

# User Time Spent between Persuasiveness and Usability of Social Networking Mobile Applications: Patterns of Influence

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**Abstract:** Using social media is one of the most common activities for mobile users. Moreover, it is a time-consuming activity that can lead to addiction. Some gaps in HCI (Human Computer Interaction) ergonomics theory gave rise to this addiction. These gaps lie in an overexploitation of the usability and/or persuasion criteria that designers and/or developers use according to their needs when applying influence strategies to affect users' engagement. Although these strategies are widely applied in online social networks, they are not well identified and their application levels are still lacking. This paper seeks to establish and validate these influence strategies. We proposed five (05) patterns of influence in online social networks that have a significant impact on Users' Time Spent (UTS) grouping the different usability criteria and persuasion strategies. Then, we conducted a classification study of those criteria / strategies, using Hybrid Card Sort method carried out by fifteen (15) eligible experts. Experts were asked to group those criteria / strategies into a set of patterns based on our predetermined (with the option to create their own patterns). The results analysis validates our five (05) proposed patterns paving the way to outline their application borderline thereafter.

## 1 INTRODUCTION

The use of social media such as Facebook, Instagram and YouTube has become the cornerstone of modern communication and connection<sup>1</sup>. The average social media user spends 135 minutes a day online. Knowing that 60 percent of social media consumption comes from mobile devices<sup>2</sup>.

A new purpose has emerged, with the great evolution of social media: to capture the attention of users and to maximize their engagement. In other words, maximize the time that users spend with social media, which can lead to addiction (Kuss and Griffiths, 2011).

In our paper (Bedjaoui et al., 2018), we presented our study about the usability and persuasion of the most used social networking interfaces Facebook and YouTube according to the UTS (Users' Time Spent). We conducted heuristic inspection using (Bastien and Scapin, 1993) usability heuristics and (Némery and Brangier, 2014) persuasion criteria grid to evaluate both interfaces. We showed that there are some gaps in the HCI (Human-Computer Interaction)

ergonomics theory that gave rise to addictive interfaces. Some usability criteria (Guidance, Explicit control, Compatibility) and persuasion criteria (Personalization, Priming, Commitment, Ascendancy) are overexploited for the purpose of persuading users to spend as much time as possible. (The "overexploitation" of persuasive techniques and ergonomic criteria, turns the techniques that should serve the user into techniques that manipulate him/her).

These overexploitation lie in the fact that designers and/or developers use their judgments to implement the different usability and persuasion criteria. In addition, these criteria have no application borderline. Thus, designers or developers can apply them according to their needs or interests without necessarily considering the users objectives (how they want to spend their time), their relationships (interpersonal and social choices), their mental and emotional limits (vulnerabilities, tiredness and ways in which their minds form habits), etc.

In the present paper, we seek to frame the various techniques and strategies of influence used by social media that aim to persuade users to stay online for as

<sup>1</sup><https://www.psychologytoday.com/us/blog/in-excess/201805/addicted-social-media>

<sup>2</sup><https://strikesocial.com/blog/50-social-media-stats-every-marketer-should-know-in-2018/>

long as possible and that led to overexploitation of usability / persuasion criteria, into a set of patterns.

Our purpose is to establish the influence patterns in order to define their application borderline thereafter.

At first, we proposed five (05) patterns that regroup, the different usability criteria and persuasion strategies (Suggestion Pattern, Reminder Pattern, Reward Pattern, Interaction Pattern and Social Influence Pattern). Then and in order to validate our proposed patterns, we conducted a classification study of those criteria / strategies, using Hybrid Card Sort method carried out by fifteen (15) eligible experts.

The remainder of the paper is organized as follows. In section 2 we give a background of the usability and persuasive technology. In section 3, we discuss related work. We give details on the study methodology in section 4, and we present the results and their analyses in section 5. In section 6 we discuss the application and relationship between these patterns as well as their influence on UTS. Finally, section 7 presents some concluding remarks and outlines topics for future research.

## 2 THEORETICAL BACKGROUND

### 2.1 Usability

The concept of usability aims to develop simple and effective interactions that take into account users' reasoning, their workload, their constraints (environment, position, and task) and strain (fatigue).

Several definitions have been proposed for usability, the well-known and commonly used was proposed by (ISO 9241-11, 1998): "The extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use".

Other definitions of usability have been proposed. They focused on more specific usability criteria, for example, (Nielsen, 1994) considered "efficiency", "ease of learning", "memorization", "errors", "safety" and "satisfaction", where (Shneiderman et al., 2016) emphasized "efficiency" and "effectiveness".

Several grids of usability criteria have been proposed for the evaluation and design of products and systems. The best known are those of (Bastien

and Scapin, 1993) including several elementary criteria grouped into eight general principles:

**Guidance:** All the means implemented to advise, direct, inform and lead the user during his interactions (messages, alarms, labels, etc.)

**Workload:** A set of interface elements that help reduce user's perception and memorization load and increase the dialogue effectiveness.

**Explicit Control:** Concerns both the system processing of the explicit actions of users and the control that users have over the handling of their actions by the system.

**Adaptability:** Refers to the ability of a system to react according to the context, and according to the needs and preferences of users.

**Error management:** All the means that aim to avoid or reduce errors, and to correct them when they occur.

**Consistency:** Refers to the way in which interface design choices (codes, denominations, formats, procedures, etc.) are kept for the same contexts, and are different for different contexts.

**Significance of Codes:** Refers to the adequacy between the object or information displayed or input, and its referent.

**Compatibility:** Refers to the agreement that can exist between the characteristics of the users and the tasks, on one hand, and the organization of the outputs, the inputs and the dialogue of a given application, on the other hand.

### 2.2 Persuasive Technology

Persuasive design, persuasive interfaces, persuasive technology and Captology are all denominations, which, according to the literature refer to the same phenomenon. All of these terminologies refer to modifying (or attempting to change) the attitude or behaviour of users through interfaces and guiding them to take actions that they would not have done spontaneously. (Fogg, 2002) has been among the first contributors in the field of persuasion technology for which he coined the term "Captology," an abbreviation for "Computers As Persuasive Technology", which he defines as "design, research, and analysis of interactive computing products created for the purpose of changing people's attitudes or behaviours". This concept describes an area in which technology and persuasion overlap. (As shown in Figure 1.)

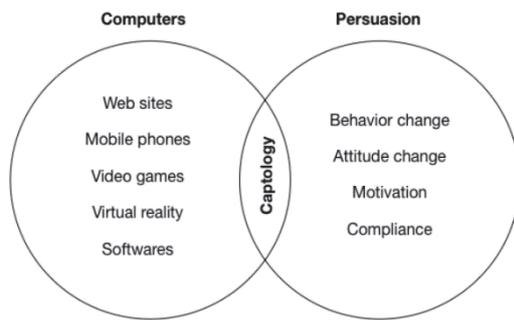


Figure 1: Captology.

He introduced the six basic levers of persuasive technology:

- **Computer as Persuasive Tools:** Presents the persuasive technologies that aim to bring users to the expected behaviour or attitude by increasing their ability to achieve them.
- **Computers as Persuasive Media:** Conceptualizes persuasive technologies supported by computers aimed at changing users' behaviours and/or attitudes through hypothetical experiences.
- **Computers as Persuasive Social Actors:** Characterize technologies that use the computer as a social actor whose goal is to change the behaviour of its users by exploiting the social dimension of technologies to influence users. This is the kind of relationship that occurs when the device plays the role of a teacher, coach, or expert (Davis et al., 1998).
- **Credibility and Computers:** Conceptualizes seven strategies according to the principle that only credible computing products can influence and convince users to change their opinions, attitudes or behaviours.
- **Credibility and the World Wide Web:** Conceptualizes the strategies defined for use on websites whose objective is to convince users that a specific website is the best way to access certain information or certain content.
- **Increasing Persuasion through Mobility and Connectivity:** Conceptualizes the strategies defined for use on mobile devices that persuade users in the appropriate time and place.

(Oinas-Kukkonen and Harjumaa, 2008) defined persuasive system as “a computerized software or information system designed to reinforce, change or shape attitudes, behaviours or both without using coercion or deception”. They proposed a framework called Persuasive Systems Design (PSD) (Oinas-Kukkonen and Harjumaa, 2009) for the development

and design of persuasive systems, composed into three distinct phases: (1) understanding key issues behind the persuasive system, (2) analysing the persuasion context and (3) designing the system qualities.

The first phase is concerned with understanding the key issues behind the persuasive system, where they define seven postulates that need to be addressed on designing or evaluating a persuasive system, as part of understanding the issues that underlie it.

The second phase of Persuasive Systems Design involves understanding the context of persuasion, which in itself consists of three aspects: intent, event, and strategy.

- **The Intent:** Involves understanding (1) who is persuader, and (2) what type of change is desired (change of attitude or behaviour).
- **The Event:** Involves analysing (1) the use context: what is happening around the behaviour or the habit, (2) the user context: user's goals and (3) the technology context, which are the system goals.
- **The Strategy:** The strategy must be clearly defined, which consists of understanding: (1) the Message that will be sent, and (2) the Route (how it will be sent).

The third phase of persuasive system development is the design of the system qualities. Where they define four supports of persuasive technologies that regroup 28 strategies, essential to the establishment and maintenance of persuasion:

- **Primary Task Support:** Includes the design principles that help users to carry out their main task. Which are reduction, tunneling, tailoring, personalization, self-monitoring, simulation, and rehearsal.
- **Dialogue Support:** Includes the design principles related to the establishment of communication between human and machine (product). Which are praise, rewards, reminders, suggestion, similarity, liking, and social role.
- **System Support Credibility:** Includes the design principles that describe how to create a more credible and thus more persuasive system. Which are social facilitation, social comparison, normative influence, social learning, cooperation, competition, and recognition
- **Social Support:** Includes the design principles that leverages social influence to motivate the users. Which are social facilitation, social comparison, normative influence, social learning, cooperation, competition, and recognition.

### 3 RELATED WORKS

We classified existing related work into three categories:

- The first category presents researches that determine models of persuasion.
- The second groups presents the approaches that determine the patterns of persuasion in online social networks.
- The last groups presents researches that determine the patterns of social influence, in social networks and the persuasive systems in general.

The first category presents researches such as those of (Fogg and Eckles, 2007). They analysed the persuasiveness of over 50 “Web 2.0” services. Based on this analysis, they identified a model applied by all major social networks, called “Behaviour Chain Model”. It outlines three Phases: “Discovery”, “Superficial Involvement”, and “True Commitment”. The first phase, “Discovery”, aims to preconize the service provided by encouraging users to become familiar with the site and to visit it. Once users endorse to the service, they enter the second phase: “Superficial Involvement”. During this phase, the site highlights the possibilities of creating content and exchanging information with other users in order to motivate them to try the service. The third phase, “True Commitment”, is characterized by three keys target behaviours: (1) creating value and content, (2) involving others, and (3) staying active and loyal. The model gives important information about the stages of behaviour change. However, it does not present the influence strategies that support it.

The second category describes persuasion patterns. (Iosub et al., 2009) have examined the social application features of the three main Romanian Social Networking Sites (SNSs), namely Facebook, Hi5 and Neogen, on six dimensions corresponding to the principles of social influence of (Cialdini, 1984) : Reciprocation, Consistency, Social proof, Liking, Authority, and Scarcity.

Their purpose was to determine how the principles of social influence were integrated into the design of SNS in order to achieve marketing goals, as well as to determine which principles of social influence are not currently used in the design of SNS, and their application could potentially have a relevant and value-adding effect on SNS competitiveness.

They analysed the three SNS from three perspectives: social influence principles - marketing goals, social influence principles - social networking site and marketing goals - social networking site, and they showed that social networking sites are mainly

organized according to social principles (reciprocity, authority, social proof and taste).

In the same context (Adaji and Vassileva, 2016) sought to identify the persuasion principles of Q&A social networks. As a case study, they analysed the StackOverflow network (social network where users ask and answer questions related to IT). The authors used the model PSD to analyse the social network where they identified all persuasive principles present in the PSD model, with the exception of just four: tunnelling, rehearsal, reminders and similarity. The authors conclude that each principle identified in the social network StackOverflow seeks to promote the engagement of users on the network.

However, their work was not comprehensive. The first paper focalized on social design features under relevant theoretical framework derived from social psychology where the second paper focused just on one type of social networks.

The last category presents researches that emphasize only social influence and its patterns. For instance, (Weiksner et al., 2008) studied Facebook as a persuasive technology using a Grounded Theory approach. They found and named six persuasion patterns. They classified these patterns into two categories: Native Patterns, relying on the functionality provided by Facebook, and Adapted Patterns, relying on functionality that was designed for other contexts (e.g., desktop software, web sites, video games, etc.).

The Native Patterns are composed of:

- **Provoke and Retaliate:** Allow a user to act towards another user, by exploiting the principle of reciprocity, the recipient of the gesture has the social obligation to respond, according to the norm of reciprocity.
- **Expression Pattern:** Allow users to create artifacts to express opinions or affiliations, etc., by exploiting the psychological principle of ingratiation.
- **Reveal and Compare:** Allow a group of users to act towards another group of users, by exploiting the principles of reciprocity, cognitive dissonance, the need to belong and social validation.
- **The Group Exchange:** Allow a group of users to create artifacts collectively following the principles of impression management, reciprocity, social validation, and context variables such as feedback and applause.

The Adapted Patterns are composed of :

- **Competition:** Consists of enhancing competition between users in order to motivate them to do particular actions.

- **Deception:** Exploits the trust already acquired from users to persuade them to achieve other desired goals.

(Oduor et al., 2014) proposed software design patterns for social influence. They aim to facilitate the development of effective persuasion systems and to make a linkage between the intent of designers and users' interactions. They proposed four patterns: social learning and facilitation, competition, cooperation and recognition. The patterns for social learning and competition are based on sharing traces, whereas cooperation and recognition rely on rich exchanges of support between users.

Nevertheless, those works focused solely on the social dimension and they did not take into consideration all the other strategies and influence processes present in the social network.

To the best of our knowledge, there is no study in the literature that has extracted all the strategies of

influences into a set of well-defined patterns in an inclusive way. An approach that presents, explains and regroups the different strategies of influence used in the different social networks, considering the different influence dimensions (social, mental, etc.). In addition, in our study, we present a direct relationship between the identified patterns and the usability/persuasion theory, and thus the criteria that have been overexploited.

## 4 STUDY METHODOLOGY

At first we proposed five (05) patterns according to a classification of usability criteria (the eight (08) usability criteria for the design and evaluation of HCI (Bastien and Scapin, 1993)) and persuasion strategies (of the PSD model proposed by (Oinas-Kukkonen and Harjumaa, 2009)) that we realized in advance defined in table (Table. 1).

Table 1: Description of the five (05) proposed patterns.

| Pattern name             | Definition   | Examples  |
|--------------------------|--|---|
| Suggestion Pattern       | The fact of presenting the right information at the right time gradually and in an allusive way, compatible with the characteristics of the user, to his needs, interests, and usage context, with the aim of capturing his attention, in order to bring him to engaging actions and to ensure his allegiance. | <ul style="list-style-type: none"> <li>▪ Providing "Friends Suggestion", "Recommended Pages" and "Suggestions of groups" functions on Facebook.</li> <li>▪ Providing a set of related videos under the video selected by the user on YouTube.</li> </ul>  |
| Reminder Pattern         | Any messages that interrupt users immediately, leading them to respond to the delivered messages asynchronously. It can take various forms, such as an email, a social notification or an SMS.   | <ul style="list-style-type: none"> <li>▪ Facebook, YouTube, LinkedIn, Twitter or Instagram notifications.</li> <li>▪ WhatsApp, Messenger or Snapchat, messaging system.</li> </ul>  |
| Social influence Pattern | Any form of influence that emphasizes the social influence (comparison, competition, reciprocity, etc.) in order to reinforce the pressure of other members on the actions of an individual.   | <ul style="list-style-type: none"> <li>▪ Number of views for each video (on YouTube).</li> <li>▪ Number of likes of each posts (on Facebook).</li> <li>▪ Number of followers/tweets (On Twitter).</li> </ul>  |
| Interaction Pattern      | Any form of incitement or restriction that makes targeted actions easy and simple while gradually increasing the cost of the actions requested, or deterring unwanted actions in order to make them more difficult than they need to be.   | <p>Generally, social media interfaces facilitate tasks that they want users to perform such as (inviting and connecting to friends, registering in groups, adding more pages), by making them simple actions.</p> <ul style="list-style-type: none"> <li>▪ Example: ("Invite", "Like", "Share" and "Register" buttons).</li> </ul> <p>And complicate the unwanted actions that they do not want the user to perform (disable notifications, delete an account, etc.) for example:</p> <ul style="list-style-type: none"> <li>▪ On Facebook, user cannot turn off all notifications. He can just choose the mode and the nature of the notifications he receives.</li> <li>▪ Deleting an account on Snapchat requires multiple steps as well.</li> </ul> |
| Reward Pattern           | Any form of encouragement of user's interaction through forms of rewards that come to reward the user in the success of his first interactions. It aims to reinforce his initiatives and maintain his engagement.  | <ul style="list-style-type: none"> <li>▪ News feed with an infinite scroll (Facebook).</li> <li>▪ Autoplay feature (YouTube) unending videos.</li> </ul>  |

Afterwards and in order to validate these patterns, we adapted a hybrid card sorting method, implemented on the web using the OptimalSort tool (Figure 2).

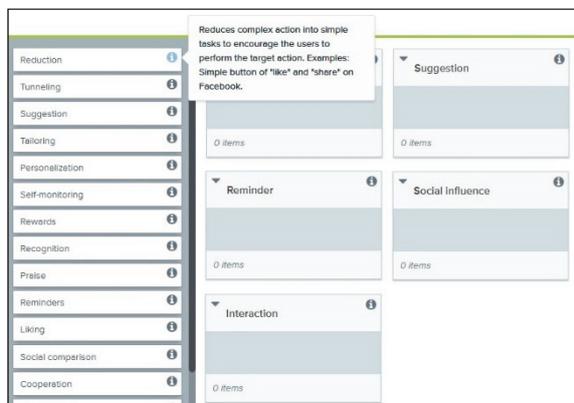


Figure 2: The OptimalSort Card Sorting Interface. (<http://www.optimalworkshop.com/>).

We invited fifteen (15) eligible HCI experts to participate in our study (5 men, 10 women), among them, 9 are specialized in User Experience/Ergonomics, 2 in Social Computing/Human-Computer Interaction, 3 in Multimodal interaction / Human-Computer Interaction, and the remaining one in Human-Computer Interaction and software engineering. Ten (10) of them have more than ten (10) years of experience in the field of HCI.

We believe that with the data of 15 experts we will achieve the desired results since with 15 participants the results obtained have a correlation of 90% as affirmed by (Nielsen, 2004).

As cards, we choose the twenty-two (22) strategies of persuasion of the PSD model proposed by (Oinas-Kukkonen and Harjumaa, 2009), because it is the only framework that exists, designed for the development and design of persuasive systems. We choose also the eight (08) usability criteria for the design and evaluation of HCI proposed by (Bastien and Scapin, 1993). The thirty (30) criteria/strategies were presented with definitions and examples.

Participants were invited to group the eight (08) usability criteria and the twenty-two (22) strategies of persuasion into categories. In addition to the categorization that we proposed, we asked experts to create their own categories if necessary, by assigning a meaningful name to each category.

For analysing participants' data, we adapted both exploratory and statistical approaches. For the exploratory one, we used Donna Spencer's (Spencer, 2009) spreadsheets in order to understand each expert's categorizations, to create standardized

categories (which is an essential part of card sorting) and to generate correlation matrix in order to summarize the range of classification as well as to provide information about each card's placement and the relationship between cards and participants. While for the statistical approach, we used Hierarchical Cluster Analysis (HCA) using complete linkage method in order to highlight patterns in data.

## 5 RESULTS AND ANALYSIS

### 5.1 Standardizing Categories

At first, we inserted the data of each participant extracted, in Donna Spencer's (Spencer, 2009) spreadsheet (Figure 3. Shows the generated matrix). Each row represents a card and each column a participant. The row and column intersection has the label for each category. Then, we began standardizing the labels of categories created by experts in order to create a set of consistent categories' labels.

| Card no | Card name             | Sort1      | Sort2      | Sort3      | Sort4      |
|---------|-----------------------|------------|------------|------------|------------|
| 1       | Adaptability          | Interacti  | Suggest    | Interacti  | Interacti  |
| 2       | Compatibility         | Suggest    | Social in  | Suggestion | Interacti  |
| 3       | Consistency           | Social in  | Social in  | Reward     | Social in  |
| 4       | Cooperation           | Interacti  | Social in  | Interacti  | Interacti  |
| 5       | Error Management      | Reward     | Social in  | Reward     | Social in  |
| 6       | Expertise             | Interacti  | Reminder   | Interacti  | Reminder   |
| 7       | Explicit Cont         | Social in  | Social in  | Reward     | Social in  |
| 8       | Guidance              | Interacti  | Social in  | Interacti  | Interacti  |
| 9       | Liking                | Social in  | Social in  | Suggestion | Interacti  |
| 10      | Normative in          | Social in  | Social in  | Social in  | Social in  |
| 11      | Personalizat          | Suggestion | Suggestion | Suggestion | Suggestion |
| 12      | Praise                | Reward     | Social in  | Social in  | Reward     |
| 13      | Recognition           | Social in  | Reward     | Social in  | Reward     |
| 14      | Reduction             | Interacti  | Interacti  | Inf        | Interacti  |
| 15      | Reminders             | Reminder   | Reminder   | Re         | Interacti  |
| 16      | Rewards               | Reward     | Reward     | Re         | Interacti  |
| 17      | Self-monitoring       | Interacti  | Reminder   | Inf        | Interacti  |
| 18      | Significance of Codes | Interacti  | Suggestion | Inf        | Interacti  |
| 19      | Similarity            | Suggestion | Social in  | Suggestion | Social in  |
| 20      | Social comparison     | Social in  | Social in  | Social in  | Social in  |
| 21      | Social learning       | Social in  | Social in  | Social in  | Social in  |
| 22      | Social facilitation   | Social in  | Social in  | Social in  | Social in  |
| 23      | Suggestion            | Suggestion | Suggestion | Suggestion | Suggestion |
| 24      | Surface credibility   | Interacti  | Social in  | Social in  | Interacti  |
| 25      | Tailoring             | Suggestion | Suggestion | Suggestion | Suggestion |
| 26      | Trustworthiness       | Social in  | Social in  | Social in  | Interacti  |
| 27      | Tunneling             | Interacti  | Interacti  | Interacti  | Interacti  |
| 28      | Verifiability         | Interacti  | Social in  | Suggestion | Social in  |
| 29      | Workload              | Interacti  | Interacti  | Interacti  | Interacti  |
| 30      |                       |            |            |            |            |

Figure 3: Worksheet with all the raw data.

The experts validated our suggested categories. They categorized the criteria / strategies using only our five proposed categories, with the exception of three experts, who proposed four additional ones. Thus, we intersected our categories and the additional ones proposed by experts based on similar words (terminology of labels), similar ideas and categories that contains similar cards.

For example, a participant created a category named "Restriction" that includes the cards (Explicit Control and Tunneling). However, we found that it was a subcategory of the "Interaction" category (which covers the "restriction" and the "incitement"). Another example, two participants created two categories named "Customization or Personalization" which means: "The content customized to the needs of the

user” and “Data Influence” which means: “the data that influences the user in order to attract him”, including cards (Adaptability, Compatibility, Personalization, Similarity, Suggestion and Tailoring). However, these two categories means the same as the “Suggestion” category, which means, “Offering fitting suggestions to the user in order to attract and incite him”.

### 5.2 Cards Placement

After the standardization process, we had an average of five (05) categories. Table. 2 recaps the standardized

categories, the percentage of each cards’ placement and the content of each category as well as an insight of the relationship between cards, categories and participants. According to this table (correlation matrix generated by (Spencer, 2009)), we notice that all categories have at least one card with high agreement (75% or more of participants agreed to the placement of the cards), and 60% cards belong to categories with medium agreement (50% or more of participants agreed to the placement of the cards).

Table 2: The correlation matrix created for the hybrid card-sort (as generated by (Spencer, 2009)).

| Card name             | Interacti on | Remind er | Rewar d | Social influen ce | Suggesti on | Categori es for this card | Categori es with high agreeme nt | Categori es with medium agreeme nt | Categori es with low agreeme nt |
|-----------------------|--------------|-----------|---------|-------------------|-------------|---------------------------|----------------------------------|------------------------------------|---------------------------------|
| Adaptability          | 73%          | 0%        | 7%      | 0%                | 20%         | 3                         | 0                                | 1                                  | 2                               |
| Compatibility         | 33%          | 0%        | 0%      | 20%               | 47%         | 3                         | 0                                | 2                                  | 1                               |
| Competition           | 13%          | 0%        | 7%      | 80%               | 0%          | 3                         | 1                                | 0                                  | 2                               |
| Consistency           | 80%          | 0%        | 0%      | 7%                | 13%         | 3                         | 1                                | 0                                  | 2                               |
| Cooperation           | 13%          | 0%        | 13%     | 67%               | 7%          | 4                         | 0                                | 1                                  | 3                               |
| Error Management      | 47%          | 33%       | 7%      | 0%                | 13%         | 4                         | 0                                | 2                                  | 2                               |
| Expertise             | 0%           | 0%        | 20%     | 60%               | 20%         | 3                         | 0                                | 1                                  | 2                               |
| Explicit Control      | 80%          | 0%        | 7%      | 7%                | 7%          | 4                         | 1                                | 0                                  | 3                               |
| Guidance              | 60%          | 0%        | 0%      | 0%                | 40%         | 2                         | 0                                | 2                                  | 0                               |
| Liking                | 47%          | 0%        | 7%      | 40%               | 7%          | 4                         | 0                                | 2                                  | 2                               |
| Normative influence   | 7%           | 0%        | 7%      | 80%               | 7%          | 4                         | 1                                | 0                                  | 3                               |
| Personalization       | 40%          | 0%        | 0%      | 0%                | 60%         | 2                         | 0                                | 2                                  | 0                               |
| Praise                | 0%           | 7%        | 73%     | 20%               | 0%          | 3                         | 0                                | 1                                  | 2                               |
| Recognition           | 0%           | 13%       | 47%     | 33%               | 7%          | 4                         | 0                                | 2                                  | 2                               |
| Reduction             | 60%          | 0%        | 7%      | 7%                | 27%         | 4                         | 0                                | 2                                  | 2                               |
| Reminders             | 7%           | 93%       | 0%      | 0%                | 0%          | 2                         | 1                                | 0                                  | 1                               |
| Rewards               | 0%           | 7%        | 80%     | 13%               | 0%          | 3                         | 1                                | 0                                  | 2                               |
| Self-monitoring       | 27%          | 40%       | 7%      | 13%               | 13%         | 5                         | 0                                | 2                                  | 3                               |
| Significance of Codes | 73%          | 13%       | 7%      | 0%                | 7%          | 4                         | 0                                | 1                                  | 3                               |
| Similarity            | 13%          | 13%       | 13%     | 20%               | 40%         | 5                         | 0                                | 1                                  | 4                               |
| Social comparison     | 0%           | 0%        | 7%      | 93%               | 0%          | 2                         | 1                                | 0                                  | 1                               |
| Social facilitation   | 0%           | 0%        | 0%      | 100%              | 0%          | 1                         | 1                                | 0                                  | 0                               |
| Social learning       | 0%           | 0%        | 0%      | 100%              | 0%          | 1                         | 1                                | 0                                  | 0                               |
| Suggestion            | 7%           | 0%        | 0%      | 13%               | 80%         | 3                         | 1                                | 0                                  | 2                               |
| Surface credibility   | 33%          | 0%        | 7%      | 33%               | 20%         | 4                         | 0                                | 2                                  | 2                               |
| Tailoring             | 20%          | 7%        | 0%      | 0%                | 73%         | 3                         | 0                                | 1                                  | 2                               |
| Trustworthiness       | 27%          | 0%        | 7%      | 40%               | 20%         | 4                         | 0                                | 2                                  | 2                               |
| Tunneling             | 53%          | 0%        | 7%      | 0%                | 40%         | 3                         | 0                                | 2                                  | 1                               |
| Verifiability         | 40%          | 0%        | 13%     | 27%               | 13%         | 4                         | 0                                | 2                                  | 2                               |
| Workload              | 87%          | 7%        | 0%      | 0%                | 7%          | 3                         | 1                                | 0                                  | 2                               |

|                                  |    |    |    |    |    |
|----------------------------------|----|----|----|----|----|
| Cards in this category           | 23 | 10 | 20 | 21 | 23 |
| Cards with high agreement (>75%) | 3  | 1  | 1  | 5  | 1  |
| Cards with medium agreement      | 13 | 2  | 2  | 7  | 7  |
| Cards with low agreement (<25%)  | 7  | 7  | 17 | 9  | 15 |

- **Cards in this Category:** Refer to the number of individual cards placed in this category.
- **Cards with High Agreement:** Refer to the number of individual cards with a correlation of 75% or over (75% of participants or more used this category for the card).
- **Cards with Medium Agreement:** Refer to the number of individual cards with a correlation of 25%–50%.
- **Cards with Low Agreement:** Refer to the number of individual cards with a correlation of 25% or less.
- **Categories for this Card:** Refer to the number of categories used for this card.
- **Categories with High Agreement:** Refer to the number of categories with a correlation of 75% or over (75% of participants or more put this card in a consistent category).
- **Categories with Medium Agreement:** Refer to the number of categories with a correlation of 25%–50%.
- **Categories with Low Agreement:** Refer to the number of categories with a correlation of 25% or less (participants or fewer used any consistent category).

Next, we applied an HCA to the global data matrix of the 15 experts, we were able to identify and label the clusters on the dendrogram generated by the HCA. Figure 4 illustrates these results.

### 5.3 Patterns Extraction

According to the dendrogram (Figure 4), five consistent patterns are distinguished from the classification and are cited below:

- **Suggestion Pattern:** This pattern contains four persuasive strategies from PSD Model: Suggestion, Personalization, Tailoring and Similarity and one usability criteria from (Bastien and Scapin, 1993) ergonomic criteria: Compatibility.
- **Reminder Pattern:** This pattern contains one persuasive strategy from PSD Model: Reminders.
- **Social influence Pattern:** This pattern contains seven persuasive strategies from PSD Model: Social comparison, Social facilitation, Social learning, Expertise, Normative influence, Competition and Cooperation.
- **Interaction Pattern:** This pattern contains seven persuasive strategies from PSD Model: Reduction, Tunneling and to a lesser extent Verifiability, Liking, Surface credibility and Trustworthiness, and six usability criteria from

(Bastien and Scapin, 1993) ergonomic criteria: Workload, Adaptability, Consistency, Explicit Control, Significance of Codes and Guidance.

- **Reward Pattern:** This pattern contains three persuasive strategies obtained PSD Model: Rewards, Recognition and Praise.

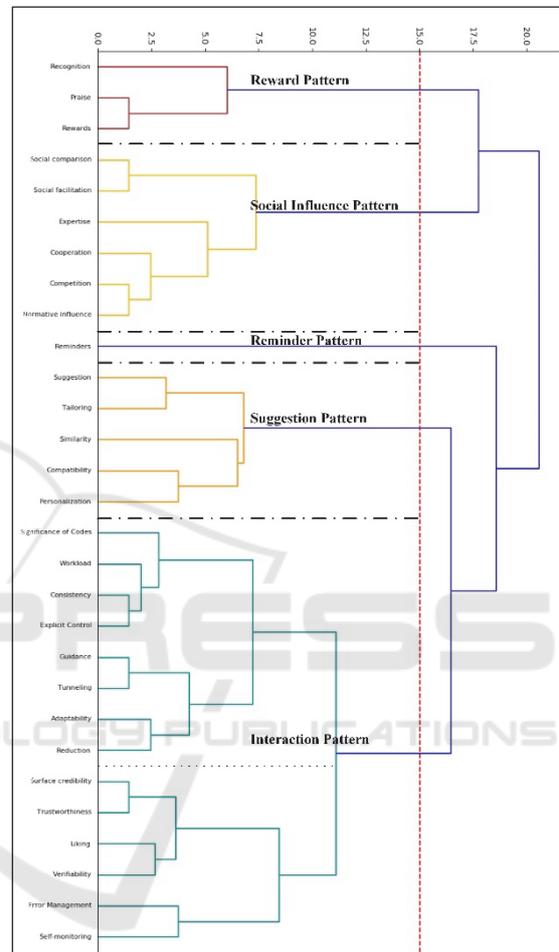


Figure 4: Dendrogram generated by the HCA of the hybrid card-sort.

### 5.4 Patterns' Relationships and Proximity

From Figure 4 we notice that there is a close relationship between patterns. The pattern “Interaction” is close to the pattern “Suggestion”, and both are in turn related to the pattern “Reminders”. This explains the design of social media that aims to attract the attention of the user and arouse his interest to undertake an engaging action, favourable to the media. On the other hand, the pattern “Social Influence” is related to the pattern “Rewards”,

applied to complete the total commitment of the user in order to control him.

## 6 DISCUSSION

In this paper, we identified five influence patterns that bring together all social media strategies having a significant impact on user time by applying hybrid card sorting method. We consider that those patterns are usually used together gradually since they support each other (as shown in Figure 5). In fact, the process of capturing the user is a temporal process that includes a start, followed by modifications of the user behaviour towards the media, leading to the objective sought (maximizing the UTS). Moreover, to bring the users to this objective, a social network must bring the user gradually over time, with a succession of phases, to capture their attention and especially to maintain their interest and their motivation.

First, the social media must solicit the user to take the first steps over the social media by offering him suggestions (proposing close people, adhere to groups, etc.), by exerting (social) pressure using the mechanism of normative influence or social comparison for example, or by reminding him of actions that he can perform (using instant notifications for example).

Moreover, to have the prescribed goal and the behaviour expected from the user, the social network must prompt him to take action where it is necessary using simple interactions (for example, buttons that say click here or subscribe now). On the other hand, the social network can complicate the unwanted actions desired by users (for example, disable the user account, or disable notifications).

Finally, the social media must reward the user for the success of his first interactions, in order to reinforce his initiatives and behaviours. Nonetheless, this process of patterns sequence is our own conclusion that may need some further research.

All these patterns are useful regarding usability and persuasion. They guide users, give them some control, present urgent messages, suggest desired videos, etc. Nevertheless, these results highlight important negative points (unlimited suggestions list, unlimited notifications at any time in the day even if there is no emergencies, etc.) encouraging users to use applications more frequently and for greater duration than they otherwise would.

In addition, patterns such as “Interaction Pattern” impose an important issue: complicating some interactions such as reducing notifications or disabling accounts is not recommended according to

usability criteria. According to (Christian Bastien and Dominique Scapin, 1993), the usability criterion “Minimal Actions” consists of reducing the number of actions necessary to accomplish a goal or a task (“limiting as much as possible the steps users must go through”). Thus, complicating some actions calls into question the interaction pattern and its use in ergonomics (especially in persuasion).

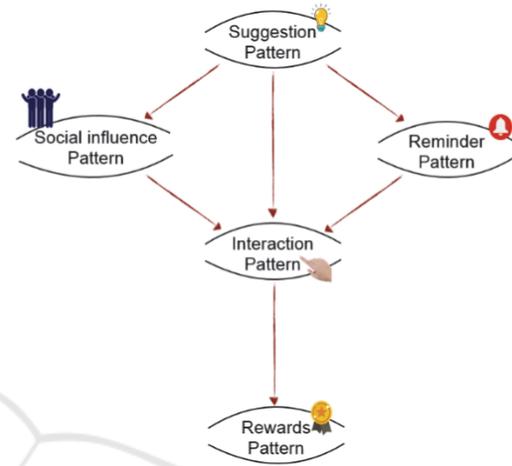


Figure 5: Relationships between patterns.

To summarize, exploiting all these patterns in usability and persuasion must be questioned not only because they have a big effect on the user's time, but also because their misapplication can conflict with the ergonomics theory and overexploit its criteria.

## 7 CONCLUSION

In our paper (Bedjaoui et al., 2018), we showed that there are some gaps in the HCI ergonomics theory that gave rise to addictive interfaces. These gaps lie in the fact that designers and/or developers have to use their judgments to implement the different usability and persuasion criteria, principles and rules. In addition, these criteria have no application borderline. Thus, designers or developers can apply them according to their needs or interests without necessarily considering the users objectives (how they want to spend their time), their relationships (interpersonal and social choices), their mental and emotional limits (vulnerabilities, tiredness and ways in which their minds form habits), etc.

In this paper, we identified five influences patterns using hybrid card sorting method. Those patterns have a significant impact on user time spent on the media and their misapplication can conflict with the ergonomics theory.

Now, we are working on an approach that frame these influence patterns. We are defining their application borderlines. For a particular pattern applied to support particular criteria, we are identifying rules that make its use more efficient (from user time viewpoint), keep its advantages and do not affect the supported criteria. Thus, while applying a pattern, designers or developers will be aware of the usage limits and thereby respect them to benefit from the mechanism advantages while respecting the users' time.

We believe that such an approach will allow to design and build products that motivate the active participation of the user and respect her/his time.

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