A DECK OF CARDS TO HELP TRACK DESIGN TRENDS TO ASSIST THE CREATION OF NEW PRODUCTS

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ABSTRACT

Innovation is the best cure for the survival of dying trends and their designs for new products. This paper looks for the answers on how the innovation can come handy especially for the creation of new products in the market. This is done through the analysis of weak and routine signals. A game based on the concept of Gin Rummy, is developed to recognize the weak and routine signals, and then working them into the favor of products. The game was introduced among groups of people, and they were taught the rules of the game. At the end of the game the players created a map that highlighted the major attributes of the products. the play help to identify shapes and trends, while the tool, in addition to stocking and graphically shaping the data, learns to recognize shapes and improves its possibilities of automating a monitoring in this way.

Keywords: Deck of cards, Rummy of attributes, Game, Design trends, New products

1. INTRODUCTION

The more competition becomes important, the more companies need to innovate in order to survive. But to innovate, they must be able to do so in terms of production and technologies, but also in terms of competitive positioning. This requires the ability to be creative, adaptable, communicative, and strategic intelligence. We will focus here on the latter capacity, which we believe is essential for anticipating product design changes and recognizing opportunities as well as threats related to possible innovations. From this point of view, the implementation of a knowledge acquisition involves the search, identification, and monitoring of signals that will allow us to recognize the appearance of such and such a danger, such and such a possibility of development, such and such a new need, such and such a new trend, etc. [1][2]. As for monitoring current or potential innovations resulting from continuous or incremental improvement development, it seems to us that monitoring them requires above all the implementation of "classic" monitoring techniques such as: reading the specialized press, visiting trade fairs, monitoring patent applications, observing

clients, etc. [3]. On the other hand, it seems to us that the search for and monitoring of opportunities and threats related to radically new innovations still pose many problems. This is why we propose to focus here on the search for and the identification of signals that allow us to identify manifestations or leads to disruptive innovations in product design [4]. To do this, we have chosen to position ourselves upstream of the innovation process, i.e. before the start of its diffusion. This means positioning ourselves at the level of creativity and research phase of the ideas that will be at the origin of the next disruptive innovations. We believe that at this level, the signals that can be associated with the appearance of these innovations can be of two kinds: weak signals [5] and routine signals [6].

In fact, we propose with this paper to contribute to the problem of identifying design trends for the design of a new product. One way to do this is to bring together a group of people who collect information and identify potential weak signals through trends that seem to emerge from various elements retained in the form of keywords, images, textures, etc [7]. The group will then be able to identify the most appropriate signals for the product design. This is the almost "traditional" approach of designers who use a variety of techniques to create trends or mood boards [8]. These approaches can integrate, as in the case of joint trend analysis, the crossing of certain elements which, through visualization and discussion about the result obtained, can lead to the emergence of other weak signals of product design [9][10]. However, in these cases, the signals identified, although always inspiring, remain weak signals that are inherently uncertain [11]. This is why we have searched for another method of anticipation of design transformation, at least from an aesthetic point of view, based on strong signals [12].

2. THEORETICAL FRAMEWORK

The method we present here links indicators to shapes and components identified on drawings or photographs. This method consists of two main parts. The first concerns the highlighting weak and routine signals. It requires a certain amount of well-targeted, indexed, and sorted data. In general, if this task cannot be automated, its implementation is quite tedious [13].

The second part is the formatting of the data via calculations and graphs from the sorting done during the previous step. Therefore, to make this process more dynamic and less tedious, the first part of the method takes the form of a data collection set [14]. This serious game was developed on the principle of Gin Rummy, the well known card game. It is in fact a kind of goal-oriented game that does not require the use of a very large number of people unlike models of the genre [15]. As an illustration of its potential, we use here an example based on the research of design indicators for the controllers of the main video game consoles between 1972 and 2017.

3. LITERATURE REVIEW

3.1 Innovation categories and knowledge acquisition

The notion of innovation can be perceived and understood in different ways. As a general rule, when the term is used, it is in reference to the work of J. Schumpeter at the beginning of the 20th century. This amounts to considering innovation on the basis of two characteristics. The first is based on the fact that innovation aims to develop a "new thing", which can be: a concept, a model, an object, an organization, a service, a system, etc. The second is based on the fact that innovation is a process of change [16]. The second reflects the fact that for there to be innovation, there must be acceptance of this "new thing" by the users who are associated with it and thought of as such [17]. From this point of view, it is the acceptance of the novelty that is more important than the novelty itself. The "new thing" may have already been proposed elsewhere, but its designers have not been able to implement it successfully, or the success of its implementation is already old and almost forgotten [18]. In the latter case, its revamping, if it takes place, will require some adaptation.

Thus, innovation must be understood as an interesting novelty and be perceived as such by the individuals to whom it is dedicated [19]. To be accepted, it must be associated with a dissemination process whose goal is to communicate it appropriately in order to gain acceptance [20]. Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system [19]. This process is not without consequences, since its implementation provides clues to follow the transformation of a "new thing" into true innovation [18]. The study of this process and its variations has made it possible to identify different categories of innovation. Thus, innovations can now be classified into three categories: incremental innovations, radical innovations, and disruptive innovations. Incremental innovation, as its name suggests, refers to continuous research and improvement of the "new thing" under consideration; it follows current trends and is linked to many determinants that are mastered by the company in charge, such as market knowledge, the costs of changing suppliers, network effects and complementary assets market [21] In contrast, radical innovation involves truly new or largely rethought production [22]. In this way, the changes made may be a technological or architectural leap (the arrangement or constitution of the components of the rethought "thing"), which will produce a surprise that cannot be anticipated by monitoring the work leading to incremental improvement [23]. Finally, disruptive innovation (unfortunately also sometimes called radical innovation) refers to the use of alternative technologies to a technology considered as the "main" technology on which the new thing to be produced and assimilated to the innovation depends [24]. These substitute technologies are cheaper and less efficient than the main technology, but end up,

through improvements, corresponding to the needs of a significant part of the users of the main technology [25]. Disruptive innovations can also surprise industry-leading companies by first originating in new market footholds before reaching sector mainstream customers [26].

3.2 Knowledge acquisition and indicator signals for future innovations

From the point of view of strategic intelligence, the research and monitoring of signals related to innovation can be named in different ways: environmental intelligence, technological intelligence, product intelligence, trend intelligence, aesthetic intelligence, innovation intelligence, creative intelligence / creative watch, etc [27]. These watches have in common research, identification and monitoring of signals indicating potential or developing innovations and creations. This research can take place throughout the diffusion process to which the developed innovation is linked. After decades of information monitoring and competitive intelligence practices, we can assume that the identification and monitoring of continuous improvements is now a "classic" practice for organizations [28]. In general, these methods involve monitoring the reading of specialized literature, visits to trade shows, regular analysis of patent applications, monitoring of specialized websites and terms used, observation of the behavior of clients, analysis of social networks, etc. [29].

In terms of intelligence, the monitoring of current or potential innovations and their translation, in terms of opportunities and threats for the organization concerned, are associated with the notion of weak signal. This goes back at least to the work of Igor Ansoff [11] and consists of identifying signs of change that are fairly weak, but which are, in fact, early warning signs of important changes that will take place and could have significant consequences. There are several ways of approaching the search for these signals. One of them treats weak signals according to the pattern management approach. But in fact, in this case, the interpretation of the weak signals is very subjective or late (the signals gain in intensity now they are identified and are therefore quickly perceived as strong signals) [30]. Another solution is to develop scenarios of credible futures and to associate a human network to identify indicators (weak signals) correlated to such or such scenarios [31]. Some other solutions are the computation and semantic analysis of the appearance of new terms as a function of time [32] and the analysis of their co-occurrences in the form of matrix representations [33]. A different and complementary approach consists in discussing possible weak signals between the people concerned, which can take the form of a call to a Delphi group of experts [34][35] by integrating them into the monitoring process [31], predictive scenarios or[36] by translating the signals and their possible consequences with the help of visual elements [35].

Although these different means and methods allow the recognition of weak signals in incremental innovations, when looking at radical innovations, it may be necessary to complement

them. An interesting means can be the monitoring of the evolution of sectors related to the technology and production sectors of the organization concerned. In order to recognize these complementary weak signals, it is necessary to observe the sectors that influence the trends in the sector concerned by monitoring innovations. This consists of identifying where new trends come from in terms of sectors [37] and the socio-cultural environment [38]. The search for weak signals is then partly shifted to other sectors, but the methods remain the same. When the analysis of these signals takes place in relation to design issues, the trends can then be translated into the form of cartograms [39] or maps and post-its allowing sorting and discussion around weak signals [40]. However, while these monitoring methods seem to be mastered, monitoring innovations for disruptions poses the problem of identifying relevant influential sectors. In this respect, it shares the same problem as monitoring radical innovations: the collection and sorting of data in order to identify certain variations over time that can be interpreted as weak signals.

3.3 Routine signal

In addition to the weak signals, it is possible to look at some stronger signals, but which are generally not or only slightly taken into account. These are the routine signals. In fact, these signals reflect the progressive evolution of trends and innovations, especially with regard to their stagnation in terms of patterns. Routine signals should warn about trends that no longer surprise anyone in their field [6]. One of the advantages of these signals is that once the effort is made to look for them, they are much easier to spot than weak signals. In contrast to weak signals, the questioning that accompanies them is based on proven predictions that can be identified in reverse to highlight certain elements or decisions that are too predictable. Once identified as weak signals, they express evolutionary and decision-making constants which, like weak signals, can be translated into threats or opportunities for the organization concerned. For example, if the sale of a product in a particular line always follows the same process and is made under roughly the same conditions, there is an opportunity to do things differently and thus surprise other market players. If nothing is done, one player will end up taking the initiative for this type of change.

We can cite a few known examples that have impacted a market following an important change in practices or product design: Nintendo with the Wii, Nestlé and the Nespresso, Dyson and its bagless vacuum cleaner, RedBull and the energy drink for the general public, and so on. Very often, signals of routines can be indicators of risks or opportunities for implementing a Blue Ocean strategy. This is a strategy of using other attributes and targeting other customers to ensure significant development when a market begins to become saturated [41]. The fact that entry into a market becomes very difficult and that the market is subject to a price war is an important indication of the need for a Blue Ocean Strategy for the players taking part in this price war. Weak

signals will therefore make it possible to identify the fact that a market tends to become saturated and routine signals will also make it possible to identify a certain number of constant attributes on which most players no longer innovate or only innovate in an incremental and therefore relatively predictable manner [14].

3.4 Research Gap and Problem Statement

The recognition of certain routine signals allows questioning the existence of particular weak signals and vice versa. To search for routine signals, it is simply necessary to identify redundancies over time as well as repeating cycles. In the field of design, the detection of these redundancies and cycles can be done by image analysis [41]. However, this usually means identifying and distinguishing attributes and shapes manually, which is very time-consuming. Recently, however, solutions have been developed to solve data acquisition problems in order to index images more efficiently. These new solutions use gaming.

3.5 Hypothesis

H_{O1}: Routine signals do not warn about trends that no longer surprise anyone in their field.

H_{O2}: Gamification is not transforming the way companies do market research.

4. RESEARCH METHODOLOGY

In recent years, when the usual data collection techniques reach their limits, a new solution can be considered: the development of a game with a purpose (GWAP). In fact, these are "games through which the playful activity makes it possible to collect data or to solve problems that are too complex, or too costly in terms of human and material resources to be solved by machines" [42]. These "games" are also associated with the recent trend of gamification [43][44][45][46]. To speak of gamification means to report a transformation of a task, an environment, or a tool in order to make it a bit playful and more fun to use or create by exploiting design principles from the gaming domain [47]. Gamification is transforming the way companies can approach many tasks including data collection, business intelligence or market research [48] or to involve the user in the idea generation process [49]. Thus, gamification, serious games and GWAP could play an important role in a knowledge management process [49][50] including knowledge acquisition and knowledge creation step. The contributions of gamification are not insignificant. Some works, notably [51], have shown that gamification improves the quality of generated ideas in terms of fluency, flexibility and originality, and revealed significant differences with tests without gamification. GWAPs are thus a way to stimulate more people to solve a previously tedious task. Thus, the game is an interesting solution to collect data. Because, if the game is well done, it focuses the attention of its participants. In fact, it seems that crowdsourcing exhibits a strong dependence on attention [52].

4.1 Research model

Currently, it seems that the greatest success among gamification and GWAPs is the Foldit software [42]. It was originally software for simulating the folding of molecules in three dimensions and has been redesigned in the manner of a casual game (a small occasional video game of which Candy Crush Saga is one of the best-known representatives). The objective of this software gamification was to discover realistic bending configurations of molecules from the point of view of maintaining energy bonds and which would prevent viruses such as AIDS from attaching themselves to the molecules concerned. Exploration by computer simulations alone did not give convincing results, so the idea of a bending game proposed to a very large number of people was developed. Foldit was proposed as a puzzle game to a crowd of players in a crowdsourcing perspective [53]. With this serious game, which is still available, protein folding problems are presented, one by one and in order of increasing difficulty, to people who wish to take up the challenge. As in the majority of current casual games, sound effects accompany the player's configurations, who receives badges as a reward in addition to the display of his or her score, which he or she can post on social networks [54]. Once a certain level is reached, Foldit offers a folding feature whose solution is unknown to everyone but can be verified with the software. After several tens of thousands of people have played the Foldit game, one of them understood through gaming experience how to solve the final problem whose solution was unknown. The solution was found within a few weeks of playing the game when years of "classic" research had failed [55].

Foldit is not the only success story of gambling or goal-oriented gambling (GWAP), but its success has inspired many people to try to solve problems through gambling. Thus, since the emergence of GWAP and even more so since Foldit's success, there have been a significant number of relative data acquisition successes through gaming. Among these, there are many games whose objective is to have relevant words for indexing or labeling images [46][54][56]. In the vast majority of these games, including the representative Google Image Labeler developed by the father of GWAP Luis Von Ahn [57], two players try to find the keywords used by another player to define an image. If a player finds a keyword already referenced, he scores points. In order to work well, these games require a large number of indexing players, which constrains their design. However, from a strategic intelligence perspective, we found it difficult to call upon a very large number of players, since discretion is required [58]. Therefore, our objective in designing a game associated with a monitoring system was limited to the motivation of a few dozen people, which corresponds to people that can be solicited within a company or a sufficiently small group that can, if necessary, sign an explicit confidentiality clause.

This is why, in order to mark, in particular, this difference with gamification and GWAP, we

have preferred to use the term disengagement. This is a development process that works in contrast to gamification. With gamification, it is a question of imagining how tools, tasks, or environments can be transformed using elements that make video games a success [59]. With the disengagement approach, the reasoning is reversed. First, of course, we identify a problem and try to understand it (in our case, it is a need for data acquisition). Then, we look for a game that, a priori, has the potential to solve the problem. Once we have found the game, we then imagine how to transform it into a tool to solve the problem. In order to do this, the chosen game must therefore have characteristics that correspond to the needs of visualization, sorting, knowledge sharing, etc., which would make it possible to solve the problem under consideration. The GWAPs can be developed based on existing games, including board games or card games [60].

As previously mentioned with the Google Image Labeler, indexing images using a form of GWAP is not new. From the point of view of designing a set of cards dedicated to this purpose, previous experiences are a little more rare [53][61], but some can be found, some of which can be associated with a monitoring system [62]. However, we have not found any case of GWAP intended for a design trend monitoring. This is for us the main originality of our proposal completed by the fact that it does not require to solicit a large number of people which makes it a discreet monitoring solution [63].

4.2 Data collection

As mentioned above, our work focuses on highlighting signals related to product design. The aim is to solve a problem of data and information acquisition concerning the shape of objects from image observation. As far as our application case is concerned, we already had a corpus of about fifty images showing as many "standard" controllers (i.e. supplied with the console in its most basic packaging) of video game consoles between 1972 and 2017. Our objective is to highlight several design routines before 2017, combined with a gradual reduction in the number of players on the market. Our hypothesis considers that these routines and market saturation are at the origin of the introduction of the Wii Nunchuk controller since Nintendo's CEO has himself confirmed the implementation of a Blue Ocean strategy for the development of this console [64]. Similarly, we suppose that the update in terms of controller design for the Playstation (3 and 4) consoles (PS move system), as well as the proximity of the Wii U and Nintendo Switch controllers can also be easily deduced with this solution [65].

4.3 Research methodology

A possible solution to highlight weak and routine design signals of these controllers was to establish a list of questions in order to have a description of their shape and visible components (for example the number of buttons and their positioning). However, this solution was very tedious and

could quickly reach its limits in terms of the time spent describing the images. This task is not very fun and therefore the volunteers were hard to find and convince despite the design sector involved. That's why we looked for an alternative solution based on games. We needed a quick and simple game that would be suitable to make this image description task more user-friendly. So, we started by running the image description process that we needed:

Images of controllers are collected, referenced with the name of the console and the year it was released on the market.

Images are selected and formatted to present the controllers in an equivalent manner and with a similar size.

The images are analyzed and described from an orientation (main face, top/bottom of the joystick, right/left side) in the form of a list of attributes (example: the shell is made of a single block, it is crescent-shaped, it has a directional cross on the left side of the main face, etc.)

The referenced attributes are analyzed according to their number of appearances per year.

Potential weak signals and routine signals are identified and prepared for discussion with experts or sent directly as an alert.

Following the feedback from the discussion or alert, new image collections and analyses are made.

After reflection, we considered that certain stages of this process were part of a "classic" monitoring approach and did not pose any problem. The gambling research, therefore, did not focus on these steps. However, we felt it was important to associate the stage and problem of collecting data from image descriptions with gambling. This problem translated into the form of a game was like finding a game in which one tries to describe objects that one then tries to group together. This is how we identified Gin rummy as a game to be transformed. In this card game, each player tries to get rid of the cards in his or her hand by trying to establish sequences of at least three cards of different values, but of the same suit, or groups of cards of the same value, but of different suits [66]. A game consists of several rounds, in each of which players start with 10 cards in hand and must make groups of cards in order to be the first to run out of cards in hand. When this is the case, the other players then have pointed penalties depending on the cards they have left [67].

5. DATA ANALYSIS

We named the transformation of this game that would be dedicated to the highlighting of attributes from images: Rummy of attributes. It is a game for recognizing the commonalities between images offered on a support in the form of a map [68]. It requires a map development

phase before it can be played. Each of the cards made up presents a photograph of a joystick with the name of the corresponding console, its year of release, and a number identifying the card (figure 1).

Figure 1. Example of a card group with some common attributes.

5.1 Population sampling

The game itself is played according to the following rules:

- 2 to 8 players are brought together
- Each player receives, to start a round, 8 cards that form his hand and that he hides from the other players (each player ignores the cards that the others have in their hands, but can know the number of cards in their possession).
- The rest of the cards are placed on the table (face down) as a draw pile, next to which the first card of the draw pile is placed face up as the first card of the stockpile.
- The first player may either take the card face up from the stockpile and then turn over a new card to occupy that position, or take the top card from the deck.
- The same player may:
    - announce the constitution of a group of cards and place it in full view of everyone on the table (this group must include at least 4 cards with a common point corresponding to the name given to the group, for example 1 directional cross on the left ;
    - complete with at least 1 card, 1 or more groups of cards placed on the table;
    - draw from any group of cards already formed to form another group, provided that no group consisting of less than 4 cards remains on the table.
- Each player may create as many groups of cards as he can in his turn, provided that it takes less than one minute.

- The player scores 1 point per card added to an already created group or as many points as the new group he has created contains cards (the announcement of a new common point between the cards of the same group automatically changes the name of the group).
- Before finishing his turn, the player must make sure that he has less than 10 cards in his hand, if this is not the case, he must discard a card that he places on the discard pile.
- When a player has completed his turn, it is up to the next player to play (clockwise).
- If the draw pile is empty, the discard pile is taken, shuffled, and the deck is replaced to form a new draw pile by turning over the first card face up.
- The round ends when you have finished the draw pile and you have already redistributed the deck twice or once there is no more draw pile.
- The points scored by each player are added up by removing 1 point for each card still in his hand.
- The player with the highest point total wins the game (if the game is played in one set, but you can also decide the winner in 3 sets).

At the end of one play, the players have created a set of group names, which allows a set of descriptive attributes to stand out from the images.

6. DISCUSSION

6.1 Game integration in a monitoring system

Once the game has been designed and tested, its integration into the knowledge acquisition system is simple to achieve (figure 2). The game acts as a complementary source of information and data for human resources. It requires only an initial phase of image indexing followed by a phase of card creation, which itself ends with the printing and cutting of the cards. At the data collection level, we used post-its that are placed next to the groups created. It is, therefore, necessary to write the common attribute or name of the group of cards in a very legible way on the corresponding post-it [69]. The person designated as secretary notes, during the play, the names of the proposed groups on the post-its with the numbers of the corresponding cards [70]. At the end of one or more games, the knowledge acquisition specialist collects the post-its and may index all the attributes found in a database [71][72]. All that remains then is the problem of possible synonyms to manage before moving on to the processing and analysis of the collected data. Certain analyses will then allow the identification of cycles and constants in product design, i.e. signals of potential routines, or recent, slight changes, i.e. potential weak signals [20].

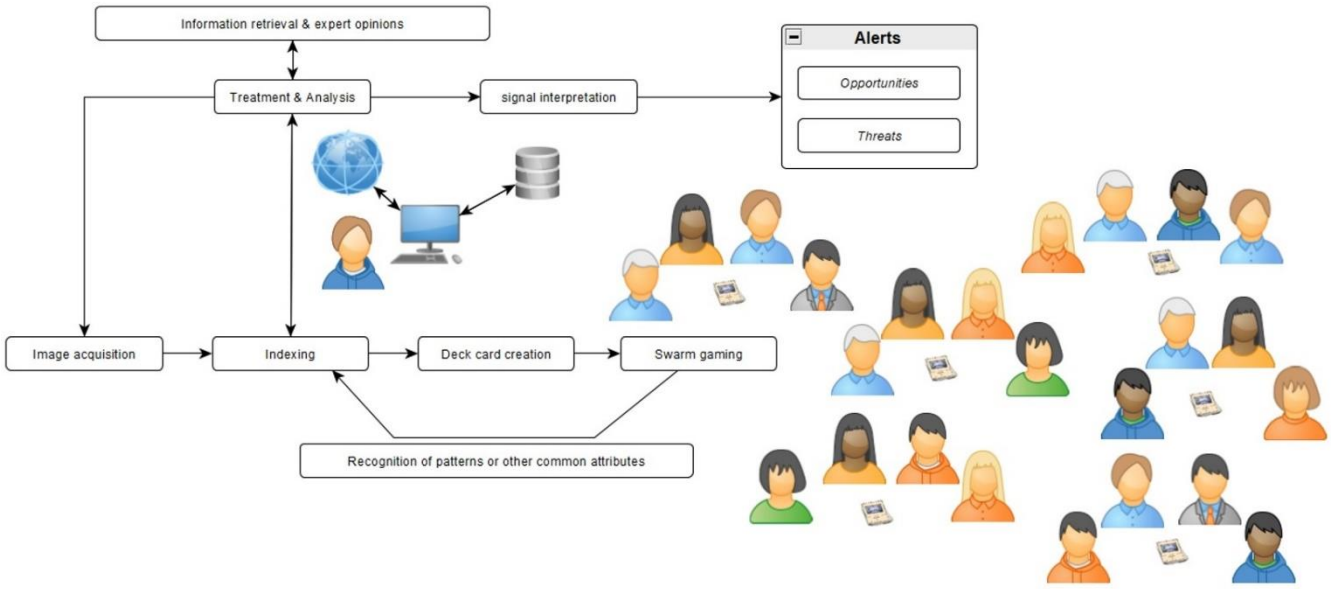

Figure 2. Design schema of a knowledge acquisition system using the rummy of attributes.

In order to consolidate the collected data, not to bore the voluntary players, and to vary the profiles of the participants the swarm gaming format is advised. The principle is simple, the idea is to offer several plays of the game to different people [73]. After several plays, verification, cross-checking, or calling on a group of experts, the information monitoring specialist then translates the signals thus identified into warning signals associated with opportunities and threats to disseminate them in the most appropriate form to the decision-makers concerned [74].

7. RESULTS AND CONCLUSION

For the moment we have been able to test the Rummy of attributes with 81 people (from the second year of the Bachelor's degree to the first year of the Master's degree). They are 6 male students in the second year of a computer science degree, 24 students in a professional computer science degree including one woman, 51 students in the first year of a master's degree in library science including 39 women. After many play, the results are very encouraging. After an invitation all but 9 students played a game again [75].

People enjoy the game and quickly understand the usefulness of the collected data. All participants easily understood the rules and were able to play within minutes. A simple two minutes demonstration was enough to understand how the play works. We did not have to do anything more. Just remember to index the cards and don't just play and forget the purpose of the game. 24 students did not wait for an invitation to play a new round when the first game ended. After invitation [76].

The rounds take, for a set of 62 cards, from 10 to 15 minutes. A test with a set of 40 cards was also carried out with recipe images. This also seems to work well. It is in fact the notation of

attributes on the post-its that slows down the game. It seems to us that a completely digital version of this game could speed up the indexing of the revealed attributes, but we also assume that this will have an impact on the participants as well as certain modalities for starting the game (several players must be able to access the game at the same time) [77]. We have not yet been able to have a digital prototype made that would easily allow for networked multiplayer play, map design, and indexing of the data collected. This remains a project we would like to see completed. For example, we would like to know if when the people asked to play are decision-makers concerned by this monitoring, the user-friendliness, and discussions made possible by the card game continues in digital form. However, on the basis of our first experiences, we make the hypothesis that GWAP in the form of card games (digital or paper) seems to be a solution that can be easily adapted to various contexts according to the preferences of the designers, the specificities of the data to be collected and the means made available to those in charge of the knowledge acquisition or competitive intelligence [78][60].

Another possibility that seems interesting to us concerns the exploitation of the cards already made from a new game, i.e. from the development of new rules. In particular, we are thinking of collecting data about the advantages and disadvantages of products, which would be a good complement to the identification of trends in product design [72].

Finally, another perspective that this system offers is that of its exploitation as a captcha tool to improve automatic shape (design) recognition [79]. Thus, the play help to identify shapes and trends, while the tool, in addition to stocking and graphically shaping the data, learns to recognize shapes and improves its possibilities of automating a monitoring in this way.

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