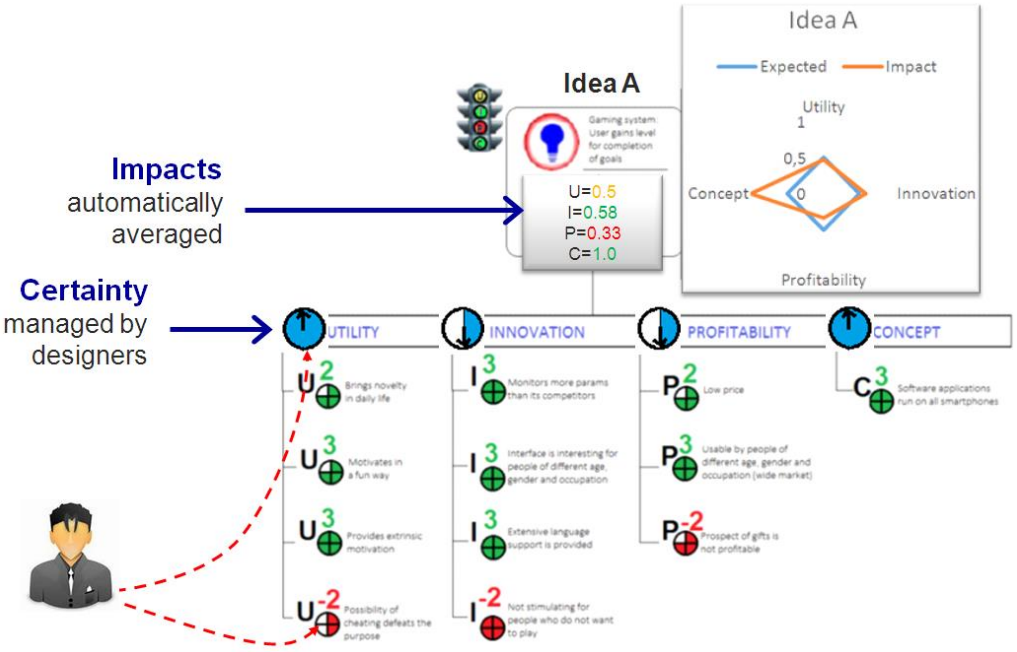

Figure 4. UIPC arguments, impact and certainty vectors for idea A, represented in UIPC-monitor tool

Table 4. UIPC impact and certainty vectors for idea B

Impact / Certainty	**U** Utility	**0.58**	**I** Innovation	**0.58**	**P** Profitability	**0.89**	**C** Concept	**1.0**
	Human being a social animal, is interested in social interactions	+3	Interface is interesting for people of different age, gender and occupation	+3	Low price	+2	Software application runs on all smartphones	+3
	Motivates in a fun way	+3	Monitors more params than competitors	+3	Usable by people of different age, gender and occupation	+3		
	Application provides intrinsic motivation	+3	Extensive language support	+3	Social networking effectively publicises app for free	+3		
	Peopl not interested in social networking may not purchase the app	-2	use of already existent social network is required	-2				

After the primary SWOT analyses on the ideas, the process starts to be dynamic. A general graphical dashboard (see Figure 5) allows to opportunistically justify the search for a new argument of U, I, P or C type for a given idea. The ideation process may be traced because the reasons for brainstorming on a given question is motivated by an insufficient certainty, i.e. lack in idea maturation. In addition, the abandonment of an idea or the preference of an idea on another may now be easily justified and guided.

Table 5. UIPC impact and certainty vectors for idea C

Impact / Certainty	**U** Utility	**0.67**	**I** Innovation	**0.58**	**P** Profitability	**0.5**	**C** Concept	**1.0**
	Human being a social animal, is interested in social interactions	+3	Monitors more params than its competitors	+3	Low price	+2	Software application runs on all smartphones	+3
	Motivates in a fun way	+3	Interface is interesting for people of different gender, age and occupation	+3	Interface is made interesting for people of different age, gender and occupation	+3		
	Provides extrinsic as well as intrinsic motivation	+3	Extensive language support is provided	+3	social networking effectively publicises the app for free	+3		
	Possibility of cheating	-2	Use of already existent social netwoek is required	-2	Prospect of gifts is not profitable	-2		
	Group competitions enhance the motivation greatly	+3		-2				

4. Conclusion

Measuring and controlling ideation is different from monitoring innovation. We noted that an idea in an innovation process was rarely assessed for its value-add or *utility*, its *profitability* and its feasibility or proof of *concept*. We adopt here the UIPC model for assessing the likelihood of an idea to become a successful innovation as already showed in (Yannou, Zimmer, et al., 2013). We propose a process for concurrently assess the UIPC impact and certainty vectors of a set of ideas. The process is initiated by idea SWOT analyses and it becomes dynamic, looking opportunistically for new evidences or arguments for augmenting

the certainty of UIPC proofs of the ideas. The process ends when sufficient certainty is reached, the best idea with the best UIPC impact is then chosen. Of course, tradeoffs must often be made between utility, innovation, profitability and concept advantages. It all depends on the project, product line and company strategy. Proving the efficiency of our UIPC monitoring, i.e. the good convergence of incubated ideas, is the next step of our work.

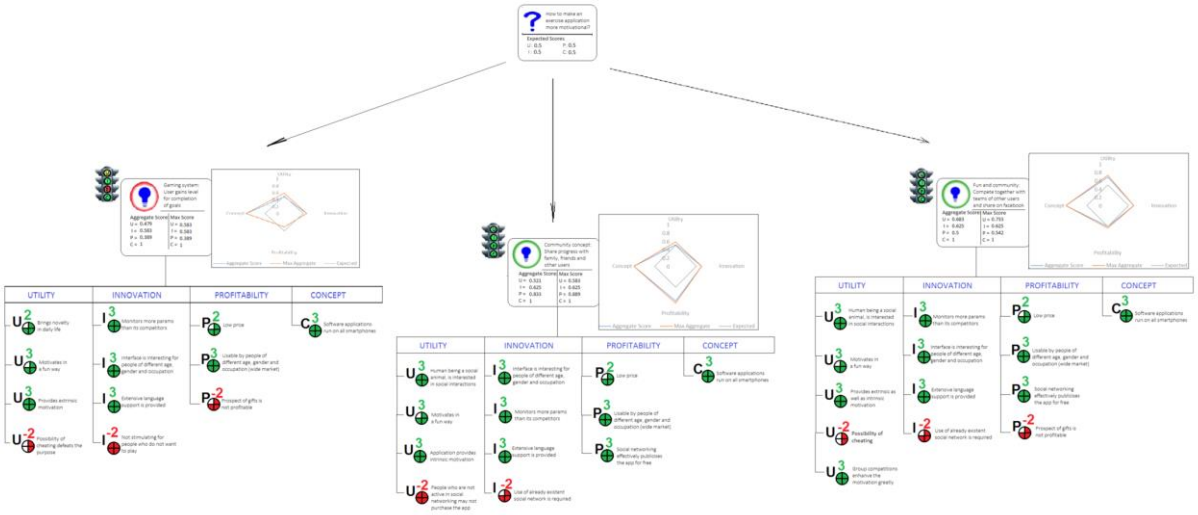

Figure 5. The general dashboard of UIPC-monitor tool for ideas A, B and C

Acknowledgement

We thank Anand Parikh for his work on developing the UIPC-monitor software platform.

References

Bekhradi, A., Yannou, B., Farel, R., Jena, S., & Zimmer, B. (2014, May 19 - 22). *Simulating global utility of design solutions to elderly falls by building relevant usage segmentation.* Paper presented at the International Design Conference, Dubrovnik, Croatia.

Chakrabarti, A., Sarkar, P., Leelavathamma, B., & Nataraju, B. S. (2005). A Functional Representation for Aiding Biomimetic and Artificial Inspiration of New Ideas. *AI EDAM, 19*(2), 113-132.

Christensen, C. (2003). *The Innovator's Solution: Creating and Sustaining Successful Growth*: Harvard Business School Press.

Christensen, C. (2011). *The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business*: HarperBusiness.

Goldschmidt, G. (1990). *Linkography: assessing design productivity.* Paper presented at the Tenth European Meeting on Cybernetics and Systems Research, Singapore.

Goldschmidt, G., & Tatsa, D. (2005). How good are good ideas? Correlates of design creativity. *Design Studies, 26*(6), 593-611.

Grace, K., Maher, M. L., Fisher, D., & Brady, K. (2014, 23-25 June). *Modeling Expectation for Evaluating Surprise in Design Creativity.* Paper presented at the DCC'14: International Conference on Design Computing and Cognition, London, UK.

Hatchuel, A., & Weil, B. (2003). *A new approach of innovative design: an introduction to C-K theory*. Paper presented at the 14th International Conference on Engineering Design - ICED'03.

Kan, J., & Gero, J. (2008). Acquiring information from linkography in protocol studies of designing. *Design Studies, 29*(4), 315-337.

Kazakci, A. O., Gillier, T., Piat, G., & Hatchuel, A. (2014, 23-25 June). *Brainstorming vs. Creative Design Reasoning: A Theory-Driven Experimental Investigation Of Novelty, Feasibility And Value Of Ideas.* Paper presented at the DCC'14: International Conference on Design Computing and Cognition, London, UK.

Kim, C. W., & Mauborgne, R. (2005). *Blue ocean strategy - How to create uncontested market space and make the competition irrelevant*. Boston, USA/MA: Harvard Business School press.

Maher, M., & Fisher, D. (2012). *Using AI to evaluate creative designs*. Paper presented at the 2nd International Conference on Design Creativity.

Sarkar, P., & Chakrabarti, A. (2011). Assessing design creativity. *Design Studies, 32*(4), 348-383.

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

Thompson, S. C., & Paredis, C. (2010, August 15-18). *An Introduction to Rational Design Theory.* Paper presented at the IDETC/DTM: ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conferences / Design Theory and Methodology Conference, Montreal, Canada.

Wright, P. (2012). The three levels of innovation. *CEO Forum*(http://www.ceoforum.com.au/article-detail.cfm?cid=6143&t=/Paul-Wright-Invetech/The-three-levels-of-innovation).

Yannou, B., Farel, R., & Cluzel, F. (2015, Jan 7-9). *The DSM value bucket tool.* Paper presented at the ICORD: International Conference on Research into Design, Bangalore, India.

Yannou, B., Jankovic, M., Leroy, Y., & Okudan Kremer, G. E. (2013). Observations from radical innovation projects considering the company context. *Journal of Mechanical Design, 135*(2).

Yannou, B., Yvars, P.-A., Hoyle, C., & Chen, W. (2013). Set-based design by simulation of usage scenario coverage. *Journal of Engineering Design, 24*(8), 575-603.

Yannou, B., Zimmer, B., Farel, R., Jankovic, M., & Stal Le Cardinal, J. (2013). *Proofs of Utility, Innovation, Profitability and Concept for innovation selection*. Paper presented at the ICED: 19th International Conference on Engineering Design.