




The common sense of dependence on smartphone: A comparison between digital natives and digital immigrants

new media & society
2016, Vol. 18(7) 1236–1256
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sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/1461444814554902
nms.sagepub.com


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Abstract

Recently, mass media and researchers have begun to be concerned about excessive dependence on smartphones. Their interest, however, has largely focused on description of the phenomenon (i.e. severity of the addiction, current status of the addiction) or the development of measurement scales to assess the addiction. In this study, we ask a fundamental question about smartphone addiction: what users' common sense of dependence on smartphones is. More specifically, employing a core–periphery analysis of social representations, this article explores how the younger generation has a different understanding of this addiction from the older generation. Findings of the study can provide a rich knowledge about users' perceptions of and attitude toward smartphone addiction.

Keywords

Actor–observer bias, addiction, attribution theory, core–periphery analysis, smartphone, social representations theory

Introduction

Mobile phones have led to drastic changes in human life. They have radically changed our daily life and have even transformed culture and values. For example, by facilitating communication among different classes of people, mobile phones lower gender

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barriers and further accelerate democratic progress (Doron and Jeffrey, 2013). Particularly, smartphones enable people to engage in diverse activities, such as sending email, online shopping, and social networking, anywhere, anytime. Smartphone users reached 1.9 billion in 2013, corresponding to 27% of worldwide population, and it is predicted that the number of users will increase to 5.6 billion by 2019 (Ericsson Mobility Report, 2013).

Although the numerous benefits of smartphones are welcome, a deepening dependence¹ on these devices is causing concerns about smartphone addiction. According to a survey conducted in the United States in 2012, approximately 54% use their phones while lying in bed, before and after sleeping (Lookout, 2012). As the compulsive use of smartphones becomes problematic, mass media reports its seriousness, and researchers try to find symptoms of the excessive dependence on mobile phones or develop addiction measurements (Bianchi and Phillips, 2005; Billieux, 2012).

Current interest in smartphone addiction, however, focuses largely on negative outcomes, and there is a lack of discussion from the *users'* perspective of the addiction. In particular, digital natives (DN), who have grown up with digital technologies, may have different understandings of excessive IT use from digital immigrants (DI), who were first exposed to digital technologies later in life (Prensky, 2001). While the term "digital natives" indicates the young generation born after the 1980s, "digital immigrants" designates the parent generation of DN. Because DN have been growing with diverse digital technologies, they are inclined to adopt and be favorable to emerging technologies. On the other hand, DI, who have been exposed to digital technologies in the later parts of life, tend to mistrust new information technologies (Prensky, 2001). A recent report also shows that the young generation (late teens and 20s) has a significantly higher Digital Quotient (DQ) score, indicating the level of tech-savvy, than the older generation (40s and 50s) (Ofcom, 2014). The degree of familiarity with technologies may have an influence on individuals' perception of and attitude toward digital technologies. The gap between both generations may cause distorted social communication, which ultimately induces social conflicts. Accordingly, as the younger generation's problematic use of smartphones is becoming a social issue (Nam, 2013), it is important to investigate the differences in understanding smartphone addiction from generation to generation. Based on a social representations theory providing the theoretical framework for exploring a social group's common sense (Moscovici, 1961, 1984), this study explores how DN understand the excessive use of smartphones differently from DI.

Research background

Social representations theory

The theoretical framework of this study is the social representations theory, which inquires about commonsense knowledge shared by members of a social group (Moscovici, 1961, 1984). Social representations are the stock of common knowledge which group members share about the social world (Augoustinos et al., 2006). They are reconstructions of reality rather than reflections of reality in that they are formed through interaction and communication among members in socially and historically conditioned

environments. Social representations offer a referential framework for community members to categorize and interpret a social object or phenomenon (Moscovici, 1984).

The social representations theory has been fruitfully applied to investigate how a social object is collectively understood by groups or communities. The theory has been employed to study collective sensemaking on a wide range of topics, such as health and illness (Herzlich, 1973), African American identity (Philogène, 1999), and the electronic purse (Penz et al., 2004). The theory has also been used to explore different understandings among social groups. For example, Wagner et al. (2002) used the theory to investigate how differently “biotechnology” is understood in 15 European countries, and Vaast (2007) demonstrated different understandings of the term “security” by different occupational groups, such as physicians, nurses, and administrative staff, in a hospital. Therefore, social representations theory is well suited to this study aiming at exploring generational differences in understanding smartphone addiction.

An essential part of the social representations theory is a structure of social representations, which is seen as consisting of a central core and peripheral elements (Abric, 2001). A social representation is composed of a body of information, beliefs, opinions, and attitudes about a given object, and those constituents are categorized into cores or peripherals. Social representations are characterized as an ambivalent trait: rigid and malleable, consensual and disagreed (Abric, 2001). Such an ambivalent stable/changing nature leads to the two-layer structure of social representations. The central core is the non-negotiable and stable element of the representation, ensuring the lasting nature of the representation in diverse contexts. On the other hand, the peripheral elements, which are organized around and interpreted with the central core, are less shared and are the area of adaptation based on new information or changing environments. Because the core-periphery perspective provides structural information as well as finding conceptual components of social representations, the perspective has been widely used to investigate social representations (e.g. Mäkineniemi et al., 2011; Pawlowski et al., 2007; Wagner et al., 1996).

Smartphone addiction

Addiction indicates repetitive acts with lack of control that precipitate personal and social problems (Marlatt et al., 1988). This intoxicated state may be caused by continued use of a harmful substance, such as drugs, alcohol, or tobacco (Corsini, 1994), or repeated behaviors to pursue pleasure or to escape from mental agony. Addictive behaviors often lead to adverse consequences, such as lower work/school performance or family conflict (Billieux et al., 2008; Caplan, 2002). As IT becomes more interwoven with everyday life, concerns about excessive use become more of an issue, and it is regarded as another type of addictive behavior (Griffiths, 1996; Young and Abreu, 2010). For example, a compulsive use of the Internet can be a means of psychological escape from real or encountered problems (Young, 1998). With the advent of diverse digital devices used by individuals, pathological use of IT can be widely spread in our society and may become a more complex matter (Young and Abreu, 2010). Therefore, it is meaningful to investigate a variety of IT compulsions using diverse approaches to develop a comprehensive understanding of technological addiction.

Because of their portability and versatility based on diverse applications and constant Internet connection, smartphones are more attached to humans in daily life than any other type of IT. Such embeddedness of smartphones in everyday life can induce techno-dependence. Based on research on Internet addiction, problematic use of mobile phones has recently been studied (Bianchi and Phillips, 2005; Chóliz, 2010; Salehan and Negahban, 2013). Excessive dependence on mobile phones is considered a behavioral addiction without source chemicals, along with gambling and compulsive shopping (Chóliz, 2010). Symptoms of addiction to mobile phones or smartphones include not only mental indications (e.g. withdrawal symptoms, compulsion) but also improper social interaction (e.g. use while driving, use during conversation) (Salehan and Negahban, 2013).

Previous research regarding addiction to mobile phones focused on the development of addiction measurements. Bianchi and Phillips (2005) developed the Mobile Phone Problem Use Scale (MPPUS), consisting of 27 questions covering tolerance, withdrawal, escapism, craving, and negative effects on daily life. Another measurement scale is the Problematic Mobile Phone Use Questionnaire (PMPUQ) (Billieux et al., 2008) which measures mobile phone addiction by four facets: dangerous use (e.g. use while driving), prohibited use (e.g. use in class), dependence symptoms (e.g. withdrawal), and financial problems (e.g. excessive expense). Other studies have also used MPPUS or PMPUQ to investigate the mobile phone addiction of a particular type of user (e.g. adolescent users) (Güzeller and Coşguner, 2012; Lopez-Fernandez et al., 2014) or have transformed or advanced the prior scales (Rutland et al., 2007). However, initial research on mobile phone addiction is skewed toward a way of measuring addiction and mainly deals with youths' addictive use of mobile phones. This research trend may limit our understanding of addiction to mobile phones. Research rarely explores fundamental questions, such as how users understand the phenomenon, and further, how the young have different thoughts about addiction from the older generations. Answers to these questions can provide essential knowledge about addiction to smartphones.

Methodology

This study employed the core–periphery analysis of social representations. We explored the core–periphery structure of social representations about smartphone addiction. In particular, we investigated and compared the representations made by DN and DI. For this purpose, we elicited social representations through semi-structured interviews and then conducted content analysis of the interviews. Next, the data were analyzed to reveal the structure of the representations on the basis of the core–periphery model (Borgatti and Everett, 2000). Finally, the core–periphery structure is presented with a maximum tree (Flament, 1986) which visualizes elements on a perceptual space.

Semi-structured interview

One of the best ways to elicit social representations is to analyze the content of writing or speaking about the theme (Farr and Moscovici, 1984). Participants were South Korean citizens. South Korea is one of the leading countries in mobile services. Almost every

citizen uses mobile phone services, and 37 million people, corresponding to 74% of the total population, had smartphone devices in 2013.² Considering the wide diffusion of mobile services, South Korea is a suitable place for investigating perceptions of smartphone addiction. Data were collected through face-to-face interviews which lasted 30 minutes on average and were recorded. The interview was conducted in a semi-structured format, guided by stimulus questions about (1) a specific case of smartphone addiction, (2) definitions of smartphone addiction, and (3) causes and results of smartphone addiction. To avoid bias, we did not explain what we meant by the term smartphone addiction, nor were any cases presented. A total of 85 participants were interviewed (47 DN and 38 DI). All of the participants own and regularly use a smartphone. On average, DN were 25 years old, and DI were 44 years old.³

Content analysis

The first task of the analysis processes was a detailed coding of interviews. The first coder, one of the researchers, coded interview transcripts based on an open coding process in which codes are not determined, but rather emerge from the data. At the beginning of coding, 49 codes were identified. After six discussion sessions with coding facilitators, consisting of three graduate students, codes were elaborated and were grouped into 24 codes. A second coder re-coded the data using the new set of codes. The inter-rater reliability, the degree of consensus among coders, was 91.1%, implying that the two raters were in agreement on a high level (Fleiss et al., 2003). Table 1 shows the final 24 conceptual components (topics) of smartphone addiction derived from content analysis.

Analysis of the structure: core and periphery analysis

The next step of the analysis classified topics of smartphone addiction into core and peripheral elements. Following prior studies on a core–periphery structure of social representations (e.g. Jung et al., 2009; Pawlowski et al., 2007), we used the core–periphery algorithm, which was developed by Borgatti and Everett (2000), to identify a core–periphery structure in the network data. The statistical software UCINET, which was also developed by Borgatti and colleagues and is widely employed in social network analysis, was used to generate coreness and membership of elements in the core or periphery.⁴ Based on each element's coreness, indicating the extent to which each element is associated with the latent center (Borgatti and Everett, 2000), the software classifies elements into two groups: core and periphery. The co-occurrence matrix was used as the data matrix for the core–periphery analysis. In the results for DN, 10 topics were classified to the core and the remaining 14 to the periphery. In the results of DI, 8 topics were central elements and the remaining 16 topics were peripheral.

Mapping social representations

First, source data presenting relationships among topics were produced to visualize the structure of the social representations. We conducted an analysis of similarity, which

Table 1. Topics in the social representation of smartphone addiction.

	Topics	Examples
T1	Convenience/ usefulness	"Users can work more quickly with their smartphone. It's useful," "Smartphone is a convenient tool, because it provides lots of things"
T2	Portability	"I bring my smartphone almost everywhere," "I can always access the Internet on my smartphone," "Users can do lots of work anywhere thanks to their smartphone"
T3	Studying/working	"I use the smartphone for studying English," "I check email mainly with my smartphone"
T4	Communicating/ sharing information	"Smartphones offer mobile messengers as well as voice communication. Today, they are an essential communication tool!" "Smartphones facilitate sharing information with friends"
T5	Killing time	"Smartphones are an excellent gadget for killing time at one's leisure," "I use it[smartphone] when waiting for the bus"
T6	Game	"I play social games on my smartphone," "My main usage of my smartphone is gaming"
T7	Daily necessity	"Today, smartphones are a daily necessity," "Without smartphones, people may feel inconvenience"
T8	Social belonging	"The use of my smartphone makes me feel connected to my peer group," "If I might not use a smartphone, I would be isolated away from the world"
T9	Lack of control	"Addiction is caused by users' lack of control over smartphones," "Smartphones make users lack control"
T10	Young generation	"Teenagers use smartphones too much," "The young generation has become addicted to smartphones"
T11	Habitual use	"People habitually use their smartphones," "I check my smartphone over and over without even thinking about it"
T12	Waste time	"Smartphones make people waste time," "I stupidly spend time using a smartphone"
T13	Interrupting study/ work	"Smartphones decrease work efficiency," "Smartphones are very distracting"
T14	Physical harm	"When using a smartphone, I feel eyestrain," "I am stiff-necked"
T15	Digital dementia	"It[smartphone] decreases memory," "Smartphones make people think less"
T16	Withdrawal symptom	"I am nervous without my smartphone," "I feel something's missing"
T17	Negative effect on mental health	"Smartphones make people impulsive," "Become impatient"
T18	Decline of face-to- face interaction	"Less conversation among family members," "More time alone with a smartphone"
T19	Heavy expenditure	"I spend much money in apps and smartphone services," "Expensive devices"
T20	Harmful/ provocative content	"Consuming unfavorable content (e.g. adult video clips, gambling)"
T21	Crime/insecurity	"Increasing cyber-bullying," "Increasing theft of smartphone devices," "Increasing insecure mobile banking services"

Table 1. (Continued)

	Topics	Examples
T22	Natural/inevitable phenomenon	"Increasing dependence on smartphone is a natural part of today's life," "Similar to diffusion of automobiles"
T23	Keeping personal relationship	"Smartphones help us to keep relationships with friends," "Tool connecting me with others"
T24	Escapism	"A smartphone sometimes makes me ignore what I have to do," "Excessive dependence on smartphones may be caused by the desire to escape from reality"

identifies relationships among elements of social representations (Flament, 1986; Pawlowski et al., 2007). A Jaccard's similarity coefficient, indicating a degree of similarity based on co-occurrence (Hammond, 1993), was generated between two topics, and all coefficients were summarized into the inter-attribute similarity (IAS) matrix (Appendix 1). Next, the similarity relationships were visualized as a maximum tree, which seeks to single out relationships among all nodes within the network in a way that maximizes the overall similarity within the representation of the map (Flament, 1986). A maximum tree is constructed by the nearest neighbor algorithm which is a procedure to link two topics. The first task of the procedure is to find the topic (X) with the largest frequency value and include it in the map; then among the other topics, the one with the highest similarity to X is selected and connected to X. If there were multiple topics with the same similarity, the one with the highest frequency value is picked. The results of the analysis are shown in Figure 1.

Results

Results of the content analysis show that both DN and DI have the same 24 constituent representations of smartphone addiction, implying that both generations have an overall similar understanding of this issue. The core-periphery analysis of the representations, however, revealed the understanding gap between the two generations. DN and DI shared five core elements: Decline of face-to-face interaction (T18), Portability (T2), Withdrawal symptoms (T16), Game (T6), and Habitual use (T11). Despite the common representations, there are differences in the understanding of smartphone addiction between the two generations. While Communicating/sharing information (T4), Interrupting study/work (T13), Wasting time (T12), Convenience/usefulness (T1), and Physical harm (T14) were core topics in the representation of smartphone addiction by DN, lack of control (T9), Young generation (T10), and Crime/insecurity (T21) were core elements in the representation by DI. Table 2 illustrates core-periphery membership of topics and differences between DN and DI in the membership. In particular, Table 3 summarizes causes and effects (or symptoms) of smartphone addiction by DN and DI. Furthermore, the perceptual map (see Figure 1), which visualizes the representations, more clearly illustrates different structures of the representations between the two generations. Accordingly, we can initially conclude that although DN and DI have communal representations of

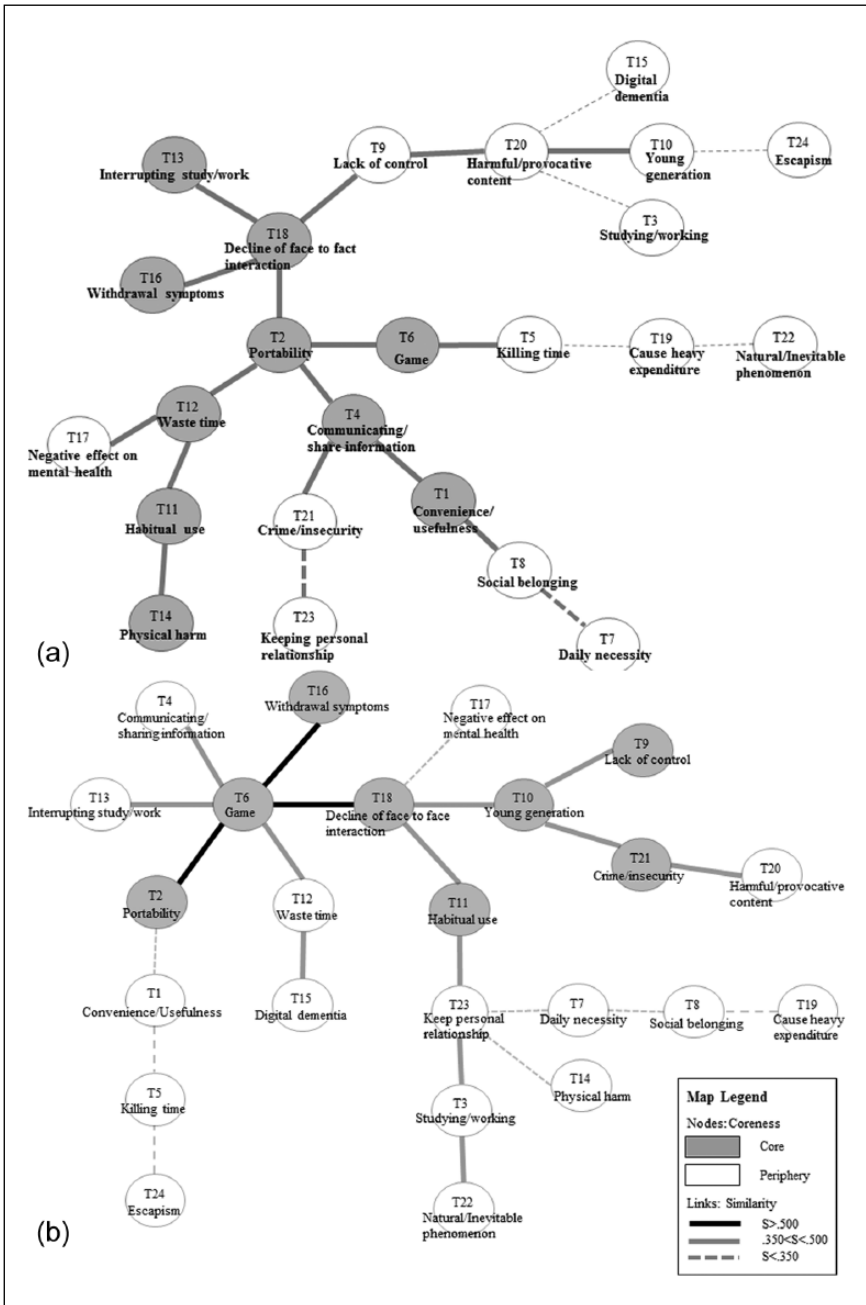


Figure 1. Social representation map: (a) digital natives and (b) digital immigrants.

Table 2. Core–periphery structure.

Digital natives			Digital immigrants		
No.	Topic	Coreness	No.	Topic	Coreness
T18	Decline of face-to-face interaction	0.407	T6	Game	0.442
T2	Portability	0.314	T18	Decline of face-to-face interaction	0.442
T4	Communicating/ sharing information	0.303	T2	Portability	0.321
T13	Interrupting study/ work	0.300	T16	Withdrawal symptoms	0.321
T16	Withdrawal symptoms	0.291	T11	Habitual use	0.273
T6	Game	0.288	T9	Lack of control	0.229
T11	Habitual use	0.282	T10	Young generation	0.227
T12	Waste time	0.272	T21	Crime/insecurity	0.204
T1	Convenience/ usefulness	0.225	T4	Communicating/sharing information	0.182
T14	Physical harm	0.201	T15	Digital dementia	0.171
T21	Crime/insecurity	0.186	T13	Interrupting study/work	0.17
T5	Killing time	0.169	T12	Waste time	0.165
T8	Social belonging	0.153	T1	Convenience/usefulness	0.138
T17	Negative effect on mental health	0.141	T17	Negative effect on mental health	0.126
T20	Harmful/ provocative content	0.106	T23	Keeping personal relationship	0.109
T9	Lack of control	0.105	T20	Harmful/provocative content	0.103
T19	Heavy expenditure	0.066	T24	Escapism	0.102
T10	Young generation	0.063	T3	Studying/working	0.091
T23	Keeping personal relationship	0.061	T8	Social belonging	0.067
T3	Studying/working	0.033	T19	Heavy expenditure	0.065
T7	Daily necessity	0.030	T5	Killing time	0.061
T22	Natural/inevitable phenomenon	0.020	T14	Physical harm	0.057
T24	Escapism	0.017	T7	Daily necessity	0.043
T15	Digital dementia	0.008	T22	Natural/inevitable phenomenon	0.039

Shading indicates core elements, and bold indicates common core elements of digital natives and digital immigrants.

smartphone addiction, there are different understandings of the issue in detail between the two generations. A detailed discussion follows in the next section.

Table 3. Causes and effects (symptoms) in core topics.

	Digital natives	Digital immigrants
Causes	T2: Portability T6: Game T1: Convenience/usefulness	T6: Game T2: Portability T9: Lack of control
Effects or symptoms	T18: Decline of face-to-face interaction T13: Interrupting study/work T12: Waste time T14: Physical symptom	T18: Decline of face-to-face interaction T21: Crime/insecurity T15: Digital dementia

Discussion

The social representation approach helped identify how DN and DI interpret addictive use of smartphones. The findings of the empirical investigation provided a detailed and comprehensive view of smartphone addiction. In this section, we first interpret results of the core–periphery analysis and then discuss the detailed structures of the representations of both generations.

Comparison of the core topics

As seen in Table 2, five topics were core elements shared by both generations. The overlapping core elements include Portability, Game, Habitual use, Withdrawal symptoms, and Decline of face-to-face interaction. Shared topics indicate both generations' common viewpoint on smartphone addiction and typically present causes and effects of smartphone addiction. Based on the results, the portable characteristic may make users use smartphones when unnecessary and may even lead to habitual use. Particularly, mobile games are picked up as a principal cause of addictive use by both generations. The common central effects of smartphone addiction include both individual and social troubles. Excessive dependence on smartphones may not only cause psychological anxiety without their own smartphone but may also decrease social interaction.

Although both DN and DI share several core elements, there are others that are specific to each group. While the remaining different core topics of DN are Communicating/sharing information, Interrupting study/work, Wasting time, Convenience/usefulness, and Physical harm, those of DI are Lack of control, Young generation, and Crime/insecurity. As shown in Table 3, although both DN and DI commonly regard the portable attribute and games as the main causes of addictive use, both also describe different reasons. DN think of dependence on smartphones as an inevitable phenomenon because these devices are the main means for communication and are very convenient for people. In other words, they ascribe their dependence to the *external* environment developed by smartphones. On the other hand, DI find causes of smartphone addiction in users' *intrinsic* characteristics. DI feel that users' lack of control over smartphone use or the younger generation's characteristics may cause addiction.

Such interpretations can be better explained by attribution theory (Jones and Nisbett, 1971), which deals with how humans combine information in order to arrive at causal explanations for an event (Fiske and Taylor, 1991). The theory argues that according to their perception of involvement in the phenomenon (i.e. *actors* highly involved, *observers* rarely involved), people are inclined to make causal judgment in two ways: personal (or internal) causes and situational (or external) causes of behavior (Fiske and Taylor, 1991). While actors are inclined to attribute their actions to situational requirements, observers tend to attribute the same actions to personal dispositions (Fiske and Taylor, 1991).

In this study, both generations have different positions or attitudes toward users' dependence on smartphones. DN regard themselves as actors, in that they ascribe smartphone addiction to situations provided by smartphones, whereas DI treat themselves as observers, in that they attribute smartphone addiction to users. Because smartphones are deeply interwoven with the life of DN, this generation may have a position of actors. In order to mitigate dissonance between inevitable use of smartphones and uncomfortable feelings of excessive dependence, DN attribute the addiction to situational factors rather than their own characteristics. On the other hand, because DI think that smartphone addiction is mainly relevant to young people, they regard themselves as observers outside the addiction. In regard to the effects or symptoms of smartphone addiction (see Table 3), the actor–observer perspective can also be applied. DN mention concrete and tangible negative outcomes (i.e. interrupting study/work, wasting time, physical harm), implying that they are *actual* users of smartphones and know much about the consequences of using smartphones. DN explain the negative effects based on their individual experiences, such as withdrawal symptoms or disrupted daily tasks. DI focus on social-level effects of smartphone addiction, such as smartphone theft or fraud. Therefore, DI have a different position (i.e. observers) from DN in that DI list more abstract effects, rather than use-based experiences. We can guess that the understanding gap of smartphone addiction is triggered by the different positions (i.e. actors vs observers) of the two generations.

Comparison of the structure of the representations

In this section, we discuss the structures of the representations. Because peripheral elements indicate individuals' variation in social representations in the community, our discussion focuses on structures directly connected to core topics.

Portability (T2) has a pivotal role in the structure of representations by DN. In the context of smartphones, portability indicates the ubiquitous availability of various applications and Internet connection rather than device portability per se. The portable property of smartphones may lead to regrettable feelings by unnecessarily using smartphones and, furthermore, decrease social and family interaction by making users use devices anytime and anyplace. Simultaneously, DN think that the portability provides a better environment for communicating and killing time with games and may make users perceive that smartphones are convenient and useful. In short, DN recognize the merits of smartphones as well as the negative effects of addictive usage. It is interesting that they mention positive aspects of smartphone usage when they were asked about smartphone

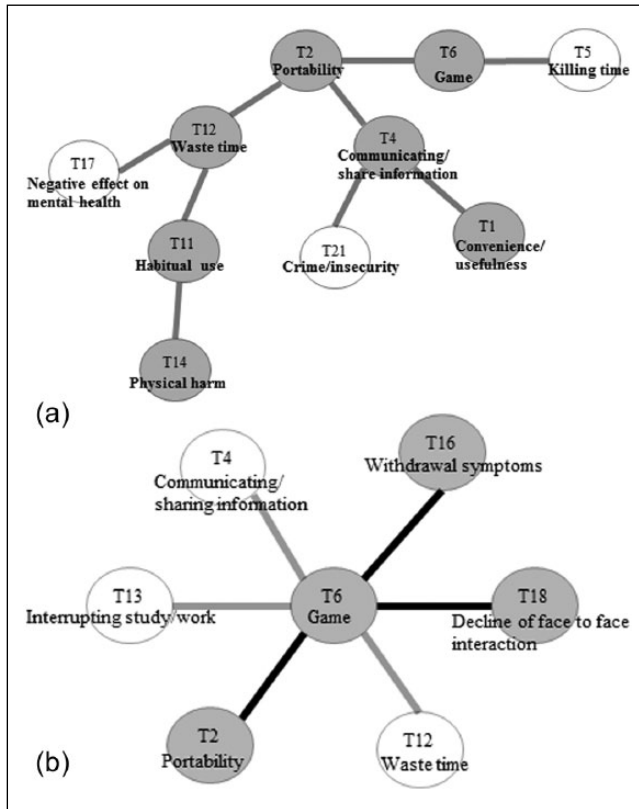


Figure 2. Main causes of smartphone addiction—Portability (T2) versus Game (T6): (a) digital natives and (b) digital immigrants.

addiction. One possible explanation is that they intend to reduce discomfort from recognizing an excessive dependence on smartphones by mentioning positive aspects of smartphone usage.

On the other hand, Game (T6), which is considered a key cause of addictive usage, plays a hub in the structure of representations by DI. Most of the topics around the hub correspond to negative effects of smartphone addiction, such as Wasting time (T12), Interrupting study/work (T13), Withdrawal symptoms (T16), and Decline of face to face interaction (T18). DI, therefore, focus on negative effects of smartphone usage and seem to attribute these effects to mobile games, whereas DN recognize the fundamental attribute leading to addiction (i.e. portable) and value of using smartphones. Figure 2 shows differences between the social representations centering Portability (T2) and Game (T6) of DN and DI, respectively.

Smartphones are no longer a technology that is functionally devoted to communication, and they allow users to have a wide range of activities, such as Internet surfing, sending email, playing social games, and social networking (Billieux, 2012). The versatile

properties may tie users to smartphones and reduce actual interaction with others (Chóliz, 2010). Our results also confirm this. Decline of face-to-face interaction (T18) is considered a crucial effect of smartphone addiction by both generations. However, there are different structures around Decline of face-to-face interaction (T18) by the two generations. In the partial structure of the representations, while DN recognize the portable property of smartphones as a cause of increasing attachment to devices, which decreases social and family interaction, DI regard mobile games and habitual use as the cause. Additionally, DI think that the lack of interaction is more salient to the young, implying that the young are more easily addicted to smartphones and have less interaction with others. Accordingly, we can conclude that DI make smartphone addiction related to user-specific characteristics (i.e. individual users' habit, young users), whereas the representations by DN are relevant in more experiential effects as they have first-hand experiences. This finding supports the actor–observer perspective on DN and DI which is described in the former section about comparing core topics. Figure 3 shows connections between Decline of face-to-face interaction (T18) and other topics.

In the structure around Young generation (T10), the positions of actor and observer are clearly exposed. In the structure of DN, Lack of control (T9), which is one of the causes of smartphone addiction, is connected directly to Decline of face-to-face interaction (T18), which is the most critical effect of smartphone addiction (T18 has the highest coreness in both generations). In the structure of DI, Lack of control (T9) is connected with Decline of face-to-face interaction (T18) mediated by Young generation (T10), meaning that youth is a factor inducing smartphone addiction.

DN are usually surrounded by and immersed into new IT, while DI are not (Brickfield, 1985; Selwyn, 2009). Thus, DN have actual users' position for new IT; DN grasp IT from a third-party perspective. The fundamental attitude of each generation toward IT is also applied to the side effects of IT use. Based on most findings of this study, we can conclude that while DN, as actors, are inclined to describe smartphone addiction with their concrete experiences, DI, as observers, focus on more abstract factors and users' individual characteristics in delineating the addiction. Figure 4 shows the differences in social representations centering Lack of control (T9) between DN and DI.

Implications

The overarching contribution of this article is that our findings provide fundamental knowledge of smartphone addiction for future research. Despite rising social concern, research on smartphone addiction is still limited. Prior research on mobile phone or smartphone addiction focused on development of addiction scales or simply examined addiction as a factor influencing user adoption of smartphones or relevant services. This study explores a more fundamental question of how users understand smartphone addiction by elucidating and comparing the common sense of two generations. The structures of the representations specify important topics and their relations, and such information can be used to develop a behavioral model for investigating smartphone addiction. For example, the portability of smartphones is a highly central element of representations of smartphone addiction in both generations. As described in the "Discussion" section, smartphone portability denotes the ubiquitous availability of various contents or services

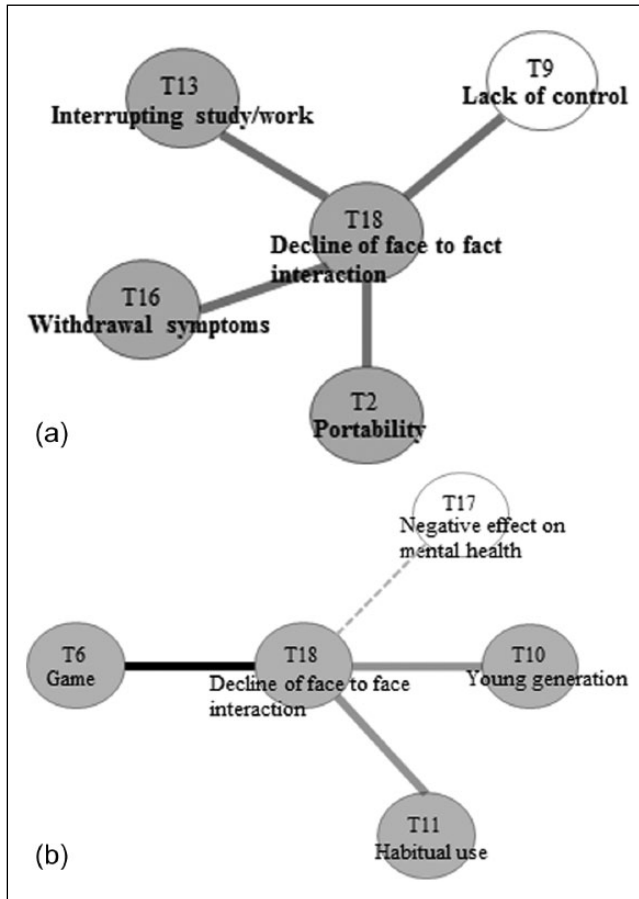


Figure 3. Decline of face-to-face interaction (T18) as a crucial effect of smartphone addiction: (a) digital natives and (b) digital immigrants.

supported by applications and the Internet rather than device portability per se. Therefore, although a portable attribute can be applied in other types of addictions (e.g. addiction to cigarettes), the availability is a peculiar factor in explaining smartphone addiction. Future research may need to intensively examine the influence of portability on smartphone addiction. More specifically, it can be promising to explore the influence of types of smartphone content on smartphone addiction.

Another implication of the study is that users, the young in particular, consider benefits as well as negative effects of smartphone usage in understanding smartphone addiction. The results confirm the argument on users' risk-benefit appraisal of using IT (Chellappa and Sin, 2005). Therefore, future research may need to consider users' perception of benefits for a comprehensive understanding of smartphone addiction from the users' perspective.

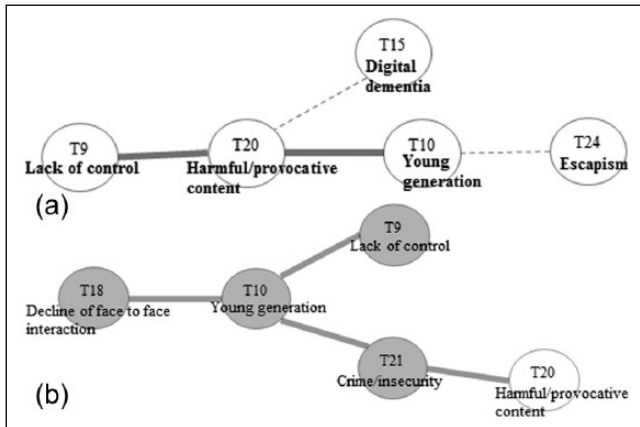


Figure 4. Lack of control (T9) as a cause of smartphone addiction: (a) digital natives and (b) digital immigrants.

Finally, this study suggests that users may have a different understanding of smartphone addiction by their routinization of smartphone use. DN have grown up as being constantly surrounded by and immersed in IT, while DI did not (Selwyn, 2009). Accordingly, the younger generation's use of IT is usually routinized, and their understanding of the side effects of IT use may be different from the previous generation. If we extend the finding, we expect that an individual's IT routinization may affect their perception of or behavior involved in negative consequences from using IT. For example, users whose use of social network sites is highly routinized may tend to underestimate privacy risk in order to mitigate dissonance between habitual use and recognition of privacy risk (Festinger, 1962). Future research, therefore, will be able to provide a better explanation of the negative consequences of using IT by examining the role of routinization.

The study also has practical implications. The finding of the actor–observer bias toward smartphone addiction implies that the risk of smartphone addiction may be underrated in society. Young people regard smartphones as a part of their daily life, and middle-aged people, who consider themselves observers standing outside of the phenomenon of smartphone addiction, may also take their own dependence on smartphones too lightly. The bias is not limited to smartphones, but can be extended to problematic use of other digital devices. Therefore, relevant organizations, such as governmental agencies, non-profit groups, and service providers, need to continue to educate the public on the side effects of IT. Particularly, campaigns need to remind middle-aged people that the pathological use of IT could also be a risk for them and is not specific to the younger generation. If campaigns or policies try to inform people about the risk of addiction without grasping different opinions of the addiction, such efforts will not work well, but rather may lead to distortion of social or family communications, which in turn will cause social conflicts. Conclusively, campaigns and policies addressing the risk of smartphone addiction should follow a two-pronged strategy for each generation.

Limitations

This study is not without limitations. One limitation of the study is that participants were recruited in one country. Thus, results may be different in other countries because social representations may vary. A study which investigates cultural differences in understanding smartphone addiction is promising, in that such a study can offer a richer knowledge about users' perceptions of the addiction. Another limitation is that an analysis of users' dependence on various contents of smartphones is excluded in this study. Epistemic values coming from installing and using new applications in their own smartphones may have a significant influence on people's attachment to their devices. Also, particular content, like social network site apps, can lead to addictive behavior (Salehan and Negahban, 2013). Because of the exploratory nature of the analysis, this study offers a rough sketch on smartphone addiction, different understandings of the addiction by generation in particular, rather than focus on specific factors related to the addiction. Future research may concentrate on potential smartphone attributes (e.g. content [apps], device properties) and examine how those attributes affect addictive behavior in different generations.

Concluding remarks

This article explored two generations' understanding of smartphone addiction, which is considered an emerging social problem. Although DN and DI have common knowledge of and attitudes toward the addiction, each generation has different structures of the representations. While DN understand the addiction as actual users of smartphones, DI recognize it from the outside as observers. Thus, based on acknowledgment of different understandings of smartphone addiction, researchers and relevant organizations should deal with or cope with the addiction.

Funding

This work was supported by the National Research Foundation (NRF) of Korea grant funded by the Korean government (NRF-2013S1A3A2043357).

Notes

1. In this article, the term "addiction" is mainly used to indicate "excessive dependence" or the degree of dependence, rather than the actual addictive state measured by indices or scales. Therefore, it is used interchangeably with the term "dependence" in this article.
2. IT Statistics of Korea (<http://www.itstat.go.kr/home.it>).
3. The concept of digital natives (DN) and digital immigrants (DI) was coined to describe a generational difference in familiarity with information technology (Prensky, 2001). Also, because this study aims to explore the gap of understanding of smartphone addiction between two generations, the operationalization of DN and DI was based on participants' age.
4. We used UCINET 6.0. More detailed information on UCINET is available in <https://sites.google.com/site/ucinetsoftware/home>.

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Appendix I

Inter-attribute similarity (IAS) matrix

Topic no.	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24
<i>Digital natives</i>																								
T1	1.000	0.194	0.048	0.355	0.185	0.281	0.222	0.107	0.125	0.091	0.281	0.290	0.200	0.259	0.000	0.258	0.208	0.250	0.095	0.125	0.231	0.050	0.143	0.000
T2	0.194	1.000	0.115	0.225	0.258	0.412	0.036	0.226	0.133	0.069	0.297	0.424	0.361	0.171	0.080	0.314	0.161	0.462	0.111	0.172	0.147	0.077	0.069	0.077
T3	0.048	0.115	1.000	0.037	0.000	0.080	0.000	0.133	0.083	0.000	0.174	0.130	0.037	0.000	0.000	0.042	0.071	0.029	0.000	0.182	0.125	0.000	0.000	0.167
T4	0.355	0.225	0.037	1.000	0.310	0.382	0.077	0.156	0.138	0.071	0.306	0.314	0.263	0.250	0.040	0.286	0.250	0.333	0.074	0.138	0.310	0.125	0.200	0.038
T5	0.185	0.258	0.000	0.310	1.000	0.321	0.059	0.080	0.150	0.000	0.156	0.161	0.226	0.111	0.000	0.250	0.136	0.278	0.188	0.095	0.167	0.133	0.053	0.063
T6	0.281	0.412	0.080	0.382	0.321	1.000	0.125	0.125	0.103	0.074	0.243	0.216	0.343	0.147	0.000	0.375	0.063	0.410	0.167	0.185	0.233	0.083	0.074	0.083
T7	0.222	0.036	0.000	0.077	0.059	0.125	1.000	0.000	0.000	0.111	0.080	0.040	0.037	0.000	0.000	0.087	0.071	0.059	0.125	0.083	0.125	0.000	0.111	0.000
T8	0.107	0.226	0.133	0.156	0.080	0.125	0.000	1.000	0.375	0.188	0.125	0.296	0.194	0.261	0.000	0.214	0.200	0.324	0.059	0.158	0.125	0.067	0.000	0.067
T9	0.125	0.133	0.083	0.138	0.150	0.103	0.000	0.375	1.000	0.250	0.185	0.107	0.138	0.190	0.000	0.154	0.111	0.206	0.077	0.286	0.211	0.000	0.071	0.000
T10	0.091	0.069	0.000	0.071	0.000	0.074	0.111	0.188	0.250	1.000	0.208	0.037	0.154	0.222	0.000	0.125	0.063	0.118	0.100	0.364	0.176	0.000	0.000	0.000
T11	0.281	0.297	0.174	0.306	0.156	0.243	0.080	0.125	0.185	0.208	1.000	0.364	0.306	0.345	0.042	0.333	0.214	0.310	0.037	0.280	0.276	0.000	0.160	0.083
T12	0.290	0.424	0.130	0.314	0.161	0.216	0.040	0.296	0.107	0.037	0.364	1.000	0.314	0.188	0.091	0.265	0.320	0.385	0.080	0.107	0.161	0.042	0.167	0.042
T13	0.200	0.361	0.037	0.263	0.226	0.343	0.037	0.194	0.138	0.154	0.306	0.314	1.000	0.333	0.040	0.406	0.207	0.474	0.115	0.138	0.152	0.080	0.071	0.000
T14	0.259	0.171	0.000	0.250	0.111	0.147	0.000	0.261	0.190	0.222	0.345	0.188	0.333	1.000	0.000	0.321	0.174	0.333	0.000	0.087	0.154	0.000	0.048	0.000
T15	0.000	0.080	0.000	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.091	0.040	0.000	1.000	0.000	0.083	0.063	0.000	0.100	0.000	0.000	0.000	0.000
T16	0.258	0.314	0.042	0.286	0.250	0.111	0.087	0.214	0.154	0.125	0.333	0.265	0.406	0.321	0.000	1.000	0.067	0.472	0.083	0.071	0.094	0.043	0.125	0.043
T17	0.208	0.161	0.071	0.250	0.136	0.063	0.071	0.200	0.111	0.063	0.214	0.320	0.207	0.174	0.083	0.067	1.000	0.162	0.067	0.176	0.136	0.077	0.133	0.000
T18	0.250	0.462	0.029	0.333	0.278	0.410	0.059	0.324	0.206	0.118	0.310	0.385	0.474	0.333	0.063	0.472	0.162	1.000	0.121	0.139	0.179	0.000	0.056	0.094
T19	0.095	0.111	0.000	0.074	0.188	0.167	0.125	0.059	0.077	0.100	0.037	0.080	0.115	0.000	0.000	0.083	0.067	0.121	1.000	0.077	0.056	0.143	0.000	0.000
T20	0.125	0.172	0.182	0.138	0.095	0.185	0.083	0.158	0.286	0.364	0.280	0.107	0.138	0.087	0.100	0.071	0.176	0.139	0.077	1.000	0.278	0.000	0.071	0.000
T21	0.231	0.147	0.125	0.310	0.167	0.233	0.125	0.125	0.211	0.176	0.276	0.161	0.152	0.154	0.000	0.094	0.136	0.179	0.056	0.278	1.000	0.000	0.250	0.063
T22	0.050	0.077	0.000	0.125	0.133	0.083	0.000	0.067	0.000	0.000	0.000	0.042	0.080	0.000	0.000	0.043	0.077	0.000	0.143	0.000	0.000	1.000	0.000	0.000
T23	0.143	0.069	0.000	0.200	0.053	0.074	0.111	0.000	0.071	0.000	0.160	0.167	0.071	0.048	0.000	0.125	0.133	0.056	0.000	0.071	0.250	0.000	1.000	0.000
T24	0.000	0.077	0.167	0.038	0.063	0.083	0.000	0.067	0.000	0.000	0.083	0.042	0.000	0.000	0.043	0.000	0.043	0.000	0.094	0.000	0.063	0.000	0.000	1.000

Appendix I. (Continued)

Topic no.	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24
Digital immigrants																								
T1	1.000	0.273	0.000	0.167	0.083	0.226	0.000	0.000	0.143	0.118	0.227	0.105	0.235	0.200	0.188	0.071	0.118	0.226	0.000	0.143	0.235	0.000	0.063	0.214
T2	0.273	1.000	0.136	0.240	0.045	0.500	0.105	0.100	0.259	0.160	0.321	0.240	0.292	0.158	0.318	0.379	0.208	0.412	0.095	0.130	0.292	0.048	0.227	0.080
T3	0.000	0.136	1.000	0.059	0.000	0.167	0.143	0.000	0.167	0.067	0.263	0.059	0.059	0.000	0.067	0.174	0.067	0.129	0.000	0.000	0.059	0.500	0.400	0.167
T4	0.167	0.240	0.059	1.000	0.143	0.367	0.077	0.154	0.174	0.100	0.250	0.200	0.200	0.071	0.048	0.179	0.222	0.323	0.067	0.118	0.200	0.071	0.176	0.176
T5	0.083	0.045	0.000	0.143	1.000	0.100	0.000	0.167	0.000	0.077	0.100	0.000	0.000	0.000	0.000	0.087	0.167	0.138	0.000	0.100	0.067	0.000	0.000	0.200
T6	0.226	0.500	0.167	0.367	0.100	1.000	0.069	0.103	0.333	0.219	0.382	0.367	0.367	0.103	0.219	0.515	0.219	0.568	0.065	0.161	0.323	0.067	0.194	0.194
T7	0.000	0.105	0.143	0.077	0.000	0.069	1.000	0.250	0.063	0.000	0.053	0.000	0.000	0.000	0.000	0.095	0.000	0.033	0.000	0.000	0.000	0.000	0.250	0.000
T8	0.000	0.100	0.000	0.154	0.167	0.103	0.250	1.000	0.125	0.000	0.000	0.071	0.000	0.000	0.000	0.091	0.083	0.067	0.167	0.000	0.071	0.000	0.100	0.000
T9	0.143	0.259	0.167	0.174	0.000	0.333	0.063	0.125	1.000	0.389	0.269	0.227	0.174	0.000	0.190	0.333	0.087	0.375	0.118	0.100	0.350	0.059	0.150	0.150
T10	0.118	0.160	0.067	0.100	0.077	0.219	0.000	0.000	0.389	1.000	0.167	0.294	0.222	0.000	0.111	0.292	0.111	0.219	0.000	0.000	0.222	0.000	0.059	0.200
T11	0.227	0.321	0.263	0.250	0.100	0.382	0.053	0.000	0.269	0.167	1.000	0.111	0.200	0.105	0.167	0.300	0.167	0.469	0.158	0.087	0.200	0.105	0.300	0.130
T12	0.105	0.240	0.059	0.200	0.000	0.367	0.000	0.071	0.227	0.294	0.111	1.000	0.333	0.071	0.375	0.269	0.100	0.242	0.067	0.188	0.263	0.000	0.000	0.176
T13	0.235	0.292	0.059	0.200	0.000	0.367	0.000	0.000	0.174	0.222	0.200	0.333	1.000	0.071	0.158	0.138	0.158	0.281	0.000	0.111	0.143	0.071	0.053	0.176
T14	0.200	0.158	0.000	0.071	0.000	0.103	0.000	0.000	0.000	0.000	0.105	0.071	0.071	1.000	0.083	0.043	0.000	0.067	0.167	0.111	0.154	0.000	0.222	0.100
T15	0.188	0.318	0.067	0.048	0.000	0.219	0.000	0.000	0.190	0.111	0.167	0.375	0.158	0.083	1.000	0.348	0.176	0.300	0.077	0.214	0.294	0.000	0.000	0.059
T16	0.071	0.379	0.174	0.179	0.087	0.515	0.095	0.091	0.333	0.292	0.300	0.269	0.138	0.043	0.348	1.000	0.192	0.471	0.087	0.217	0.320	0.091	0.160	0.036
T17	0.118	0.208	0.067	0.222	0.167	0.219	0.000	0.083	0.087	0.111	0.167	0.100	0.158	0.000	0.176	0.192	1.000	0.258	0.167	0.063	0.048	0.083	0.059	0.125
T18	0.226	0.412	0.129	0.323	0.138	0.568	0.033	0.067	0.375	0.219	0.469	0.242	0.281	0.067	0.300	0.471	0.258	1.000	0.100	0.161	0.323	0.067	0.156	0.194
T19	0.000	0.095	0.000	0.067	0.000	0.065	0.000	0.167	0.118	0.000	0.087	0.188	0.118	0.111	0.077	0.087	0.167	0.100	1.000	0.100	0.143	0.000	0.091	0.000
T20	0.143	0.130	0.000	0.118	0.100	0.161	0.000	0.000	0.100	0.000	0.087	0.188	0.118	0.111	0.217	0.217	0.063	0.161	0.100	1.000	0.357	0.000	0.071	0.071
T21	0.000	0.292	0.059	0.200	0.067	0.323	0.000	0.071	0.350	0.222	0.200	0.263	0.143	0.154	0.294	0.320	0.048	0.323	0.143	0.357	1.000	0.000	0.053	0.053
T22	0.000	0.048	0.500	0.071	0.000	0.067	0.000	0.000	0.059	0.000	0.105	0.000	0.071	0.000	0.000	0.091	0.083	0.067	0.000	0.000	1.000	0.000	0.222	0.100
T23	0.063	0.227	0.400	0.176	0.000	0.194	0.250	0.100	0.150	0.059	0.300	0.000	0.053	0.222	0.000	0.160	0.059	0.156	0.091	0.071	0.053	0.222	1.000	0.143
T24	0.214	0.080	0.167	0.176	0.200	0.194	0.000	0.000	0.150	0.200	0.130	0.176	0.176	0.100	0.059	0.036	0.125	0.194	0.000	0.071	0.053	0.100	0.143	1.000