The Effects of Smartphone Addiction Drivers on Work Performance

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Abstract

Smartphone addiction is a new phenomenon when a smartphone becomes a necessity in our daily life. This study explores smartphone usage patterns associated with its addiction drivers and results. Four factors such as ease of use, emotional lift, preference of social interaction, and flow, are used for drivers and neglect of work is used as a proxy of addiction result. In the output of path analysis, preference of social interaction is not related with usage behaviors like usage frequency and usage hours. In the analysis of U.S. users, emotional lift and flow are two drivers and in the analysis of Korean users, ease of use and flow are drivers. Even if there is a trend of converging user behavior because of globalization, drivers for smartphone addiction are different in the U.S. and Korea.

Keywords

Smartphone, Addiction, Path Analysis, Work Performance

Introduction

According to a quarterly report of the Cellular Telephone Industry Association (CTIA), more than 90% of U.S. mobile device sales were smartphones in the 4Q of 2013. According to a report by comScore, a leading digital media analytic company, 75% of U.S. mobile users own a smartphone at the end of 2014. After the introduction of Apple’s iPhone in 2007, mobile phones have been gradually replaced by smartphones. A smartphone is a device integrated with mobile computing technology and telecommunication technology. Smartphones change people’s daily life. People use smartphones as a gateway to the internet. Smartphones have multiple functions. People can use smartphones as a GPS navigator, video and music player, document readers, camera, communicating devices for e-mail and chatting. In addition, with an introduction of near field communication (NFC) technology, smartphones become a mobile wallet. As smartphone penetration rate increases, the dependency of smartphone increases (Shin, L., 2014) and there are negative effects for compulsive use of smartphones (Lee, Chang, Lin, and Cheng, 2014).

In the 1990s, internet was commercialized and the number of internet users has increased exponentially with an advent of graphical web browsers. In 1998, internet addiction was coined by Dr. Kimberly Young, who developed the Internet Addiction Diagnostic Questionnaire (IADQ) (Shin, L., 2014). The adoption of the smartphone has changed a pattern of internet addiction from computer addiction to smartphone addiction. In addition, the focus of internet addiction research has moved to smartphone addiction.

Korea has been a pioneer for broadband mobile service in the early 2000s (Yoo, Lyytinen, & Yang, 2005) and Korea is the first country to widely introduce mobile TV services to its mobile phone users (Shim, Shin, & Weiss, 2006). As a by-product, Korea has historically suffered from internet addiction (Block, 2008) and recently it has suffered from smartphone addiction (Lee, 2013). Internet addiction studies were initiated in the U.S. (Young, 1998) and mobile internet prevalence highlighted mobile internet dependency in the U.S. (Shin, L., 2014).

According to the wireless statistics by CTIA, U.S. wireless penetration exceeded 104% in 2014 and U.S. is a world leader of 4G mobile service, which is based on the fact that 47% of U.S. wireless subscribers can
access mobile internet by 4G LTE technology. The OECD’s statistics show that Korea is one of the top countries in OECD member countries in the wireless broadband subscription ratio, 99.3% in 2011. According to the statistics by Korea Communications Commission (KCC), in 2012, the wireless penetration was over 107% and 60.1% of Korean wireless subscribers adopted the 4G LTE service in 2014.

Google is conducting a project, “Our Mobile Planet” (http://think.withgoogle.com/mobileplanet/en/), which surveys 48 countries to understand smartphone adoption and users’ behaviors. In 2013, smartphone penetration rates of Korea and USA are 73% and 56% respectively. According to the Time Mobility Poll (2012), which surveyed smartphone user behaviors of eight countries, including the U.S. and Korea, Koreans are more dependent on smartphones.

‘Nomophobia’ is coined recently, a fear of being out of mobile phone contact, which is a rising trend in students (Elmore, 2014). As smartphone penetration rises, the nomophobia is focused on smartphone addiction. Smartphone addiction sometimes causes car accidents. According to the McKinsey study (Whitney, 2013), 35% of U.S. smartphone owners use their smartphones while driving; among them, 68% use smartphones for navigation and 31% use them for accessing the internet. Even though many U.S. states prevent drivers from texting while driving, according to the report from the National Highway Traffic Safety Administration (NHTSA, 2011), in 2010, 6% of respondents have been in crashes while texting or e-mailing during their operation of an automobile. This statistic shows how severe smartphone addiction is in our daily life.

As the Korean Government considers internet addiction as one of the public health issues (Block 2008), current studies about smartphone addiction on Korean high school and college students show the potential risk for smartphone addiction (Lee, 2013; Kim, 2013; Seo et al., 2013; Park & Lee, 2014; Mok et al., 2014; Park & Park, 2014). It is a phenomenon in Korea but it could also be a phenomenon of any country with a high penetration of smartphone.

Due to the relative early stage of smartphone service, there are only a few empirical studies on smartphone service addiction. The comparative study of intents is to develop an initial relationship model between smartphone addiction itself and its drivers and compare the results of two countries. This paper is organized in the following order: In the next section, the authors explore literature review of smartphone addiction. In the third section, the authors explain the research plan which includes hypothesis and questionnaire development. In the fourth section, results are presented. The discussion and conclusion sections are added at the end.

**Literature Review**

Internet Use Disorder (IUD) is a preoccupation with internet activity and online gaming. For the IUD, excessive use with a loss of sense of time is known as a big factor for Internet addiction (Block, 2008). As more and more people use smartphones for their online activity, it is natural that the internet addiction moves to smartphone addiction.

Block (2008) pointed out that South Korea had a serious internet addiction problem compared to United States. Pies (2009) argued that even though internet addiction is a term frequently used, it was not listed in the Diagnostic and Statistical Manual of Mental Disorders, fifth Edition (DSM-V) and it was listed in the appendix. Gaming addiction is the only behavioral addiction listed in the DSM-V. Block (2008) also argued that because internet addiction was complicated by comorbidity, it is not easy to estimate accurately prevalence of internet addiction.

Lee et al. (2014) analyzed college students’ smartphone usage patterns related to smartphone overuse. They divided the subjects into two groups: risk group and non-risk group. They found that the risk group spent longer time in smartphone usage than the non-risk group and the mobile instant message (MIM) app is the most frequently used app and the risk group spent more time on MIM which was triggered by MIM notification. Park and Lee (2011) investigated that three factors for compulsive smartphone usage are satisfaction, loneliness, and personal innovativeness. Seo, M. J. et al. (2013) studied the relationship between smartphone addiction and PC internet addiction. They found there is a positive relationship between the smartphone addiction rate scales and Young’s internet addiction scales. Park and Lee (2013) investigated the difference of smartphone usage patterns between two smartphone addiction tendency groups, high and low, which is grouped by self-evaluation. They found that more females belonged to the
high addiction tendency group and the high addiction tendency group has a higher shyness, loneliness and depression score and a lower self-esteem score.

Bernroider, Krumay and Margiol (2014) studied the negative effect of smartphone addiction with technology acceptance. They integrated the technology acceptance model (TAM) in their proposed model. They found that perceived security, perceived usefulness, and perceived enjoyment are positively related with smartphone usage behavior and these relations are positively inflated by smartphone addiction. Among the above three factors, perceived enjoyment is the most important factor to influence the smartphone acceptance.

**Hypothesis Development**

Measures of the variables were developed in several stages. Firstly, all the measures were borrowed from the previous studies and modified to be suitable for the smartphone addiction research context. Secondly, a list of all measures and variables was submitted to a panel of academicians to verify initial content validity. During the process, the questionnaire was made and refined continuously. The hypothesis in this research is the four factors such as ease of use, preference for online social life (POSI), flow, and emotional lift would influence the usage frequency and usage hours, which also influences the neglect of work as a result of compulsive usage.

Venkatesh and Davis (1996) found in their experiments that usability and self-efficacy are two main factors for ease of use perception and Venkatesh (2000) found that control, intrinsic motivation, and emotion determine early perception about the ease of use of a new system. The authors assume that ease of use will affect usage frequency and usage hours. Faber and O’Guinn (1992) stated that emotional lift is one of the main factors to influence behavior of compulsive buying. The authors assume that emotional lift is also a factor for compulsive use of smartphone. Caplan (2010) stated that POSI has a positive predictor of compulsive use of internet through deficient self-regulation. The authors assume that POSI is a factor for compulsive use of smartphone. Huizingh and Hoekstra (2003) found that the hierarchy of effects model, which explains steps from viewing a product advertisement to product purchase, is good to describe the attitudinal changes of consumers after visiting a website and four levels of hierarchy effects are closely related to the level of flow that consumers experience during visiting the website. The authors assume that flow is a factor for compulsive use of smartphone. Shin, L. (2014) investigated that the relationship of smartphone usage hours and access frequency toward mobile internet addiction. He stated that access frequency has more influence to mobile internet addiction than usage hours. Lee (2013) found that among various factors for smartphone addiction, neglect of work, escape reality, and lack of control are strong effective factors in relation with smartphone addiction. Kim et al. (2014) found disturbance of adaptive functions and virtual life orientation are important factors for smartphone addiction, which are similar as neglect of work and escape reality. The authors assume there is a strong relationship of neglect of work from smartphone usage hours and usage frequency. The following is a list of hypotheses used in this study.

- H1 Ease of Use has a positive effect on use of smartphone frequency.
- H2 Emotional lift has a positive effect on use of smartphone frequency.
- H3 Preference of online social life has a positive effect on use of smartphone frequency.
- H4 Flow has a positive effect on use of smartphone frequency.
- H5 Ease of Use has a positive effect on use of smartphone hours.
- H6 Emotional lift has a positive effect on use of smartphone hours.
- H7 Preference of online social life has a positive effect on use of smartphone hours.
- H8 Flow has a positive effect on use of smartphone hours.
- H9 Frequency of smartphone usage has a positive effect on Usage Hours.
- H10 Frequency of smartphone usage has a positive effect on neglect of work.
- H11 Usage Hour of smartphone have a positive effect on neglect of work.

Figure 1 represents the research model and its hypotheses used in this study. Table 1 provides a list of all measurement items.
Variable | Measure
--- | ---
Ease of use | (a1) My interaction with smartphone would be clear and understandable.  
(a2) Integrating with smartphone would not require a lot of mental effort  
(a3) I find smartphone would be easy to use  
(a4) I find it easy to get smartphone to do what I want it to do
Emotional lift | (a5) I use smartphone because using it makes me happy  
(a6) Using smartphone is fun.  
(a7) I get a real 'high' from using smartphone
Preference for online social interaction | (a8) I am treated better in my mobile social relationships (ex: Facebook) than in my face-to-face relationships.  
(a9) I am more confident socializing in mobile social service rather than face-to-face.  
(a10) I feel safer relating to people in mobile social service rather than face-to-face.
Flow | (a11) I feel like I am totally absorbed by smartphone.  
(a12) While using the smartphone, time seemed to go by very quickly.  
(a13) While using the smartphone, I forget about my immediate surroundings.  
(a14) While using the smartphone, I am not aware of how long I have been there.
Neglect of Work | (a15) My work suffers because of the amount of time I spend mobile.  
(a16) My job performance suffers from smartphone.  
(a17) I use smartphone longer than intended during I work.  
(a18) I lose sleep due to late night use of smartphone and reach my office late.
Usage Frequency | (a19) Daily frequency for using a smartphone
Usage Hours | (a20) Daily hours for using a smartphone

Table 1. List of Measurements

**Analyses and Results**

**Reliability and Validity**

In order to collect data, structured questionnaires are designed to contain multiple questions. The questionnaires are submitted to college students in the U.S and Korea by using an internet survey site. The questionnaires are written in both Korean and English and both versions are identical. 570 responses were received between October and November, 2014. In the process, respondents who are not using smartphone service are excluded. As a result, 543 questionnaires out of 570 are selected for the analysis. The descriptive analysis of the data shows that 46.8% is U.S. college students and 53.2% is Korean and
their average age is 24 years old. This statistic indicates that most of the respondents tend to be young college students in their twenties. Table 2 presents demographic information of the sample.

<table>
<thead>
<tr>
<th>Country</th>
<th>Gender</th>
<th>Age</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>- U.S (46.8%)</td>
<td>- Male (37.0%)</td>
<td>- 18~25 years (81.2%)</td>
<td>- Student (100.0%)</td>
</tr>
<tr>
<td>- Korea (53.2%)</td>
<td>- Female (63.0%)</td>
<td>- 26 or higher (18.8%)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2. Demographic Information**

### Reliability and Validity

Reliability and validity of measures in the questionnaire were tested by analyzing Cronbach’s alpha score and performing factor analysis. Internal consistency was initially evaluated by computing Cronbach’s alpha score (see Table 3). Cronbach’s alpha was found to be more than 0.70, suggested by Nunnally (1967), in most of the variables except emotional lift, whose Cronbach’s alpha value was 0.692.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (S.D)</th>
<th>Alpha score</th>
<th>Number of item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of use</td>
<td>3.928 (.612)</td>
<td>.767</td>
<td>4</td>
</tr>
<tr>
<td>Preference for online social interaction</td>
<td>2.232 (.885)</td>
<td>.786</td>
<td>3</td>
</tr>
<tr>
<td>Flow</td>
<td>3.023 (.746)</td>
<td>.717</td>
<td>4</td>
</tr>
<tr>
<td>Emotional lift</td>
<td>3.276 (.733)</td>
<td>.692</td>
<td>3</td>
</tr>
<tr>
<td>Neglect of Work</td>
<td>2.450 (.954)</td>
<td>.839</td>
<td>4</td>
</tr>
</tbody>
</table>

**Table 3. Cronbach’s Alpha**

### Factor Analysis

To test the validity of variables, additional factor analysis is executed selecting principal component analysis method and VARIMAX rotation option. In the test, four factors are extracted successfully (see Table 4).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Item</th>
<th>EU</th>
<th>EL</th>
<th>POSI</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of use (EU)</td>
<td>a3</td>
<td>0.795</td>
<td>0.132</td>
<td>-0.073</td>
<td>-0.027</td>
</tr>
<tr>
<td></td>
<td>a4</td>
<td>0.785</td>
<td>0.115</td>
<td>0.037</td>
<td>-0.064</td>
</tr>
<tr>
<td></td>
<td>a1</td>
<td>0.747</td>
<td>0.050</td>
<td>-0.020</td>
<td>0.055</td>
</tr>
<tr>
<td></td>
<td>a2</td>
<td>0.721</td>
<td>-0.057</td>
<td>-0.019</td>
<td>0.102</td>
</tr>
<tr>
<td>Emotional lift (EL)</td>
<td>a5</td>
<td>0.001</td>
<td>0.855</td>
<td>0.034</td>
<td>0.113</td>
</tr>
<tr>
<td></td>
<td>a7</td>
<td>-0.051</td>
<td>0.799</td>
<td>0.053</td>
<td>0.187</td>
</tr>
<tr>
<td></td>
<td>a6</td>
<td>0.291</td>
<td>0.586</td>
<td>-0.005</td>
<td>0.013</td>
</tr>
<tr>
<td>Preference for online social interaction (POSI)</td>
<td>a10</td>
<td>-0.003</td>
<td>0.062</td>
<td>0.868</td>
<td>0.089</td>
</tr>
<tr>
<td></td>
<td>a9</td>
<td>-0.012</td>
<td>0.104</td>
<td>0.851</td>
<td>0.097</td>
</tr>
<tr>
<td></td>
<td>a8</td>
<td>-0.048</td>
<td>-0.052</td>
<td>0.773</td>
<td>0.053</td>
</tr>
<tr>
<td>Flow</td>
<td>a14</td>
<td>-0.006</td>
<td>0.120</td>
<td>0.089</td>
<td>0.847</td>
</tr>
<tr>
<td></td>
<td>a13</td>
<td>-0.015</td>
<td>0.013</td>
<td>0.097</td>
<td>0.824</td>
</tr>
<tr>
<td></td>
<td>a11</td>
<td>0.015</td>
<td>0.470</td>
<td>0.123</td>
<td>0.553</td>
</tr>
<tr>
<td></td>
<td>a12</td>
<td>0.174</td>
<td>0.401</td>
<td>0.000</td>
<td>0.472</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>3.233</td>
<td>2.495</td>
<td>1.797</td>
<td>1.216</td>
<td></td>
</tr>
<tr>
<td>% of variance</td>
<td>23.08%</td>
<td>17.82%</td>
<td>12.83%</td>
<td>8.68%</td>
<td></td>
</tr>
<tr>
<td>Total variance</td>
<td>62.43%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4. Factor Analysis**
Path Analysis

The hypothesized relations are tested using the path analysis technique. The variables are evaluated by a five point Likert scale (1=very little, 3=medium, 5=very much). In the test, most hypotheses are supported. The results of causal relations between smartphone addiction driving variables and usage frequency of smartphone indicate that H1, H2, and H4 are supported. Ease of use has a positive relationship with usage frequency. In other words, more convenient service experience will lead to higher usage frequency. Emotional lift and flow has a positive relationship with usage frequency. Higher emotional lift and flow experience makes people use smartphones more frequently. However, in this model, we do not witness significant impacts of reference for POSI. The relations between smartphone addiction driving variables and usage hour are tested. In the test, H6 and H8 are supported. The relations of emotional lift and flow with usage hours are supported. The relations between usage frequency, usage hours and neglect of work are supported. Figure 2 and Table 5 present the outcomes of path analysis.

**Figure 2. Path Analysis of Combined Data**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>$\beta$ (Std. $\beta$)</th>
<th>S.E</th>
<th>C.R</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>H01. Ease of use $\rightarrow$ Usage Frequency</td>
<td>.196 (.129)</td>
<td>.062</td>
<td>3.181</td>
<td>.001*</td>
</tr>
<tr>
<td>H02. Emotional lift $\rightarrow$ Usage Frequency</td>
<td>.215 (.170)</td>
<td>.057</td>
<td>3.802</td>
<td>.000*</td>
</tr>
<tr>
<td>H03. POSI $\rightarrow$ Usage Frequency</td>
<td>.039 (.037)</td>
<td>.043</td>
<td>.905</td>
<td>.365</td>
</tr>
<tr>
<td>H04. Flow $\rightarrow$ Usage Frequency</td>
<td>.257 (.206)</td>
<td>.056</td>
<td>4.576</td>
<td>.000*</td>
</tr>
<tr>
<td>H05. Ease of use $\rightarrow$ Usage Hours</td>
<td>-.031 (-.022)</td>
<td>.042</td>
<td>-.742</td>
<td>.458</td>
</tr>
<tr>
<td>H06. Emotional lift $\rightarrow$ Usage Hours</td>
<td>.098 (.082)</td>
<td>.039</td>
<td>2.492</td>
<td>.013**</td>
</tr>
<tr>
<td>H07. POSI $\rightarrow$ Usage Hours</td>
<td>-.024 (-.024)</td>
<td>.029</td>
<td>-.800</td>
<td>.424</td>
</tr>
<tr>
<td>H08. Flow $\rightarrow$ Usage Hours</td>
<td>.167 (.144)</td>
<td>.039</td>
<td>4.280</td>
<td>.000*</td>
</tr>
<tr>
<td>H09. Usage Frequency $\rightarrow$ Usage Hours</td>
<td>.608 (.651)</td>
<td>.029</td>
<td>20.714</td>
<td>.000*</td>
</tr>
<tr>
<td>H10. Usage Frequency $\rightarrow$ Neglect of Work</td>
<td>.122 (.119)</td>
<td>.058</td>
<td>2.119</td>
<td>.034**</td>
</tr>
<tr>
<td>H11. Usage Hours $\rightarrow$ Neglect of Work</td>
<td>.321 (.292)</td>
<td>.062</td>
<td>5.190</td>
<td>.000*</td>
</tr>
</tbody>
</table>

*Table 5. Path Analysis (* $p<0.01$, ** $p<0.05$)*
Comparison of Path Analysis for U.S. and Korea

To test the difference between the two countries, path analysis is performed again after separating the data into two groups according to the respondents’ country. In the output of the U.S. analysis (see Figure 3 and Table 6), H2, H8, H9 and H11 are supported. Emotional lift has a positive relation with usage frequency and flow has a positive relation with usage hours. Usage frequency has a positive relation with neglect of work via usage hours. In the output of Korea analysis (see Figure 4 and Table 7), H1, H4, H8, H9, H10, and H11 are supported. Ease of use has a positive relation with usage frequency and flow has a positive relation with both usage frequency and usage hours. Both usage frequency and usage hours have a positive relation with neglect of work. The difference between the analyses of the two countries is driver for usage frequency. The main drivers for usage frequency are emotional lift for U.S. users and those for Korean users are ease of use and flow.

Table 6. Path Analysis for U.S. Users (* p<0.01, ** p<0.05)
**Discussion and Conclusion**

There is a discussion about homogenous user’s behaviors toward a new technology because of globalization. In the study of internet addiction, it is a phenomenon of international prevalence even if there is a difference of addiction rate (Weinstein et al., 2014): U.S. (4% – 6%), Europe (4% - 10%), and Asia (10% - 20%). Some studies in Korean smartphone addiction show that there is a similar pattern between internet addiction and smartphone addiction (Kwon et al., 2013; Lee, 2013; Seo et al., 2013). Most smartphone addiction studies use a modified internet addiction diagnostic test. They measured severity of smartphone addiction without considering drivers and results. In this study, the authors divided drivers and results of smartphone addiction and compared the outputs of U.S. and Korea. In the previous smartphone addiction study (Caplan, 2010), POSI is a main factor to determine smartphone addiction. In this study, among the four drivers, POSI is not related with smartphone usage behaviors in both countries. According to Jiang, et al. (2013), 80% of online social network users visit a social networking site less than or equal to once a day. In their analysis, 93% of the online social network users
are latent users and most of active interactions are attributed to a very small group of highly interactive users. This implicates that most smartphone users are passive users to read and consume content made by active users like a power blogger. For the passive users of online social networks, POSI is not a strong factor to determine usage behaviors of smartphone.

While flow is a common driver to influence smartphone addiction of both U.S. and Korea, emotional lift is a driver for U.S. users and ease of use is a driver for Korean users. In the mobile payment study (Shin, Lee, and Odom, 2014), while Korean users consider convenience is an important factor for their use of mobile payment, U.S. users consider safety as a more important factor. In addition, Korean smartphone users have a higher mobile payment frequency because Korea has developed smartphone payment systems for public transportation. Therefore, Korean smartphone users consider their smartphone as a payment tool as well as a source of entertainment. Smartphone users have a preference for a specific operating system. The dominant operating systems are Google’s Android and Apple’s iOS. While Korea is one of the countries with high market share of Android operating system, Apple is the number one smartphone maker in the U.S. market. In 2012, 90% of smartphones in Korea had Google’s Android operating systems and 9% of them had Apple’s iOS (Shin and Lee, 2014). According to the comScore report about the U.S. digital future (2014), the market share of iPhone in U.S. is 42% in 2013. While there is only one manufacturer in iOS, many manufacturers exist in Android. The different market shares of the two operating systems in both countries causes different levels of ease to use because different Android smartphone manufacturers have different user interfaces.

For the Korean smartphone users, flow influences both usage frequency and usage hours, but for the U.S. users, flow influences only usage hours. Due to a well deployed wireless network in Korea, Korean smartphone users can access wireless internet even in public transportation. The availability of wireless internet network leads to an increase in the usage frequency. In addition, most college students in Korea use public transportation to go to school. According to the OECD statistics for commuting hours (2010), Korea is the number one country for commuting hours. During the commuting times, smartphones entertain Korean college students.

Usage frequency and usage hours of Korean smartphone users have an influence on neglect of work but only usage hours of U.S. smartphone users has an influence on neglect of work. According to Lee (2013), one of the most popular apps (92.6%) is mobile chatting services. Kakao Talk is the number one messaging service in Korea and its message notification sound influences its users to check their smartphone habitually (Lee et al., 2014). A network effect of Kakao Talk increases usage frequency of the smartphone in Korea. Even if there is a trend of converging user’s behaviors because of globalization (Mooij, 2010), drivers for smartphone addiction are different in the U.S. and Korea.

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