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**SEOUL NATIONAL UNIVERSITY,
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ENGINEERING
INSTITUTE FOR INDUSTRIAL
SYSTEMS INNOVATION
SEOUL NATIONAL UNIVERSITY

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A Multidisciplinary Initiative of Intervening Mobile Addiction via Family-focused and Gamification-enhanced Design

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Abstract:

Excessive use of mobile and other electronic screen-based products among adolescents in Hong Kong and China is becoming much more notable these days. Overuse of mobile or Internet devices causes not only physical health problems but also behavioral addictive symptoms like craving and withdrawal. Whereas family, as a potential psychosocial element for reducing the likelihood of addiction development among adolescents is substantially weakened owing to the deteriorating parent-adolescent relationships associated with growing excessive mobile use at home. Situations of potential over-dependence on this highly engaging medium have sparked great concerns of addictions services in Hong Kong. Based on the '*family functioning*' concept and the '*gamification*' theory, this paper reports on an ongoing collaboration between a Hong Kong-based social service center and a design institute, which explores an alternative '*family-focused*' intervention strategy to enhance parent-adolescent interactivities whilst addressing excessive mobile use of adolescents through specifically designed games. In order to reveal both the '*usual*' mode of mobile usage patterns and the '*occasional*' mode of parent-adolescent interactivity of the targeted families, an interactive play-platform, and a specific lifestyle research method have been deployed. Initial results support the belief of integrating clinical and design practices for addiction assessment or even treatment. Moreover, feedback from project participants apparently reinforced the potential of "*gamification-enhanced*" design intervention for excessive mobile use in a *family* context. Through game and play, not only are parents-adolescent emotional connectivity stimulated, delightful memories of family activities before excessive mobile use are also relived and revealed. In return, further development of multidisciplinary approach of research and design interventions corresponding to addiction issues has been greatly encouraged.

Keywords: Multidisciplinary Approach, Design Intervention, Mobile Addiction, Family Functioning, Gamification, Lifestyle Research

1. Introduction

The exponential growth of screen-based products usage, particularly mobile devices has become very notable in recent years. With nearly two-thirds of the world's population now owning a mobile phone (Gowami and Singh, 2016), and over 60% growth in mobile subscriptions in Asia-Pacific by 2016 (Kemp, 2017), mobile usage has impacts on various aspects of our lives, such as communication, work, shopping, entertainment, travel, leisure and even in emergencies. However, at the same time, the enormous influences of mobile devices have brought along corresponding problems of addiction among younger generation worldwide.

Excessive use of mobile phones has been known to cause detrimental physical, physiological, mental and social consequences for adolescents. For instance, problems such as obesity, vision degradation, sleep deprivation (Shek and Yu, 2016), increased sense of loneliness, depression, low self-esteem (Beranuy, Oberst, Carbonell and Chamarro, 2009), time management deficiencies and academic problems in school will be particularly prominent in students suffering from said addiction (Hong, Chiu and Huang, 2012). Previous research also shows that, addictive mobile use has a negative influence on the social relationships of youngsters (Takao, Takahashi and Kitamura, 2009), especially family relationship. While mobile phone possession and use today has been considered amongst the younger generation as a way to reinforces personal autonomy (particularly with regard to parents (as cited in Chóliz, 2012)), and when parents exhibit usual injunctive attitudes or authority toward 'inappropriate' use of internet or mobile phones by adolescents (Liu, Fang, Deng and Zhang, 2012). This gave rise to problems in interactions with parents (Chóliz, 2012) hence very possible parent-adolescent conflicts. As a result, family, as a potential psychosocial element for reducing likelihood of addiction development among adolescents (implied by Shaffer and colleagues (2004)) would likely be weakened because of these growing

conflicts.

This rising problem of over dependence of mobile devices, and the consequence of parents-adolescent conflicts are particularly prominent these days in Hong Kong. Whilst a specific established addiction treatment center - the Integrated Centre on Addiction Prevention and Treatment (ICAPT) of the Tung Wah Group of Hospitals – has acknowledged the impacts of addictions on family relationships and mental health, the Department of Health of Hong Kong also revealed that nearly 25% of Hong Kong's student mobile owners have corresponding addiction problems (as cited in Shek and Yu, 2016), compared to 16% in Korea and a mere 10% in the UK (as cited in Tao et al., 2016).

Although there have been studies either on mobile addiction and adolescents (Chen, et al. 2016; Chóliz, 2012; Goweami and Singh, 2016;), or internet addiction related to parent-adolescent issues (Liu, et al. 2012; Chen, Chen and Gau, 2015), research on how multidisciplinary research and design might intervene and affect parent-adolescent relationships corresponding to excessive mobile phone use is relatively rare or unexplored.

Based on the family functioning concept and the gamification theory, this paper reports on an ongoing study of mobile addiction through collaboration between the Asian Lifestyle Design Lab, the Interaction Design Lab of the PolyU Design and the ICAPT, a major addiction service center in Hong Kong. The purpose of this study is to explore an integrative strategy and multidisciplinary approach of *family-focused* intervention and *gamification-enhanced* design research, aiming to enhance parent-adolescent interactivities whilst minimizing excessive mobile use of adolescents. The following sections of this paper are structured as follows: We first present the theoretical background of the study. Then, we elaborate our methods use, designs and process. Lastly, we discuss the initial findings and its implications.

2. Theoretical Background

2.1 Family Functioning

Having emerged in the 1970s, the concept of '*family functioning*' generally refers as "*the quality of family life at the systemic and dyadic levels and concerns wellness, competence, strengths, and weaknesses of a family* (Shek, 2002)". Except being the basic unit of society, family provides appropriate environmental conditions and its functioning allows for the nurturing of physical, mental and social aspects within family members (Dai and Wang, 2015; Epstein, Bishop and Levin, 1978). Therefore, a family in trouble disrupts members' cohesiveness and could jeopardize its function for cultivating personal growth (Smilkstein, 1984).

In fact, a study about family functioning and well-being of Chinese adolescent showed that "*family functioning was associated with adolescent psychological symptoms, positive mental health, academic performance, substance abuse, and delinquency* (Shek, 2002)."

While parents generally exhibit injunctive attitudes toward mobile usage by adolescents, excessive use of mobile phone or internet by adolescents results in further conflict with parents, which would cripple a family's function, and make the problem of addiction for adolescents much more difficult to resolve (Yen, et al., 2007). This highlight the relevance of studying parent-adolescent relationship and corresponding adolescent mobile use addiction through the lens of family functioning. And that has been one of the key approaches of the ICAPT for addiction related assessment or treatment.

Thus far, two major streams of family functioning theories have been developed: The '*result oriented*' theory which defines family functioning by specific family features, and the '*process oriented*' theory which describes family function from the tasks families need to perform (Dai and Wang, 2015). A notable representative of a result oriented theory is the *Beavers System theory*. It has been developed to examine relationships between various functions and strain ability of family and the family system. Beavers system model theory examines family functioning from two dimensions: The '*rigid*' index, including family structure, relationships and reaction forces, and the '*soft*' index, referring to the style of communication for family members (Beavers and Hampson 2000).

As for the process oriented theory, the key representative is the *McMaster family functioning model* theory, which assumes the basic function of family is to provide the necessary resources, and perform the basic, developmental and crisis tasks for positive growth of the members in it. The model evaluates family functioning via its ability to perform essential tasks which corresponds to six major dimensions: *Problem Solving, Communication, Roles, Behavior Control, Affective Responsiveness* and *Affective Involvement* (Epstein et al., 1978).

Although both representative theories are said to be founded on empirical research, we selected the *McMaster theory* as our research design reference. Not only has it been developed mainly for clinical utility, it also predominantly places emphasis on the '*interpersonal*' level of family functioning without concerning the complications regarding the family system or psychological theories (Skinner, Steinhauer and Sitarenios, 2000). Hence this provides a *design-friendly* and *operable* model for the investigation and intervention of the project

team.

2.2 Gamification

2.2.1 Origin and definitions

The term “*gamification*” was coined by Nick Pelling (a British game developer) back in the early 2000s (Stöcklin, 2012). Later on, it has been adopted widely in the fields of HCI (Human Computer Interaction), game studies and digital marketing with various suggested definitions since the mid 2010s (Deterding, Dixon, Khaled, and Nacke, 2011).

The most prevalent definitions refer to gamification as “*the use of game design elements in non-game contexts*” (Deterding et al., 2011), and “*the phenomenon of creating gaming experiences*” (Koivisto and Hamari, 2014). When ‘*gaming experience*’, which requires the creation of a sensation of flow, feelings of mastery and intrinsic motivations of gaming (as cited in Koivisto and Hamari, 2014), is predominantly at the core of gamification’s concern (Koivisto and Hamari, 2014), the call for game design elements in non-game contexts are, in fact the two most important concepts to be discussed in relation to the application of the theory for the study.

According to Deterding and peers (2011), “non-game contexts” are contexts opposite to entertainment or sport games, where application of game design elements could be for non-game issues of training, health, sustainability or news. It also explicitly intended to exclude the use of game design elements as part of designing only games, because that wouldn’t be “gamification”, but game design.

2.2.2 Game and game design elements

“*Game*” (or gaming) is the polar opposite of play (or playing) in a continuum of play activities.

Unlike play, which has been defined as a carefree, improvising, unproductive yet amusing activity (Caillios, 2001), “*game*” entails primarily artificial conflict, is rules-defined and has a quantifiable outcome (Salen and Zimmerman, 2004). “*Game*” also require efforts, patience, skills and a play-for-real mentality for the players who engage in it (Caillios, 2001). Hence any applied “game design elements” is meant to enable the aforementioned quality of gaming experiences.

Hitherto, apparently the most comprehensive list of “*game design elements*” has been identified and collected by Deterding and colleagues (2011), and has been categorized into five levels of abstraction (from concrete to abstract) as follows:

- [i] *Game interface design patterns*: Common interaction design components and design solutions (e.g. leaderboard, level) for a known problem.
- [ii] *Game design mechanics*: Commonly reoccurring parts (e.g. time constraint, turns) of the design of a game that concern gameplay.
- [iii] *Design principles and heuristics*: Evaluative guidelines (e.g. clear goals, enduring play, or game style variety) to approach a design problem or analyze a given design solution.
- [iv] *Game models*: Conceptual models of the components of games or game experience (e.g. Mechanics-Dynamics- Aesthetics, challenge, fantasy, curiosity).
- [v] *Game design methods*: Game design-specific practices and processes (e.g. playtesting, playcentric design, value conscious game design).

On top of that, Caillios (2001) also suggested four basic rubrics - the ‘*agon*’ (competition), ‘*alea*’ (chance), ‘*mimicry*’ (simulation), and ‘*ilinx*’ (vertigo) - and implied four basic forms (physical, mental, personal and social) of games. We compiled and adapted them as a complementary set of “*game design elements*” for the project.

3. Methods

After consulting with the ICAPT, and based-on the fore cited theories, two specific methods were developed to meet the needs of the study.

3.1 Family-focused intervention

We focused initially on family relationship, especially ‘*interpersonal*’ relationship between parents and adolescent. For that, ‘*home*’ as a physical context, and ‘*lifestyle*’ as a research approach for intervention have been adopted.

At present, ‘*home*’ is where young people can easily access the internet, hence facing risks of exposure of mobile addiction or dependence. For instance, about 80% of youngsters in the UK (Spielhofer, 2010), and 90% of middle school students in China (Peng, 2016) have access to the internet and usage of mobile phones at homes. Such phenomenon could indeed, best be studied via the *lifestyle research* approach.

Lifestyles are patterns of action that differentiate people, therefore it helps to make sense of what people do, and why they do it, and what doing it means to them and others (Chaney, 1996). Unlike the prevailing quantitative-based ‘*lifestyle*’ (or better say ‘*psychographic*’) study adopted by marketers mainly for market segmentation,

lifestyle research primarily emphasizes the observable behaviors of people instead of their mere cognitive conception of self (Anderson and Golden, 1984). Hence behavioral lifestyle studies enable deeper understanding of specific consumption practices of people, as well as motivations behind their actions and preferences.

To better structure the deployment of our research approaches, we adapted the six dimensions of the *McMaster family functioning model* for framing our focuses and purposes of research that correspond primarily to the addictive mobile usage issues are displayed in “**Table 1**”.

Table 1 The six dimensions of the *McMaster family functioning model* and their corresponding study focuses.

Dimension	Study focus (purpose)
1. Problem Solving	The ability to resolve <i>affective</i> and <i>instrumental</i> disputes between adolescent and their parents in general and related to addictive mobile use.
2. Communication	<i>Daily patterns</i> of (when, where, what and how) parent-adolescent information exchange with or without digital means.
3. Roles	<i>Role play</i> and <i>accountability</i> of parents related to mobile/internet addiction issue, and <i>supportive functions</i> for children in general.
4. Behavior Control	<i>Practice</i> and <i>style</i> which the adolescent adopts for handling mobile/ internet usage related behaviors.
5. Affective Responsiveness	The ability of the family’s responses to <i>affective stimuli</i> such as love, tenderness and joy within a <i>specific family activities</i> .
6. Affective Involvement	The degree to which the family shows interest in and values <i>collective activities</i> and interests of family members.

We also divided the six dimensions into two groups, within which we made use of the first four – “*problem solving*”, “*communication*”, “*roles*” and “*behavior control*” – to review, in general, parent-adolescent relationship along with the daily pattern of mobile/internet usage of the adolescent by means of the lifestyle research approach. Whereas the last “*affective responsiveness*” and “*affective involvement*” dimensions were utilized for gauging the quality of emotional-bonding between parents and adolescent via a complementary “*gamification-enhanced design*” approach.

3.2 Gamification-enhanced design

The “*gamification-enhanced design*” approach has been adopted based-on the aforementioned “gamification” theory. The purposes of “gamification” (when applied to enhance a design) in general, are to support and motivate people to be more engaging and to perform better the required tasks through allowing the proliferation of gaming experiences (Koivisto and Hamari, 2014). But, for this study in particular, the “*gamification-enhanced design*” approach was adapted to stimulate gaming experiences for families with three major objectives. Firstly, to allow for mental diversion and escape from daily routine (Caillois, 2001) of family members, hence creating engaging interactions among them. Secondly, to enable parents and adolescent a moment of pure equality, which are likely denied in the hierarchical-structured Chinese families (Leung, Shek and Li, 2016). Thirdly, and most importantly, to facilitate affective involvement and responses within Chinese families that lack emotional expression (Leung, Shek and Li, 2016).

To attain the aforesaid objectives, and enable effective deployment of the “*gamification-enhanced design*” approach for reviewing the “*affective*” dimensions of family functioning, we developed four rubrics of “*game design elements*” which were adapted from the works of Deterfing and colleagues (2011). These elements, its specific purposes and examples are summarized in “**Table 2**”.

Table 2 The purposes and relevant examples of the developed “*game design elements*” rubrics

Element	Purpose	Example
Interface	Engaging design components to retain family members’ interest and diverting their attention away from mobile devices.	Mobile device-docking platform, visual/audio signals, physical props, performance index.
Affective stimuli	Specific conditions or stimuli of games which are designed to trigger parent-adolescent’s affective responses and interactions.	Timed eyes/bodily contact, intellectual/physical-interdependence
Mechanics	Reoccurring parts of the game’s design that concern affective responses of parents and adolescent.	Time constraint, punishments/rewards.
Type/ model	Types or Conceptual models of games selected to allow for affective involvement of all members.	Chance, challenge, competition, dynamic, simulation.

The deployment of the “*gamification-enhanced design*” approach involved the fulfillment of two essential conditions: (1) A “*gamified*” activity for which family members’ attention on their mobiles could be diverted, and (2) a set of absorbing games which stimulate affective involvement of such activity. To realize these conditions, we envisioned and conceptualized an “*interactive play-platform*” to be designed.

4. Design

4.1 Interactive play-platform

We interpreted the conceptual “*interactive play-platform*” as an interactive lamp which was integrated with a mobile charging table and a gamebook. The interactive lamp is basically a ‘*digitized*’ device designed with an intimate, animal like appearance named “*Lamb-Lamp*” “**Fig. 1**”.

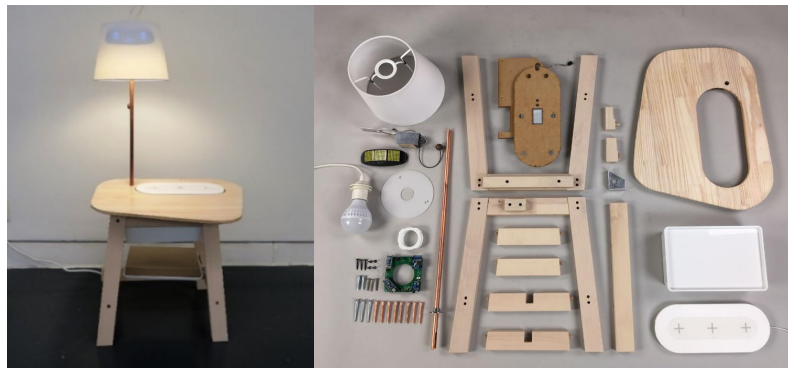


Figure 1 The interactive play-platform - “*Lamb-Lamp*”- designed to be ease of fabrication and assembling in batch and for deployment.

On the other hand, the gamebook is low-tech, basic and ‘*physical*’ “**Fig. 2**”. It consists of three items: [a] Stacks of game cards (includes five stacks which have been inscribed with various types of intellectual, physical and bodily-interactive games and one stack of ‘*favour*’ cards), [b] the contest record sheet for games, and [c] the lamp’s operation manual.



Figure 2 The gamebook with various sets of game cards and a 'favour' cards set.

Both the “*Lamb-Lamp*” and the games within the gamebook were gamified accordingly through adopting the aforementioned “*game design elements*”. Families are recommended to locate “*Lamb-Lamp*” (together with the gamebook) at home where it’s most visible. When family members return home, they are encouraged to rest their phones on the table for charging. The lamp awakes as the first mobile lands on its charger and the play sequence is activated. When all members’ phones gathered on the charging table, the lamp brightens further with a smiley and suggests members to play collectively. When one waves a hand over the lamp’s sensor, the lamp suggests games randomly via its facial display. Player can then open the gamebook and draw a card randomly from within a particular stack according to the lamp’s suggestion. Different games (such as physical-competence challenges, one-minute task challenges, and Chinese idioms guessing) with specific time constraint could be drawn. The timing function of “*Lamb-Lamp*” can simply be activated via a tap on the table. Players are supposed to contest against each other of a given task by a given time-duration “**Fig. 3**”.

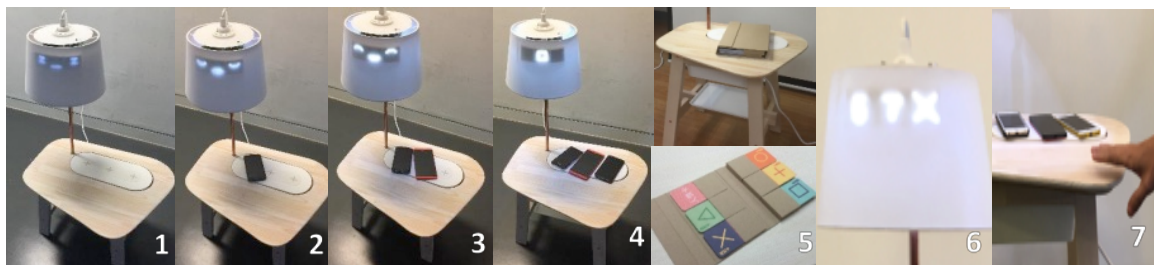


Figure 3 The play sequence facilitated by the interactive play-platform - “*Lamb-Lamp*”

In case, one member finds the given tasks indicated by the randomly-picked game card hard to achieve. He or she can opt for seeking help from any family member, however a ‘*favour*’, such as fifteen seconds of hugging, a smiley or an affectionate gaze (indicated by a drawn ‘*favour*’ card) must be performed for the help-giver in return as a reward.

Through “*Lamb-Lamp*” and the gamified activities, we aimed to create windows of opportunity for both the parents and adolescent to interact and be absorbed deeply for an occasion of playful engagement and emotional exchange.

4.2 Lifestyle probes

To supplement the “*Lamb-Lamp*”, an additional research tool named “*lifestyle probes*” was designed. It is based on the idea of “*cultural probes*” once developed to gather inspirational data about people's culture, thoughts and values via small packages of evocative tasks for design (Gaver, Dunne and Pacenti, 1999). The “*lifestyle probes*” (a set of selective self-reporting home assignments which we had developed (Leong, 2010)), on the other hand focused mainly on collecting information about daily communication, interaction patterns, Internet and mobile usage routines of parents and adolescent, as well as their perceptions on the relationship and cohesiveness of the family. The “*lifestyle probes*” were designed and

compiled as various sub-folders “**Fig. 4**” which allowed our project team to deploy those easily to participants’ home or for on-site utilization.



Figure 4 The whole set of *lifestyle probes*

These “probes” have been visually designed and structured in a way that corresponds to the four *McMaster family functioning* dimensions. For instance, the ‘*Life Pattern Diagram*’ “**Fig. 5**” helped to reveal the daily life pattern, and more specifically the “*communication*” dimension of usual time and duration of daily face-to-face and virtual gathering of the family. It also served to inform the “*role*”, “*problem solving*” and “*behavior control*” issues related to excessive adolescent mobile use.

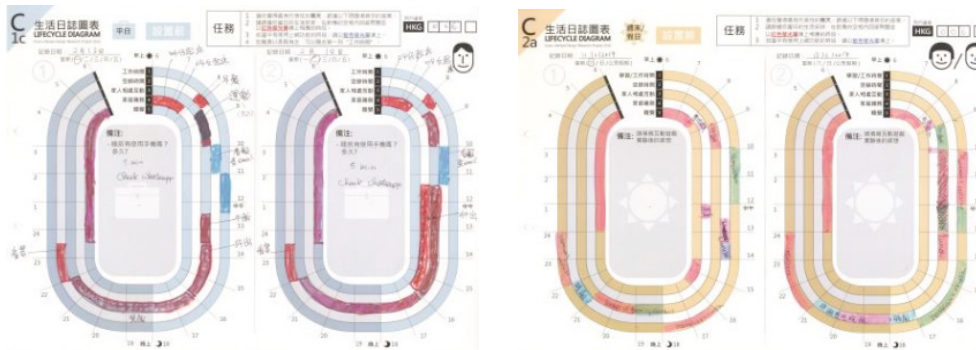


Figure 5 Examples of the ‘*Life Pattern Diagrams*’ filled by one of the recruited families’ parents and their child.

The ‘*Home Environment Setting*’ map “**Fig. 6**” supplements our understanding of the “*communication*” and “*behavior control*” dimensions of ‘where’ daily mobile device usage and face-to-face interactions occur at home.



Figure 6 A ‘*Home environment Setting*’ map prepared by a family.

The ‘*Internet Usage Pattern*’ diagram “**Fig. 7**” provided information about the “*behavioral control*”, “*problem solving*” and “*communication*” dimensions of an

adolescent's usual online activities, and with 'whom' they often interact with for these activities.

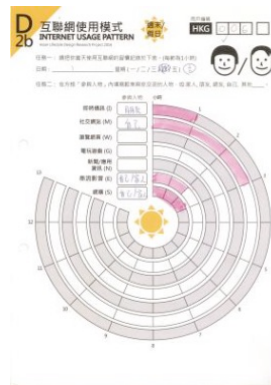


Figure 7 The 'Internet Usage Pattern' diagram

Lastly, the 'Family Harmony Diagram' (based on 'Family Circle Method' by Thrower and colleagues (1982)) and the 'Family Function (APGAR) Index' (adapted from APGAR assessment of Smilkstein (1978)) "Fig. 8" shed light on both the "problem solving" potential of the family, as well as the "role" accountability of parents in providing affective support to their children.

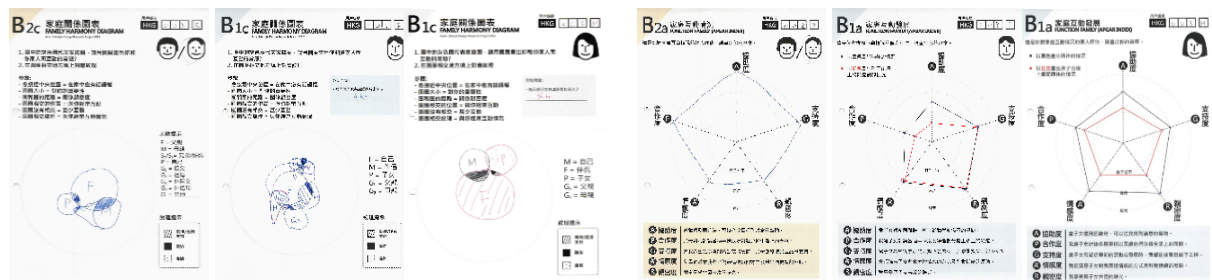


Figure 8 The 'Family Harmony Diagram' and 'Family Function (APGAR) Index' from parents and their adolescent.

The "probes" were not developed only as a supplementary research tool to "*Lamb-Lamp*", it's also meant to assist researchers to establish an '*entrée*' for getting acquainted with the family problems associated with excessive mobile use of the adolescent.

5. Process

For the ICAPT, there is a usual *engagement process* for those individuals who suffered from addiction. Such process involves five basic stages: [1] referral (through hotline by family members or referrals by professionals); [2] Intake assessment (initial problem identification); [3] detailed assessment (identify underlying issues); [4] develop treatment goals and treatment plan according to the detailed assessment; and lastly [5] case evaluation.

Our study intervened at the third stage of their process. It involved at minimum, six weeks of investigation. Through collaboration with the ICAPT, we aimed to recruit twelve families (referred by ICAPT) which involve adolescent mobile addiction problems. Because of the explorative nature of the study, the selection of families were basically random, as long as families' addicted children were age between 12 to 19 year old, and volunteered to take part in the research.

The whole *'family-focused'* engagement comprised of various meetings, visits and interviews for each family, which a planned procedure had been followed by our researchers as below:

Step 1: meet family at the ICAPT center. Explain purpose of research, demonstrate games and working prototype of *"Lamb-Lamp"*, conduct the introductory part of self-reporting assignments on-site, and past the *"lifestyle probes"* to the family.

Step 2: require family to record their daily life pattern, communication practices, and internet/mobile usage routines through the *"lifestyle probes"*.

Step 3: conduct first home visit and install *"Lamb-Lamp"* with the gamebook. Encourage members of family to take part in the gameplay facilitated by the *"Lamb-Lamp"* at least twice a week.

Step 4: conduct second home visit and take back *"Lamb-Lamp"* and the *"lifestyle probes"* from participants home. Conduct analysis of collected *"lifestyle probes"* and prepare for the second interview.

Step 5: Organize second interviews with parents and their children *separately* to obtain reflections about their experiences of collective gameplay, as well as their thoughts and motivations behind their internet/mobile usage practices and actions.

At this point in time, eight families had been engaged out of the targeted twelve. And among these engaged families, four have been fully completed, while the other four remain at the last two steps of the research process. Data collected from the four completed cases had been sorted, coded and analyzed.

6. Initial findings

Data collected from the completed cases initially revealed two *'parallel'* modes of parent-adolescent relationship based on the *"lifestyle research"* and *"gamification-enhanced design"* methods of studies.

One is the *'usual'* mode of daily parent-adolescent interactivity corresponding to the *"communication"*, *"role"*, *"behavioral control"* and *"problem solving"* dimensions of internet/mobile usage practices. Another is the *'occasional'* mode of parent-adolescent behavior, which correlated to the *"affective involvement"* and *"affective responsiveness"* dimensions at the collective-play activities facilitated by the gamified *"Lamb-Lamp"*.

Through the *"lifestyle probes"*, we observed that the *'usual'*, daily face-to-face *"communication"* between the adolescents and parents for most families were pretty limited (less than an hour in average). Whilst nearly all family activities happened in the living room, major face-to-face communications were mainly at dinner time, which indicated a very *'weak'* desire between adolescents and parents in actively seeking to communicate (please refer to **"Table 3"** for more information).

When it comes to *"role"* accountability, we found that majority of the parents are relatively supportive when their children ran into troubles, or when assistance is needed for any daily life challenges. Most of them are also trying to be a role model by refraining from unnecessary usage of internet and mobiles in daily life.

We also noticed that, although these families had tried out various *"problem solving"* measures to reduce the dependence of their children on the internet and mobiles, such as providing rewards, encouraging alternative activities (e.g. outdoor strolling, pet keeping, and limiting WiFi access), it seemed that all these measures hasn't helped in mitigating the degree of addictiveness of internet/mobile use for the adolescents. This results in relatively weak *"behavioral control"* exhibited by the adolescent over the purpose and duration of internet/mobile use, as well as their sleeping pattern. As a result, the perceived *'usual'* parent-adolescent relationships of those completed family cases are predominantly barely satisfied, as concluded by the summary table **"Table 3"** below.

Table 3 Summary of perceived satisfaction of parent-adolescent relationship related to internet/mobile usage via the four family functioning dimensions of McMaster model.

	family 001 14 yrs old (male)	family 003 19 yrs old (male)	family 005 16 yrs old (male)	family 006 17 yrs old (female)
COMMUNICATION (parents-adolescent)				
WHEN (key physical communication time):	dinner time	night time	lunch + dinner time	before/during dinner
WHERE (usual gathering place):	living room	living room	living room	living room/reading room
WHEN (average duration - physical/ virtual):	< 40 mins / ~ 30 mins.	< 30 mins / ~ 1 hr	~ 1 hr / 0 hr	~ 1.5 hrs / ~ 3 hrs
HOW (via digital means):	Instant message	social network sites	NIL	social network sites
ROLE (parents)				
Role model set for mobile/Internet usage	yes	not intended	yes	seemingly yes
Supportive role (perceived)	barely ok	ok	quite ok	quite ok
BEHAVIOURAL CONTROL (adolescent)				
Major purposes of Internet/mobile usage	games + stream media	Social networking + games	games + stream media	Social networking + shopping
Internet/mobile usage duration (wk day/end)	1.5 hrs / > 9 hrs	12 hrs/ 13 hrs	> 8 hrs/ 7 hrs	1.5 hrs / >10 hrs
Sleep pattern	laissez-faire	chaotic	laissez-faire	Laissez-faire
PROBLEM SOLVING (parents-adolescent)				
Actions/methods adopted for addictive internet/mobile use	personal persuade / reward with oversea trips	reasoning / provide book reading as an option	encourage outdoor activity / turn off WiFi connection	pet keeping / limit WiFi access
Quality of affective sharing	Unsatisfied (All members are unsatisfied)	just satisfied (parents were less satisfied)	barely satisfied (mother was unsatisfied)	just satisfied (parents were less satisfied)
Family cohesiveness	weak	apparently fine (particularly between father and son)	quite weak (but more issues between mother and son)	apparently fine (particularly from the perspective of daughter)
Overall rating* :	1	2	1.5	2.2

* KEY FOR OVERALL RATING: 1 = unsatisfied 2 = barely satisfied 3 = quite satisfied 4 = satisfied 5 = very satisfied

But at the same time, through reflections extracted from the interviews conducted with the same group of families, we found that the ‘occasional’ collective-play activities (stimulated by the “Lamb-Lamp”) helped to reveal quite a contradictory picture, particularly in relation to the ‘affective’ dimensions of parent-adolescent relationships.

On one hand, three out of four families commented that the interactive lamp had helped to provide valuable opportunities of “affective involvement” and quality interactions for members and even between the different generations within families.

For example, the mother of family 006 said: “The lamp has enabled us to get together more.”, and her husband followed up by saying that, “It really helped to stimulate our involvement, particularly the Chinese idioms guessing game, even children’s grandparents enjoyed the game too..... our interactions were very intense indeed.” Another example involves the father of family 003, who reported that: “I sensed that my son enjoyed pretty much the games and playful experiences.” While from the perspective of the adolescents, the son of family 005 expressed that: “Whenever daddy is at home on the weekends, we’ll get together and play.” the daughter from family 006 also acknowledged: “The amount of communication (through the lamp) increased, I even shared about personal anxiety.....I’m now quite used to interacting with my family after dinner.”

As for “affective responsiveness” on the other hand, there was positive feedback from the participants on three major kinds of affective experiences stimulated during the collective-play activities facilitated by the “Lamb-Lamp”.

Firstly, the sensation of a moment of joy and warmth. As the mother of family 005 recalled: “It was a special moment, we played and laughed happily. So warm indeed.” While her son reinforced: “The atmosphere of togetherness was nice and has been improved, when we gamed!”

Secondly, the revelation of graceful subtle emotions and sentiments. For example, mother of family 003 said: “When my son used the ‘favor’ card and asked for my help, and when he said tenderly ‘thanks mother’, it was so lovable!” Her husband continued: “When my son and I discussed possible play strategies, our status were level (equal). That’s an interesting sentiment for me.”

Lastly, the sentiment of the revival of lost moments of intimacy. The father of family 006 indicated, for instance, that: “There is always an invisible, but enormous barrier between us when my daughter is with her mobile.....But once we engaged the play, we enjoyed it a lot, the daughter who I used to know ‘reappear’ again!” His spouse then said: “An enjoyable moment like this were rare before..... I felt like we returned to the intimate moments when she was in kindergarten.” Whereas the parents of family 003 also remarked: “We do really enjoy again this lost intimacy, which mainly happened when he was much younger.”

Drawing on various reflections and observations gained predominantly from the ‘usual’ and ‘occasional’ modes of parent-adolescent relationship studies, initial results apparently support the benefits of “gamification-

enhanced design” intervention in a *family* context. Although there were no immediate changes regarding adolescent addiction behavior, none of the adolescent rejected the simple physical card games as opposed to the flashy digital games in their mobile devices, whereas parents also welcomed the intervention of the gamified designs. Through intellectual, physical and bodily interactions, not only is parent-adolescent emotional connectivity stimulated, joyful memories of family activities before excessive mobile use are also relived and revealed.

7. Implications

Although targeted family cases are yet to be completed and analyzed, initial insights gained from the study has certain implications, and possible contributions to clinical research and practice relevant to addictive behavior of adolescent in three ways.

Firstly, to the best of our knowledge, this study is the first of its kind which explore gamification-enhanced design intervention for an in-depth review of familial relationship corresponding to excessive mobile phone use in a specific *cultural* (Chinese) context. Future research can look into a comparable context for deepening the learning.

Secondly, although the ‘*occasional*’ exerted collective-play activities seemed unlikely to change ‘*usual*’ habits and addictive mobile use of the adolescents, the activities provided them – according to one of the ICAPT clinical staffs – an effective way to reflect on their intrapsychic condition, hence leading to greater awareness of the impacts of their addiction. This has indicated a potential of further development of the ‘*family-focused*’ and ‘*gamification-enhanced*’ design intervention as an alternative approach of addiction treatment besides assessment.

Lastly and most importantly, this study involved a close collaboration between a design and clinical institutes, which has explored and experimented a novel integration of *multidisciplinary-based, family-focused* and *gamification-enhanced* design research approach. As this approach has apparently been well received by the eight participated families at this point, it could become a possible reference and showcase of effective yet delightful implementation of addiction-related social service in China or Asia.

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References

- Anderson Jr, W. T., and Golden, L. L., (1984), “Lifestyle and Psychographics: A Critical Review and Recommendation”, *Advances in Consumer Research*, vol.11, No.1, pp.405-411.
- Beavers, R., and Hampson, R. B., (2000), “The Beavers systems model of family functioning”, *Journal of Family Therapy*, Vol.22, No.2, pp.128-143.
- Beranuy, M., Oberst, U., Carbonell, X., and Chamarro, A., (2009), “Problematic Internet and mobile phone use and clinical symptoms in college students: The role of emotional intelligence”, *Computers in Human Behavior*, Vol.25, No.5, pp.1182-1187.
- Billieux, J., Maurage, P., Lopez-Fernandez, O., Kuss, D. J., and Griffiths, M. D., (2015), “Can disordered mobile phone use be considered a behavioral addiction? An update on current evidence and a comprehensive model for future research”, *Current Addiction Reports*, Vol.2, No.2, pp.156-162.
- Caillois, R., (2001), *Man, Play and Games*, (1958. Trans. Meyer Barash), University of Illinois Press, Urbana and Chicago.
- Chaney, D., (1996), *Lifestyles: Key Ideas*, Routledge, London, NY.

- Chen, Y. L., Chen, S. H., and Gau, S. S. F., (2015), "ADHD and autistic traits, family function, parenting style, and social adjustment for Internet addiction among children and adolescents in Taiwan: a longitudinal study", *Research in Developmental Disabilities*, Vol.39, pp.20-31.
- Chen, L., Yan, Z., Tang, W., Yang, F., Xie, X., and He, J., (2016), "Mobile phone addiction levels and negative emotions among Chinese young adults: the mediating role of interpersonal problems", *Computers in Human behavior*, Vol.55, pp.856-866.
- Chóliz, M., (2012), "Mobile-phone addiction in adolescence: the test of mobile phone dependence (TMD)", *Prog Health Sci*, Vol.2, No.1, pp.33-44.
- Dai, L.T. and Wang, L.N., (2015), "Review of Family Functioning", *Open Journal of Social Sciences*, Vol.3, pp.134-141.
- Deterding, S., Dixon, D., Khaled, R., and Nacke, L., (2011, September), "From game design elements to gamefulness: defining gamification", In Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments (pp. 9-15), ACM.
- Epstein, N. B., Bishop, D. S., and Levin, S., (1978), "The McMaster model of family functioning", *Journal of Marriage and Family Counseling*, Vol.4, pp.19-31.
- Gaver, B., Dunne, T., and Pacenti, E., (1999), "Cultural Probes", *Interactions*, Vol.6, No.1, pp.21-29.
- Goswami, V., and Singh, D. R., (2016), "Impact of mobile phone addiction on adolescent's life: A literature review", *International Journal of Home Science*, Vol.2, No.1, pp.69-74.
- Hong, F. Y., Chiu, S. I., and Huang, D. H., (2012), "A model of the relationship between psychological characteristics, mobile phone addiction and use of mobile phones by Taiwanese university female students", *Computers in Human Behavior*, Vol.28, No.6, pp.2152-2159.
- Kemp, S., "Digital in 2017: Global Overview", We are Social, (2017, January 24), Retrieved: 17 November 2017, <https://wearesocial.com/uk/special-reports/digital-in-2017-global-overview>
- Koivisto, J., and Hamari, J., (2014), "Demographic differences in perceived benefits from gamification", *Computers in Human Behavior*, Vol.35, pp.179-188.
- Leong, B.D., (2010), "Strategic 'Green' Design: What Could we Learn from Our Ways of Living in China?", *Zhuangshi*, Vol.212, pp.60-68.
- Leung, J. T., Shek, D. T., and Li, L., (2016), "Mother-Child Discrepancy in Perceived Family Functioning and Adolescent Developmental Outcomes in Families Experiencing Economic Disadvantage in Hong Kong", *Journal of youth and adolescence*, Vol.45, No.10, pp.2036-2048.
- Liu, Q. X., Fang, X. Y., Deng, L. Y., and Zhang, J. T., (2012), "Parent-adolescent communication, parental Internet use and Internet-specific norms and pathological Internet use among Chinese adolescents", *Computers in Human Behavior*, Vol.28, No.4, pp.1269-1275.
- Peng, S. B., (2016), "Report on the Use of Mobile Phone for Middle School Students", *Hunan Middle School Physics*, Vol.1, pp.46-48 (in Chinese)
- Salen, K., and Zimmerman, E., (2004). *Rules of play: Game design fundamentals*, MIT press, Cambridge.
- Shaffer, H. J., LaPlante, D. A., LaBrie, R. A., Kidman, R. C., Donato, A. N., and Stanton, M. V., (2004), "Toward a syndrome model of addiction: Multiple expressions, common etiology", *Harvard Review of Psychiatry*, Vol.12, No.6, pp.367-374.
- Shek, D. T., (2002), "Family functioning and psychological well-being, school adjustment, and problem behavior in Chinese adolescents with and without economic disadvantage", *The Journal of Genetic Psychology*, Vol.163, No.4, pp.497-502.
- Shek, D. T., and Yu, L., (2016), "Adolescent internet addiction in Hong Kong: prevalence, change, and correlates", *Journal of pediatric and adolescent gynecology*, Vol.29, No.1, pp.S22-S30.
- Skinner, H., Steinhauer, P., and Sitarenios, G., (2000), "Family Assessment Measure (FAM) and process model of family functioning", *Journal of Family Therapy*, Vol.22, No.2, pp.190-210.
- Smilkstein, G., (1978), "The family APGAR: a proposal for a family function test and its use by physicians", *Journal of Family Practice*, Vol.6, pp.1231-1239.
- Smilkstein, G., (1984), "The physician and family function assessment", *Family Systems Medicine*, Vol.2, No.3, pp.263-278.
- Spielhofer, T., "Children's online risks and safety: A review of the available evidence", the National Foundation

- for Educational Research, (2010, March), Retrieved: 17 November 2017, <https://www.nfer.ac.uk/publications/COJ01/COJ01.pdf>
- Stöcklin, N., “Who coined the term "gamification"?", Quora, (2012, November 28), Retrieved: 17 November 2017, <https://www.quora.com/Who-coined-the-term-gamification>
- Takao, M., Takahashi, S., & Kitamura, M., (2009), “Addictive personality and problematic mobile phone use”, *CyberPsychology & Behavior*, Vol.12. No.5, pp.501-507.
- Tao, S., Wu, X., Wan, Y., Zhang, S., Hao, J., and Tao, F., (2016), “Interactions of problematic mobile phone use and psychopathological symptoms with unintentional injuries: a school-based sample of Chinese adolescents”, *BMC Public Health*, Vol.16. No.1, p.88.
- Thrower, S. M., Bruce, W. E., & Walton, R. F., (1982), “The family circle method for integrating family systems concepts in family medicine”, *Journal of Family Practice*, Vol.15, pp.451-457.
- Yen, J. Y., Yen, C. F., Chen, C. C., Chen, S. H., and Ko, C. H., (2007), “Family factors of internet addiction and substance use experience in Taiwanese adolescents”, *CyberPsychology & Behavior*, Vol.10, No.3, pp.323-329.