Experiential interaction design model

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A B S T R A C T

This study proposes a model for experiential interaction design with a business purpose covering a series of interactive activities. The model includes components such as curiosity, motivation, play, and effect as well as their relationships. While the model balances motivation with the effects, continuous rewarding may be necessary to motivate users to continue their interaction until the effects are achieved. Ease of use is also important for designing the interactions. Lastly, the series of interactive activities should be fun. This study summarizes three types of business purposes: donation-oriented, challenge-oriented, and amusement-oriented. The proposed model can be applied to each type of design, but different implementation details serve various effects, such as charity, engagement, and marketing. This study uses real cases to exemplify and explain the model, thus providing a holistic view for experiential interaction design. Future research can probe more in-depth into each component of the model.

1. Introduction

The Internet and information and communication technologies (ICT) are now very popular and common in everyday life (Huarng, 2011; Huarng, 2015), with ICT usage in product design even helping to promote a multitude of applications. While digital transformation is deeply rooted in various applications (Huarng, Yu, & Lai, 2015; Galindo-Martín, Castaño-Martínez, & Méndez-Picazo, 2019), it is not particularly limited to innovative businesses or even high-tech companies (Ferraris, Mazzoleni, Devalle, & Couturier, 2019; Warner & Wäger, 2019). Such transformation has already changed businesses at all levels, but it still presents new managerial opportunities and challenges (Verma, Gustafsson, Kristensson, & Witell, 2012; Bresciani, Ferraris, & Del Giudice, 2018; Scuotto, Del Giudice, Tarba, Petruzzelli, & Chang, 2019).

Some studies in the literature cover applications from digital transformation through different business aspects - for example, social media in marketing (Gunawan & Huarng, 2015; Swani, Milne, Brown, Assaf, & Donthu, 2017), big data in business intelligence (Rothberg & Erickson, 2017), etc. Other studies explore the impact of digital transformation on different business areas (Erevelles, Fukawa, & Swayne, 2016), business models (Loebbecke & Picot, 2015; Alberti-Alhtaybat, Al-Htaybat, & Hutaibat, 2019), business performances (Ferraris et al., 2019; Ferreira, Fernandes, & Ferreira, 2019), and required capabilities

(Muninger, Hammedi, & Mahr, 2019; Warner & Wäger, 2019).

Interaction design has been identified as contributing to e-commerce, and e-commerce growth is beginning to blur the distinction between marketing and interaction design (Siegel, 2001). Interaction design can be applied to all business activities, from electronic payment systems (Abrazhevich, 2004) to outdoor billboards. It refers to the creation of a meaningful relationship between a human and a product, which is identified and created through user-centered design methods (Kolko, 2010). Hence, interaction design relates to human–computer interaction.

Human-computer interaction covers the fields of human factors in computer systems, human–computer interface design (Shneiderman et al., 2016), psychology of computer users, and more (Card, 2018). Other texts explore the nature of design as it relates to aesthetic and emotional values. Lenz, Hassenzahl, and Diefenbach (2017) suggest aesthetics as attributes of the interface (the "look") and usability as an attribute of the interaction (the "feel"). Moreover, affective elements allow for both a systems approach (Czaja & Nair, 2006) and a more holistic view toward understanding human–computer systems (Jeon, 2017). Recent literature explores the semantic connections between technology and form (Kolko, 2010).

Digital transformation also shapes experiential design, engaging in the value of the experience that a user derives from using a product (Baurley, 2004). Pallot (2009) considers experiential design as an

iterative process consisting of the actions that co-create, explore, experiment, and evaluate. Experiential design has been applied to a wide range of areas, such as classrooms (Burke, 2007), tourism (MacLeod, Hayes, & Slater, 2013), museum marketing (Ober-Heilig, Bekmeier-Feuerhahn, & Sikkenga, 2014), and elsewhere.

Digital transformation injects personal interaction into experiential design so that the design can be more versatile and funner. Angulo (2017) deploys an experiential interaction design of an astronaut-training program to promote astronomy education and space exploration. Baurley (2004) integrates smart technology into textile clothing, which acts as a communication tool between users and the environment. Because experiential design projects are complex, Dalsgaard (2008) presents an experiential design schema for interactive environments that offer designers a tool to build specific experience-oriented projects.

Experiential interaction design refers to the design of a whole system (instead of just a design object) that offers great experiential interaction for users. Hence, an experiential interaction design includes a holistic interaction design between human and objects, where the objects can be computer-assisted facilities, such as user interface, visual design, etc. In addition, experiential interaction design needs to cover more activities than those of interaction design so that a human can have a broader experience when interacting with the systems. By comparison, interaction design is about the design of objects for human to interact with; this experiential interaction design has a business purpose of driving the design so that after playing, humans may have greater incentives to achieve or realize those purposes. For example, a vending machine's interaction design may be limited to its visual design. To engage customers, its experiential interaction design may encourage users to play with the system.

This study targets to provide a model for experiential interaction design, which is a new trend that helps increase an experiential impact upon users, including components such as curiosity, motivation, play, and effect, as well as their relationships. To facilitate explanation, this study roughly categorizes the applications into three business purposes that are donation-, challenge-, and amusement-oriented and points out that the model can be applied to each purpose. However, different implementation details serve various effects, such as charity, engagement, and marketing.

The rest of the paper runs as follows. Section 2 introduces the components of the model. Section 3 interprets the characteristics of the components and relationships among the components. Section 4 collects and categorizes real cases to exemplify and explain the model. Section 5 proposes criteria to evaluate these cases with the model. Section 6 concludes this study.

2. Experiential interaction design model

This study proposes an experiential interaction design model by adding digital transformation into the design. Thanks to digital transformation, the design can be more versatile and funner. The experiential interaction design has a business purpose covering a series of interactive activities, including components like curiosity, motivation, play, and effect.

The model starts with curiosity, through which the specific design attracts users' attention to approach the design systems so that they may become more interested in interacting with them. Curiosity can attract attention, which can spur popularity. Hill, Fombelle, and Sirianni (2016) consider curiosity in terms of how retailers drive purchase motivation. Cachero-Martínez and Vázquez-Casielles (2017) conclude that if a retailer can stimulate shopping and consumer curiosity, such as imagination and creativity in the store, then it will have more devoted consumers. Curiosity is one of the components for designing participatory information systems (Steen, 2013). Game design should thus integrate both curiosity and uncertainty (To, Ali, Kaufman, & Hammer, 2016), because interesting displays, logos, and facilities are quite effective at attracting users.

In the second step, when users are attracted by the design and approach the design systems, their own motivation decides whether or not to continue with any subsequent interaction. Motivation thus plays an important role in instruction design (Keller, 1979; Keller & Susuki, 2004; Small, 2000) and job design (Grant, 2007; Steers & Spencer, 1977). Motivation is often mentioned in the game design literature (Asgari & Kaufman, 2009; Cota, Ishitani, & Vieira, 2015; Dickey, 2007), because it justifies subsequent user interactions.

Motivation can come from empathy, a sense of accomplishment, hedonic feelings, etc. Zaki (2014) states that empathy has three major components: experience sharing (users' tendency to take on the states they encounter in targets), mentalizing (users' capacity to draw explicit inferences about targets' intentions, beliefs, and emotions), and mind perception (users' detection of targets' internal states). Any of these components can be applied in the design to draw empathy as a form of motivation. Empathy can help interpret user experience in a co-design class (Ho, Ma, & Lee, 2011). Consumer empathy and intuition play a decisive role in making an engagement program effective (Vivek, Beatty, & Hazod, 2018). Additionally, Wikström, Carell, and Frostling-Henningsson (2002) describe Internet shoppers as tending to be motivated by technology.

Sense of accomplishment can be another type of motivation. In the design of a location-based game, the accomplishment of a collaborative gaming activity is the main target for analysis (Guribye, Wake, & Wasson, 2014). The task to accomplish can be either mental- and/or physical-related. If the purpose of the design is to challenge users, then the design tends to be more difficult. The tougher the tasks are, the greater the challenges are for the users. Conversely, if the goal of the design is to attract more people to participate, then easier accomplishments may form the design's guidelines.

Hedonic value is found to be important in consumer activities (Babin, Darden, & Griffin, 1994). Hedonic feelings represent the amusement and entertainment gained from playing with the design objects.

In the third step, the users proceed to interact with the design objects through technology, which can be transformed into play. The design objects provide interactions with which the users play. Play is both fundamental (Salen, Tekinbaş, & Zimmerman, 2004) and radical (Flanagan, 2009) in game design. Csikszentmihalyi (2014) reports the experiences of people involved in various plays, such as rock-climbing, chess, dance, etc. That study suggests criteria for making these activities enjoyable, such as users being able to concentrate on a limited stimulus field where they can use their skills to meet demands, forgetting their own problems, having a separate identity, and obtaining control over the environment. These criteria can be considered when designing the play.

After being offered the format of the play, the design objects hopefully are able to achieve their purposes, which include effects that can range from charity to engagement to marketing. The design attracts the users to donate for charity, while engagement refers to a meaningful, authentic, and interesting exchange, conversation, or transaction that creates a dynamic between the users and the brand (Wagler, 2013). The design offers a new tool to engage the users (Millard, 2006) and can also serve as a new marketing channel (Hamari & Lehdonvirta, 2010).

3. Characteristics and relationships of the design components

In the model the designers provide stimuli to arouse users' curiosity. Motivation originates from the users. Play occurs between the users and the design objects. Effect is what the designers expect, but the users and the designers can both observe what happens after the interaction. Fig. 1 depicts the components and relationships of the experiential interaction design model.

In Fig. 1 the whole interaction course should be fun. It is a pleasant experience to interact with the design systems, which is at the core of the experiential interaction design. The design of different effects may
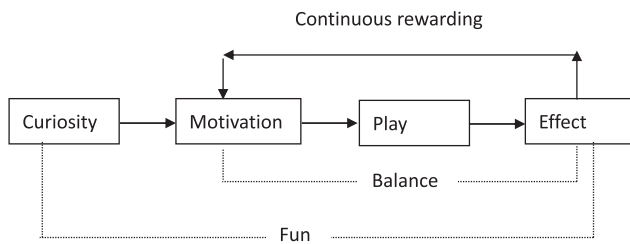
Fig. 1. Model of experiential interaction design.

present different degrees of fun. Although the motivation resides within the users, the effect is the goal to be achieved, and there must be a balance between motivation and effects. An over-expected effect may harm the motivation and reduce users' willingness to participate. Some designs have continuous stimuli to motivate the users to continue with their interaction until the effects are achieved. Continuous rewarding can also be a design criterion (Walter, Forssell, Barron, & Martin, 2007).

This study hence uses four criteria to evaluate different real cases, including perceived ease of use, affordability, duration, and fun. In the design of the play component, ease of use is important. It is actually one of the elements in the technology acceptance model (Davis, 1989; Grover, Kar, Janssen, & Ilavarasan, 2019) and is considered essential for any human-centered design (Wiggermann, Rempel, Zerhusen, Pelo, & Mann, 2019). Particularly, ease of use is the key to solving users' problem over a lack of confidence when they face technologies (Jordan, 2002).

Affordability is important to attract users at the bottom of the pyramid. Prahalad (2006) stresses the need for focusing on the fortune at the bottom of the pyramid. Moreover, affordable pricing is considered as key to attracting people at the bottom of the pyramid (Huarng, 2013).

Duration of the entire interaction course is another design consideration. Based on different effects, the time that users take to interact with the design systems is different. The time duration becomes longer when the effect moves from charity to engagement to marketing. For the effect of charity, the design expects more users to participate. Hence, it is better to complete the interaction as soon as possible, because offering a longer interaction may distract the users. On the other hand, for engagement and marketing, the design hopes to occupy the users for a longer period so that it has a chance to impress them. Hence, the duration is longer.

Digital transformation changes the design to awaken users' curiosity. For example, a big screen in the shopping mall with interesting slogans or a billboard on a building outdoors can easily attract users' attention. Digital transformation often changes the design of play in order to create a lot of fun.

4. Cases

This study surveyed some popular experiential interaction design cases. These cases have different business purposes that are donation-, challenge-, and amusement-oriented.

4.1. Donation-oriented design

The Social Swipe was developed by Germany's NGO Misereor and the marketing firm Kolle Rebbe (https://www.youtube.com/watch?v = dVvZdC2Kp14). Misereor is an overseas development agency of the Catholic Church, founded in 1958 to fight poverty and injustice in the world (Misereor, 2020). The Social Swipe has an interactive screen and a credit card swipe machine. When people see the screen saying "Feed Them" or "Free Them", the display attracts their attention as well as arouses their empathy. When they approach the screen, a swipe of their credit card acts like a knife to cut a slice of bread or to cut the ropes

tying their hands. The play experience makes users feel they are really feeding or freeing people, which is the key to the success of the design. Users can swipe their credit cards to give away two euros, which are used for either daily bread given to a poor family or to free an imprisoned child to return to a normal life. The effect is the donation of two euros for each swipe.

Fashion Revolution (https://www.youtube.com/watch?v = KfANs2y_frk) set up a vending machine for users to play with. The screen shows that fashion for a bargain is what everyone wants. A t-shirt for two euros is not inconceivable, but people do not often consider who is paying the real price. The design tests whether people would still buy the t-shirt if they were confronted with the facts of how the t-shirt had been produced. At the end of the interaction, the machine asked if the users want to buy it or to donate money.

A big sign saying "T-Shirt 2 Euros" attracts users' attention. The messages on the screen arouse their empathy. After reading through all the messages, the users can decide to buy the t-shirt or to donate the money. Fashion Revolution believes that people care when they knew the truth. Many users actually have chosen to donate after the interaction. In fact, eight out of ten shoppers generally decide to donate.

Melanoma Institute Australia worked with Disciple and JCDecaux Australia on an innovative outdoor campaign encouraging passers-by to make a donation to help fight melanoma (https://www.youtube.com/watch?v = Odd4u43V2XE). On a screen, an animation of a melanoma that slowly grows is shown until a donation is made. The animation attracts the users to approach the design systems. The messages arouse users' empathy. When people donate, the melanoma on the screen shrinks, which is the play. The effect is to encourage a donation.

A donation-oriented design links directly to the effects. Digital transformation provides a display to attract users' empathy. The play with digital transformation is designed to be simple and straightforward so that users can quickly complete the interactions with the design objects. The duration of the interaction is usually short, so that the design systems may have a chance to attract some other users.

There are other ways in comparison to promote donations, such as campaigns on flyers, TV, or even the Internet. However, these campaigns hardly arouse users' interest, which is the curiosity phase in the model of experiential interaction design. As a result, their performance is limited.

4.2. Challenge-oriented design

Contrex is a brand of mineral water owned by Nestlé Waters since 1992 and is part of the mineral water company Vittel that includes Vittel and Hépar. Nestlé Contrex encouraged an exercise through two campaigns of "Ma Contrexpérience". In the first campaign (https://www.youtube.com/watch?v = GimoLDYI_JE), some exercise bikes were set up in front of a building to attract people's attention. After people ride the bikes, an image of a striptease is projected onto the building. When more people peddle harder, the dancer dances more excitingly. The motivation is to see the dancing, which covers both accomplishment and amusement. The play is to peddle the exercise bike and to see the striptease continue. At the end, the dancer comes out with a sign covering his private part. The sign shows the amount of calories the people have burned during the session of interaction. The design is full of amusement.

The second "Ma Contrexpérience" campaign for Contrex ignited a fire on the main building of the University Halls of Paris using video mapping (https://www.youtube.com/watch?v = D2VrCx1XtwM). A video-projected fire threatens two young men, who scream for help from the windows of the building. The users can then get on the steppers to activate the fire hoses to put out the fire. The more people there are who interact on the steppers, the quicker the flames go down. Ma Contrexpérience II is a blend of video-mapping and live staging.

The two campaigns used exercise bikes and steppers respectively to attract users to participate in the activities. Users first started to play

Table 1
The evaluation of the cases with the model.

	Ease of use	Affordability	Duration	Fun
Donation-based				
1. The Social Swipe	●	●	Short	Less
2. Fashion Revolution	●	●	Short	Less
3. Fighting Melanoma	●	●	Short	Less
Challenge-based				
1. Exercise Bikes	●	●	Long	More
2. Steppers	●	●	Long	More
Amusement-based				
1. Drinkable Advertising	●	●	Long	More
2. Pick 'n Play	●	●	Long	More

with the vehicles out of curiosity. When playing, the users had a sense of accomplishment and amusement to see the striptease dance and to put out the fire, respectively. Both cases encouraged the users to burn more calories. After the exercise, the users needed some water to quench their thirst. The effect is to engage users to the brand.

The effect of the challenge-based design is to encourage users to have more interaction with the design systems. The duration of the interaction is longer than that of donation-oriented design, and the design can be integrated with more technologies. The play with digital transformation is expected to be funner than that of the donation-oriented design.

4.3. Amusement-oriented design

Coca Cola's first ever drinkable advertising campaign for Coke Zero created the illusion that the users actually tasted the campaign (https://www.youtube.com/watch?v = IQovoot_ZUM). Coca Cola collaborated with Shazam to provide an interactive advertising campaign. The users saw Coke Zero being poured in the screen of their smartphones and filling a glass, which ended up into an actual free Coke Zero that could be redeemed at large retail stores across the U.S.

The users played with the advertising campaign, creating a lot of fun. The design attracted their attention as well as their motivation to play. The core of the design is to play with the advertising campaign, observing the results from the interactions. The effect is marketing.

McDonald's Stockholm Pick 'n Play was an interactive billboard challenge for goodies (https://www.youtube.com/watch?v = F1FB8guuu-o). Users used smartphones to play the game in real time on a large digital screen. If the users could last for 30 s, then they won their goodies of choice.

Fun is at the heart of an amusement-oriented design, because it aims to provide amusement for users via different interactions with the design systems. The design can be integrated with different technologies to attract users. Because the play is the core of the design, the design is expected to be funner. The digital transformation can even create interactions between users' mobile devices and the design objects, while mobile interaction can attract more of the younger generations to participate. Similar to a design that is challenge-oriented, the duration of the interaction is longer than that of a donation-oriented design. The effects are to engage the users with the brand, or marketing.

For promotion, users usually see advertisements or commercials from flyers, TV, the Internet, etc. Carreón, Nonaka, Hentona, and Yamashiro (2019) suggest that advertisement exposure time has little effect in the short term at increasing positive actual purchase behavior. Even though they see discount activities, users may not feel encouraged. Hence, it is very difficult to engage customers directly from these promotions, especially as some TV commercials may tend to be unpleasant (Vecchiato et al., 2011). Following the model of experiential interaction design, users have a lack of hedonic feelings. On the other hand, through play, users may be easily engaged, because of the fun involved.

5. Design evaluation

Through real cases this study evaluates the proposed model with four criteria: perceived ease of use, affordability, duration, and fun. In the design of the play, ease of use is very essential. Digital transformation facilitates the implementation of this criterion. All the cases present this vital characteristic. For example, to encourage a donation, The Social Swipe requires just swiping credit cards. Table 1 summarizes the evaluation results.

Affordability can balance the effect and the motivation. For examples, the donation of two euros in The Social Swipe and the t-shirt are affordable for most people in airports. Peddling exercise bikes is also manageable for most users. In addition, continuous rewarding in the two Ma Contrexpérience campaigns uses video and moving images to keep the users interacting with the design objects.

Duration becomes longer when the effect moves from charity to engagement to marketing. For example, The Social Swipe takes minutes to complete the interaction. However, Ma Contrexpérience and the drinkable advertising campaign for Coke Zero may take longer to finish.

Because different effects require different durations, different designs may present different levels of fun. It is fun to interact with The Social Swipe to see the change on the screen after the donation even though it may not be as much fun as that of the Ma Contrexpérience campaigns or McDonald's Stockholm Pick 'n Play.

6. Discussion and conclusion

Digital transformation has re-shaped experiential design into being more interactive and funner. This study proposes a model for experiential interaction design that includes curiosity, motivation, play, and effect. The model is indeed rather novel. With curiosity, the design systems can attract users' attention. When the users are attracted by the design, their motivation helps them to decide over whether to continue the subsequent interaction. Play means the interaction with the design objects. When the interaction is completed, the effects are the goals to be achieved.

In the model, motivation should be balanced with the effects, and the requests from the design should be affordable in all aspects. In the challenge-oriented design, continuous rewarding may necessarily motivate users to maintain their interaction until the effects are achieved. Ease of use is important for designing the play. Lastly, the whole interaction process should be fun. It should be a pleasant experience to play with the design objects, which is the core of the experiential interaction design.

The proposed model can serve each of the business purposes of the design that are donation-, challenge-, and amusement-oriented with different implementation details. This study uses real cases to exemplify the proposed model. Hence, the model provides a guideline to design future cases instead of restricting the design of new or advanced cases. As such, the proposed model may be subject to change in the future.

The proposed model focuses on the whole system. Future research can probe further into each component of the model with an operational definition of how to measure components, linkages, and evaluation criteria of the proposed model. Proper empirical analyses can also be conducted as a complement to the existing study.

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