Chapter 139

Conceptualization and Measurement of How Cool the User Experience Can Be: A Systematic Review of the Literature

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ABSTRACT
This article presents a systematic review of the literature in order to define a more general concept of the term "coolness" and exemplify how it can be operationalized to measure how much the user experience is "cool". The motivation for carrying out this work is that the term has been integrated into the design of computational interfaces and has become part of human-computer interaction (IHC). Despite the valuable contributions to date, there is still no well-established concept. There is a need to develop a more comprehensive definition and a demand for the creation of an instrument that can determine how cool a computational interface is. Through a systematic review of the literature, articles that address the term "coolness" were analyzed. In this process, several subconcepts linked to each area were integrated, as well as instruments generated from these subconcepts to measure how legal a digital product is.

1 INTRODUCTION

Currently *cool*, in "legal" portuguese, it is a very common expression of approval to describe almost all entities, including objects, people or phenomena [Sundar 2014]. The term *coolness* has been explored by researchers in the area of Human-Computer Interaction (IHC), who seek subsidies for the design of interactive products. Psychological factors, such as *coolness*, are very important and used by professionals in various areas such as: designers, application and systems developers and marketing professionals, who apply them in new products and interfaces.

The *coolness concept* is being integrated into interactive design processes and become part of the human-computer interaction project [Bruun 2016]. Although researchers do not yet agree with a specific definition in the area of human computer interaction (IHC), what *is coolness* [Sundar 2014] there are some specific attributes that can be perceived by users and characterized as such.

The term *coolness* has been mainly addressed by researchers in the field of marketing [Nancarrow 2002], who try to define and better understand this concept [O'Donnell 2000], as well as explore it in the experience of users for creating more interesting products [Holtzblatt 2011]. But how can we define what coolness *is*?

Studies in areas such as marketing, psychology and IHC tie some concepts to *coolness* such as: emotions, affection, hedonic and pragmatic quality of the interface, fun, fluidity, enchantment, among others. Warren et al (2014) and Pricet al (2016) agree on four defining properties for the *concept that*

coolness is socially constructed. It can be said that it is a perception or attribution granted by an audience rather than an inherent risticnature of an object or person [Price et al 2016]. As popularity or status, it is similar to a socially constructed feature being highly related to the culture of the individual. In the market, the concept has been considered a provoking catalyst for the sale of products, so that a legal image helps to solidify the product, besides contributing to personal feelings of achievement, connection with others, identity and positive experiences. Some authors produced questionnaires with items identified in the context *of coolness* and factors related to subculture, attractiveness and originality, as a way of assessing how much a product is characterized as *cool*.

Despite the valuable contributions to date, there is still no general definition of the *concept of coolness* and how its aspects contribute to a good user experience (UX) in digital products. In this context, there is a need to elaborate a broader definition of the *term coolness* and a demand for the creation of instruments that can determine how cool an interface *is.*

A systematic review on the aforementioned theme is justified given the great relevance of the theme. Moreover, as far as we know,there is no systematic review in this perspective. Thus, it is important to conduct a systematic literature review (SLR) that culminates in a better understanding of the *term coolness,* as well as how it can be operationalized to measure the user experience. Thus, the contribution of this systematic review is to provide a broader definition, visualizing different aspects addressed in the literature, besides exemplifying howthe concept can be operationalized to measure how legal the user experience is in digital products.

2 IMPORTANCE OF THE CONCEPT *OF COOLNESS* IN UX

Why define a concept for *coolness and* understanding that *cool is* relevant to UX?

According to Raptis (2016) and Bruun et al (2016) in the area of HCI, our interactions with digital technologies are investigated and research on our experiences is conducted. The Hassenzahl and Tractinsky user experience (2006) is one of the main research streams in the Area of IHC, and encompasses the idea that our interactions with digital artifacts must transcend effectiveness and efficiency. Bythe is the UX is not restricted to the area of HCI or to digital artifacts. The user experience is subjective in nature, as it is about individual perception and thinking with regard to the use of a specific product, system or service. It isdynamic ta mb emm and can be constantly modified over time due to the evolution of circumstances and innovations.

In the area of HCI, UXand nvolve aspects related to efficiency and efficacy, but, in addition, emphasizes affective and experiential aspects, significant and valuable aspects of human-computer interaction.

An important aspect in UX is the process by which users form experiences. When the user finds a product, it forms a momentary impression, which evolves over time. In this process, the perception, action, motivation and cognition of the user are integrated to form a memorable and coerent storyand called

"andxperience of the usuário". This process raises emotional responses, which largely determine whether the experience will be considered positive or negative.

The perception of a product is based on the individual, the user's values and the context of use, so the perception of the user experience is highly subjective. In addition, in a competitive market, the subjective values of all stakeholders, such as the organization and the user, play a central role indeveloping the user experience [Jetter and Gerken 2007]. The subjectivity of UX opens the way for the investigation of several psychological factors, among them the perception that something is *cool.*

Some authors suggest that the term was initially conceptualized by African warriors as a way to stand out in the face of danger [Pountain et al 2000]. There is also the concept applied in contemporary times, as a characteristic of counterculture, which has become the medium that small groups of black jazz musicians resisted against white with their dominant culture, encompassing a different way of dressing and behaving.

Raptis et al (2013), states that we *use cool in our everyday life* to describe people, objects, activities, and when we attribute the *word cool* to an object, we basically perceive some of its interesting or legal characteristics at a specific time and within a social context. If the context changes, then the same characteristics can be perceived differently as not legal. As a result, there is an interaction between an individual and the object, within a social context.

The IHC community has adopted *coolness* as an importante concept and is discussing its implications in UX. Holtzblatt (2010) was the pioneer to *introduce coolness* in the area of HCI and states that a good user experience is closely linked to the experience of joy and consequently to the *concept of coolness*.

3 METHOD

This study was conducted as a systematic review of the literature based on the original diretrizes proposed by [Brereton et al 2007].

> "A systematic literary review is a means of identifying, evaluating, and interpreting all available research relevant to a particular research question, or area of a topic, or phenomenon of interest. Individual studies that contribute to a systematic review are called primary studies; systematic review is a form of secondary study." [Breretonet al 2007]."

The steps in the method of systematic review of the literature followed were planning and execution of the research.

4 SYSTEMATIC REVIEW PLANNING

At the beginning of the planning, the need for a systematic review was detected, since no review was found on the proposed theme. The following are the phases of planning subsequent to the evaluation

of the need for review, which are definition of research *questions, formulation of search strings* and selection of databases and elaboration of inclusion and exclusion criteria of bibliographic sources.

4.1 RESEARCH QUESTIONS

To date, only a few studies in the literature have presented information on the *concept of coolness*. These few studies are aimed at identifying the characteristics of coolness *in* a given area. In this context, to provide a broader definition, visualizing different aspects addressed in the literature, we sought articles that dealt with the term coolness in journals, theses, dissertations published in Brazil and abroad from 2010 to 2020. Conducting a systematic review will help describe a general definition of the concept of *coolness* and its instrumentalization in UX.

In order to present how the concept *of coolness* is defined and instrumentalized in the literature, in order to provide a holistic view of the term, the research questions that guide this systematic review are:

QP1. What is the concept of *coolness in digital products*?

QP2. How is *the concept of coolness* operationalized to test how cool the userexperience is in digital products?

4.2 THE PROCESS OF SELECTING DATABASES AND SEARCH STRINGS

Several combinations of keywords were performed, organized in *search strings* using Boolean AND and OR operations. After performing some tests with search strings, they were verified which ones resulted in the best acceptance rates and the amount of results returned. Therefore, the key words selected for the search were: ("*consumer coolness" OR "social coolness" OR "coolness attractiveness" OR "coolness research" OR "coolness concept" OR "application of coolness" OR "context of coolness" OR "coolness definition" OR "coolness evaluation" OR "coolness" or "coolness"*).

The selection of research sources was based on two categories: journals and conferences. In addition, searches were made in references of theses and dissertations published in Brazil and abroad. After defining the search parameters, searches were performed on conference pages and journals in the area of Human Computer Interaction (IHC), ACM Digital Library, IEEE Digital Library, Science Direct, ISI Web of Science, Scopus, Springer Link, CAPES Periodic Portal and Google Scholar.

4.3 INCLUSION AND EXCLUSION CRITERIA

As inclusion criteria, publications were selected between January 2010 and May 2020, articles published in English or Portuguese that had one or more of the search terms searched. Articles with duplicate information or search terms, without relevance with the terms researched or outside the publication period defined in this study were excluded.

5 IMPLEMENTATION OF THE SYSTEMATIC REVIEW

The execution of the systematic review deals with the selection of studies and extraction of relevant data to answer the research questions and, finally, the analysis of the data, which will be presented in the results section.

5.1 SELECTION OF STUDIES AND DATA EXTRACTION

The research process was carried out through a manual search of conferences and articles from specific journals, which were selected because they included empirical studies or research in the literature, or were used as sources for other systematic reviews of the literature related to research questions. In the organization and registration of the research, the *Parsifal* online *tool was used,* which allowed the import of reference files, in addition, identified duplicates between the different sources of research and enabling the evaluation of the quality of information during data extraction.

The process of selecting the work was carried out in three stages, and in the first the execution of a research with a set of specific terms in each library consulted to find related studies. In the second stage, articles whose titles and abstracts were more relevant to perform the reading were selected, and duplicate dwellarticles were rejected or did not fit the inclusion and exclusion criteria. At the end, the selected articles were analyzed, accepting them and rejecting them based on the content that each one had when answering the research questions (QP1, QP2). As a result of the research process, a total of 97 articles were initially identified, after the second selection stage this number decreased to 67 and at the end of the process culminated in 17 accepted articles, as shown in Figure 1.

Figure 1. Procedure for the selection of articles.
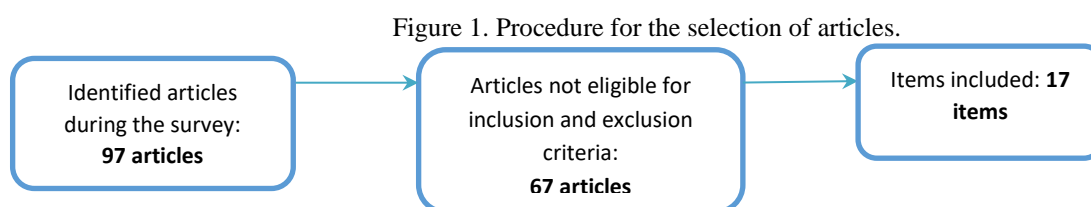
5.2 RESULTS

5.2.1. Answering the question of Research 1 - What is the concept of *coolness in* digital products?

The authors describe characteristics associated with *coolness to* provide a general notion of this concept. To understand how the concept is categorized into subconcepts, the characteristics found in the articles that are connected to the concept of *coolness* are sumarized in table 1.

Table 1 - Characteristics associated with *coolness identified* by the authors of the selected articles.

Features	Authors
Desirability	Bruun et al (2016), Raptis et al (2017), Raptis et al (2013), Irshad and Sadiq (2020), Read et al (2011), Fitton et al (2012), Warren and Reimann (2019).
Usability	Bruun et al (2016), Raptis et al (2017), Raptis et al (2013), Irshad and Sadiq (2020), Kim and Park (2019)
Utilage	Holtzblatt (2011), Mamonov and Koufaris (2020), Farnsworth et al (2014, June), Kim and Park (2019), Sundar et al (2014), Park (2019), Raptis et al (2017), Raptis et al (2013), Irshad and Sadiq (2020)
Connection	Holtzblatt (2011)
Identity	Holtzblatt (2011), Mamonov and Koufaris (2020), Farnsworth et al (2014, June)
Sensation	Holtzblatt (2011), Mamonov and Koufaris (2020), Farnsworth et al (2014, June), Kim and Park (2019)
Attractiveness	Kim and Park (2019), Sundar et al (2014), Park (2019), Raptis et al (2017), Raptis et al (2013), Irshad and Sadiq (2020), Peng et al (2016, June), Warren and Campbell (2014), Farnsworth et al (2014, June)
Unconventional	Kim and Park (2019), Sundar et al (2014), Park (2019), Raptis et al (2017), Raptis et al (2013), Irshad and Sadiq (2020), Read et al. (2011), Fitton et al (2012), Warren and Reimann (2019), Bruun et al (2016)
Innovation	Kim and Park (2019), Sundar et al (2014), Park (2019), Raptis et al (2017), Raptis et al (2013), Irshad and Sadiq (2020) , Dar-Nimrod et al (2012), Peng et al (2016, June)
Rebellion	Dar-Nimrod et al (2012), Read et al (2012), Raptis et al (2013), Bruun et al (2016), Read et al (2011), Fitton et al (2012)
Antisocial	Warren and Reimann (2019), Read et al (2011), Fitton et al (2012).

Desirability Bruun et al (2016) considersdesirability one of the *items that measures coolness*, being related to how a specific interactive product pleases personal desire, for example, "This devicecan make me happy" or "This device can make me look good". Read (2012) states that the appearance of a product or device beinga desirable and innovative device is linked to the characteristics of the device. Warren

and Reimann (2019) points out that unusual *product designs* capture better attention than *normal designs*, the unusual can be considered legal and desirable as long as it makes sense to users.

5.3 USABILITY

According to Raptis et al (2017) the perception of usability, refers to learning, the usefulness and operability of the device for example, in relation to ease of use. Sundar et al (2014) pointout that usability perception are potential in the initial judgment of a legal product. Kim and Park (2019) describe the perception of usability as a key evaluation standard for development not employed in a conventional market.

5.4 UTILITY

Mamonov and Koufaris (2020) claim that utility is measured through the association between the perception of technology (innovative/modern/futuristic) and the expected personal image, as well as its practical benefits associated with innovative use. Kim and Park (2019) and Park (2019) define utility or utility value, such as the level at which users believe that the use of a specific technology helps in establishing their tasks, improving work performance and efficiency. Sundar et al (2014) emphasizethat usefulness to the value perceived by the user in relation to the adopted products that provide various functions and services. Raptis et al (2013) points out that a product can be considered legal if it is useful for a specific group, indicating membership to that particular group.

5.5 CONNECTION TO

Holtzblatt (2011) the connection between people is fundamental to human existence. Whether in the family, social or professional context, being with someone to transcend loneliness is as necessary as breathing. In this sense, cool products help people establish relationships that matter most.

5.6 IDENTITY

Mamonov and Koufaris (2020) highlight the association between technology and the expected personal image, practical benefits linked to the innovative use of technology and its importance in meeting psychological needs, in addition to purely functional or hedonic motivations. For example, the resurgence of interest in some old video games on new platforms such as smartphones. Farnsworth et al (2014, June), Holtzblatt (2011) states that legal products bring us a way to see what others of the same age or stage in life do to become more adult, so they help us find examples of behaviors, clothing, values, or anything to see if it seems appropriate.

5.7 SENSATION

Mamonov and Koufaris (2020) state that the evaluation of how much a product will affect the user's self-perception and the perceptions of others are more important than the expectation of technology performance in the consideration of adoption. For Kim and Park (2019) products that feature useful functions, modern and splendid design are considered legal, after acquisition and use users feel distinct and satisfied with the uniqueness. Farnsworth et al (2014, June) and Holtzblatt (2011) highlight the sensation in two fields: sensory immersion, creating "time out of time" and moments of pure sensual pleasure, through products (music, televisions, games, etc.) that offer sensory immersion, becoming the core of our leisure activities absorbing us for long periods.

5.8 ATTRACTIVENESS

Sundar et al (2014) affirms that attractiveness in interactive products encompasses both aesthetic appeal and a notion of socially accepted style. According to Park (2019) affective senses, such as attractiveness, associated with specific devices and technologies make users more likely to use them. Kim and Park (2019) highlight that the attraction created by aesthetic characteristics influences the hedonic and utilitarian values of individuals when using a specific device or service. For Farnsworth et al (2014, June) the importance given the appearance points to the fact that the perception of aesthetics have a great impact on product classification.

5.9 UNCONVENTIONAL

Warren and Reimann (2019) says the *distinction between the design of legal products* from those who seem unusual or funny stray from the norm as long as it makes sense, but without disturbing the consumer. Users expect to be considered differentiated through the use of legal products, which project their inherent characteristics and interests, increasing the positive attitude towards the product [Park 2019].

5.10 INNOVATION

Park (2019) states that unique products can be enticing and pique the interest ofusers to get them. It also points out that users can get a sense of identity and style by buying and using unique and unique merchandise and displaying them for others to see. Peng et al (2016, June) refer to the degree to which users perceive whether a technology is absent in conventional culture, captured by the evaluation of a technology, in the context of appearance, in the fulfillment of its purpose in a creative way and how it allows users to accomplish things in a new and exciting way. For example, mobile devices are perceived as interesting by young people because of their attractive and original characteristics.

5.11 REBELLION

According to Dar-Nimrod et al (2012) and Read et al. (2012) rebellion can be clearly confirmed as an aspect of construction, being relatively independent of conventionally desirable characteristics such as: attractiveness and friendliness. Raptis et al (2013) points out that people considered innovative when they perceive a digital artifact as rebellious (unique or authentic) with features that make the device unusual or unconventional, so other people will perceive it as legal after some time. Bruun et al (2016)suggest that rebellion presents different constructions from existing ones and are indicated by discriminating values and internal inconsistency.

5.12 ANTISOCIAL

According to Warren and Reimann (2019) the unusual design of a product is considered legal and desirable when related to products with humorous and undesirable design, if the deviation of the norm makes sense to consumers. Farnsworth et al (2014, June) claim that aspects of antisocial behavior are seen as the key to being perceived as legal.

5.12.1 Answering The Search Question 2 - How is *coolness concept* operationalized to test how cool the user experience is being in digital products?

In view of the attempt to define an instrument to test *the aspect of coolness* in user interfaces, each author uses the characteristics observed in the study areas to test the user experience operationalized by questionnaires and interviews.

The *cool questionnaire* developed by Bruun et al (2016) presents a validated proposal to measure the internal perception of *coolness*. In this process, 3 factors related to 17 questions used specifically to measure the perception of the internal *coolness* of an interactive product were identified. Participants evaluated a mobile device, answering various questions through a web page, which displayed the device on the left side and on the right side of the questions. The questionnaire measured convenience through questions related to how a specific interactive product can appeal to personal desire.

Warren and Campbell (2014) investigated the relationship between *coolness* and the concept of autonomy, and how the factors might affect it. In this survey, 190 participants living in the United States, who read information about a coffee retailer, a family brand and an unknown brand, were changing the design of their water bottles and had access to one item of each bottle with the new logos. The participants related the perception of *coolness* by completing two scales related to non-legal or legal according to the questionnaire questions. As a result of the research, a general consensus was verified about the perception of what is legal in the context provided.

Read et al (2011) conducted a survey of teenagers from a UK school, aged between 11 and 15 years, attending the 7th year and 10th grade. They were instructed to create, in the context of their rooms, "*the life*

they would like to have", without much fantasy. The study showed differences in the perceptions *of cool* between genders and ages.

Read et al (2012) conducted studies focusing on dividing the characteristics into smaller entities andsystematically using them in the construction of blocks to produce a questionnaire focused on the interaction domains of the areas of design, marketing and music/film industry in order to measure the perception of *coolness* in a product. Through an interactive visual tool, the prototype of an application *called Cool Wall*, provides that images can be classified into four categories ('seriously not cool', 'not legal', 'cool' and 'below zero'). The result of the study shows that desirable items were classified as legal, mobile technologies more expensive as coolest items, followed by food items that would be considered unhealthy by the students' parents (sweets *and fast food*).

Farnsworth et al (2014) wanted to understand what was essential to the *cool user* experience and associate it so that it could be used systematically to develop transformative products because they believe that with the understanding of the underlying principles that makes a product interesting, they could be used to deliberately design a legal product.

The consumer survey - Summer 2010, had the involvement of 65 American consumers aged between 15 and 60 years. The interviews were in person, conducted at the participants' house who discussed and answered 3 questions. As a result, an affinity diagram was generated containing qualitative data from the main themes (constructions) that defined the conceptual structure, giving rise to seven concepts: four (realization, connection, identity and sensation) defined how the product generates joy, affecting people's lives and fulfilling their main desires, and three (direct to action, annoyance factor and learning delta) defined how people experienceand use the product itself.

In the *Smart TVs* survey, the authors used questionnaires that included questions from previous studies about items about utility, subcultural appeal, originality, attractiveness, attitude, and intent to use. Then, experts in broadcasting and media technologies conducted the review and correction of the items of the questionnaire, then a pilot survey was conducted with 20 participants who had more than 6 months of experience in the use of smart TVs.

The studies presented used questionnaires and interviews to test the user experience in addition to measuring the *perception of coolness* in the areas of HCI and interaction design. The question produced by Bruun et al (2016), called "The *cool questionnaire*", measured convenience through questions related to how a specific interactive product, represented by a mobile device appeals to personal desire. Through a web page, the participants answered questions related to the device, and from this questionnaire were extracted the characteristics identified by users, such as rebellion, which can be measured through statements related to the conventionality of the device.

Warren and Campbell (2014) investigated the *relationship between coolness and the* concept of autonomy, describing how factors can affect it and how autonomy can be measured through a questionnaire. The studies were conducted with participants who evaluated bottle design and logos of famous brands,

where they concluded that both brands and objects diverge in user perception by increasing autonomy in an appropriate and perceived *way* as cool.

In the research conducted, Read et al (2011) sought to understand design elements aimed at adolescents that could be identified as legal, and what their causes and motivations would be. They defined characteristics based on research in the literature and treated specific categories (retro, authentic, high value, rebellious, antisocial and innovative) to check the information extracted from responses from students from a UK school, aged between 11 and 15 years. As a result, special characteristics were observed in relation to the design, brands and product specifications that were associated between the categories.

With previous work Read et al (2011),Read et al (2012) focused on the premise that there is a common understanding among adolescents of what is legal, so with the expectation that there may be some "things" that would be considered less or more legal by certain subgroups. "Things" refer to physical objects (a type of technology) or other physical items that we choose to consume (a certain type of food) or associate. To evaluate this understanding, an application was developed, *Cool Wall*, which display images displayed in a predefined sequence, and when dragged to a desired category to user-defined ratings are stored in a file.

Interviews were also used in this process, Farnsworth et al (2014) who developed a *questionnaire to measure coolness*, from the performance of several studies over three years, involving 900 consumers and more than 2000 business professionals from around the world. As a result, the main characteristics described by the interviewees contributed to define the conceptual structure of *coolness*.

6 CONCLUSIONS

Traditionally the term *cool* is a way in which people often positively reference objects, activities, people or places. In areas such as marketing, fashion and music industries, *coolness is* described as a good attitude towards something and how people recognize it, and its perception is shared among members of a group. The concept of *coolness* has been increasingly used to describe the experience and approval of users in various interactive products in IHC. However, while it is an obvious criterion for new devices and applications, this is a complex concept that can mean different things between people. In the present systematic review of the literature, we sought studies that addressed the *concept of coolness* in the area of HCI, with the objective of identifying its fundamental characteristics and providing a broad notion of the term. The accomplishment of this work provided a more comprehensive view of the concept of *coolness* involving the characteristics highlighted in the literature. The sub conceptualization *of coolness* can be agreat thing for researchers and designers to develop projects aiming at a better UX. Thus, presenting a contribution to the area of HCI, enabling, from this study, the emergence of new ideas on how to design legal artifacts, evoking a better user experience.

This research found that *coolness can be* considered a personal attitude towards objects, people and activities, which are characterized according to the user's perception of the factors defined in the

characteristics. In addition, our study can be used as a starting point for the development of questionnaires and other instruments for measuring how much a digital product is experienced as *cool*. In this context, we provide practical examples both in identifying how artifacts are *perceived as cool,* and on how to use the results collected from tools used to measure the perception *of coolness*.

Another contribution of this systematic review of the literature was to reveal how it is being tested, given the experience and approval of users in relation to various characteristics, how much a product is defined as *cool*. Given the concepts presented, we can infer that one cannot directly measure *the coolness of* an object, but we can measure the level of perception of people based on personal values, created and approached in termsof the groups belonging.

However, a gap has been identified in the literature with regard to a more comprehensive tool for testing *coolness* in UX. Only limited tools were found that do not address all the above concepts. Many authors conducted studies based on questionnaires and interviews, and in some cases, selected some characteristics already identified in the literature to conduct studies, aiming to relate the characteristics or proposing new categorizations, pointing out the need for research in this sense.

This systematic review of the literature will serve as a starting point for investigations into how each subconcept *of coolness* can be observed in websites and applications and whether they can effectively be linked to this concept in this specific scenario. In other words, such as the *characteristics linked to the concept of coolness,* coming from literature, desirability, utility, usability, connection, identity, sensation, attractiveness, unconventional, innovation, rebelliousness and antisocial, can be mapped in concrete examples of websites and applications and whether they can be used to judge whether a website or application is legal. To this end, empirical tests will be carried out involving websites and applications *considered cool* and *not cool,* considering a significant number of users, seeking to provide evidence to indicate whether the characteristics compiled in this research are related to *coolness in* this perspective.

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