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Examining latent classes of smartphone users: Relations with psychopathology and problematic smartphone use

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ABSTRACT

Little is known about how people use their smartphones, and whether usage patterns are related to psychopathology and problematic smartphone use. We sampled 296 college students, and administered self-report scales to assess frequency of using various smartphone features, and problematic smartphone use. We also assessed psychopathology constructs (ruminative thinking and emotion regulation deficits), and demographics (age and gender) as potential covariates of smartphone use patterns. Using latent class analysis, we identified two distinct classes of smartphone feature use, with one class representing especially *heavy use* (particularly that of social networking, audio and visual entertainment, and image- and video-taking), and the other class involving *light use* (particularly that of social networking, audio entertainment and image- and video-taking). Higher levels of rumination, and higher levels of cognitive reappraisal as an emotion regulation strategy, were related to the heavy use class. The heavy use class scored higher on all problematic smartphone use outcome variables. Results aid in understanding the nature and relation of smartphone usage patterns to psychopathology and problematic smartphone usage.

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1. Introduction

Despite the productivity advantages of using a smartphone, its excessive use has become a concern in modern society. “Problematic smartphone use” (PSU) involves excessive use of a smartphone with associated symptoms observed in substance and addictive disorders, such as social or work interference, and withdrawal symptoms when unable to use one’s phone (Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015a). PSU is associated with adverse consequences such as distracted driving (Cazzulino, Burke, Muller, Arbogast, & Upperman, 2014), physical health problems such as musculoskeletal pain (Xie, Szeto, Dai, & Madeleine, 2016; İnal, Demirci, Çetintürk, Akgönül, & Savaş, 2015), academic difficulties (Samaha & Hawi, 2016; Seo, Park, Kim, & Park, 2016), and mental health problems (reviewed in Elhai, Dvorak, Levine, & Hall, 2017a). However, little is known about the heterogeneity of ways in which people use their smartphones, and how such heterogeneity

differentially relates to PSU.

Psychopathology is associated with PSU. In a recent paper, Elhai et al. (2017a) systematically reviewed the most widely studied psychopathology variables for relations with PSU: depression, anxiety, stress, and low self-esteem. The authors discovered that depression and anxiety severity demonstrated moderate and small associations (respectively) with smartphone use frequency and PSU. However, effect sizes for anxiety were small on average, and depression severity was sometimes non-significant or inversely related to PSU (Augner & Hacker, 2012; Elhai, Levine, Dvorak, & Hall, 2016, 2017c; J. Kim, Seo, & David, 2015). Studying more contemporary psychopathology constructs may aid in understanding what drives PSU.

Some contemporary psychopathology constructs that have become increasingly important in recent psychopathology research are “transdiagnostic”—that is, those constructs that cut across numerous mental disorders. Such constructs play a substantial role in the development and maintenance of mental disorders (Mansell, Harvey, Watkins, & Shafran, 2008), and are also clinical targets in psychological interventions across various mental disorders (Hofmann, Sawyer, Fang, & Asnaani, 2012). Two important

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transdiagnostic constructs are emotion regulation and rumination.

Emotion regulation is the process by which people regulate their emotions to adapt to their environment. Adaptive emotion regulation involves two distinct processes - higher cognitive reappraisal, and lower expressive suppression (Gross, 1998). Cognitive reappraisal involves reinterpreting negative emotional stimuli in a non-emotional, cognitive manner, while expressive suppression involves inhibiting negative emotion (Tull & Aldao, 2015). Elhai et al. (2016) found in a community sample that expressive suppression was related to higher levels of PSU, and cognitive reappraisal was related to smartphone use frequency.

Another transdiagnostic construct, rumination, is a maladaptive method of regulating negative emotion by overemphasizing negative thoughts of oneself, rather than engaging in processing the negative emotion (Mennin & Fresco, 2013). Rumination is highly related to numerous types of psychopathology (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Rumination has been conceptualized to contribute to problematic internet use (Davis, 2001). Finally, Elhai, Tiamiyu, and Weeks (in press) discovered in a college student sample that after adjusting for age, gender, and other psychopathology variables, rumination was related to increased smartphone use and PSU.

Our interest was to examine types of smartphone use and their correlates with psychopathology at a more granular level, based on specific features of use. One method of such granular analysis is to empirically explore subgroups of research participants based on their reported patterns of use, through mixture modeling. Mixture modeling is a statistical method for empirically uncovering heterogeneity among a sample of participants based on a set of observed variables (Masyn, 2013; McLachlan & Peel, 2000). One type of mixture model is latent class analysis (LCA), involving examination of cross-sectional, ordinal/categorical variables for distinct subgroups of individuals based on their responses (Muthén, 2008).

One previous paper used mixture modeling to study smartphone usage patterns. Hamka, Bouwman, de Reuver, and Kroesen (2014) recruited a community sample of adults and inquired about types of smartphone uses (albeit, without assessing psychopathology or PSU). The authors found six latent classes of smartphone users including a) very minimal smartphone users, b) basic users with limited smartphone app use, c) average users with moderate amounts of app and web use, d) information seekers with heavy amounts of web searching, but low app use, e) users with extensive app use, and f) users with high use of web utilities but low use of installed apps. However, the authors did not examine contemporary psychopathology constructs as predictor variables, nor was PSU included in the analyses.

1.1. Theory

There are several reasons and motives for using a smartphone. Some reasons include enhancing productivity (e.g., with reminders and scheduling), information seeking (e.g., web searching and news browsing), social networking, relaxation (e.g., music), entertainment (e.g., movies), monetary compensation (e.g., locating consumer deals), and personal status enhancement (Dhir, Chen, & Nieminen, 2015; van Deursen, Bolle, Hegner, & Kommers, 2015). Additionally, several factors influence the acceptance and use of a smartphone, including perceptions of value, and quality with the following dimensions: performance/system, use and access, content, service, and experience (Shin, 2015; Shin, Shin, Choo, & Beom, 2011).

Uses and Gratifications Theory (UGT) is a mass communications theory aimed at explaining motivations for consuming mass media (Blumler, 1979), adapted to explain use of particular smartphone features (Grellhesl & Punyanunt-Carter, 2012; Wei & Lu, 2014). UGT

assumes that differences across individuals drive them to have particular emotional needs to be gratified, and such needs influence their choices in consuming mass media. Background characteristics such as female gender, as well as psychological constructs such as depression, anxiety, negative affect, proneness to boredom, and behavioral activation have been supported in studies on UGT in explaining increased smartphone use (Dhir et al., 2015; Elhai, Levine, Dvorak, & Hall, 2017c; Elhai, Vasquez, Lustgarten, Levine, & Hall, in press; Grellhesl & Punyanunt-Carter, 2012; Park, Kim, Shon, & Shim, 2013; Wolniewicz, Tiamiyu, Weeks, & Elhai, in press).

One widely-used categorization of internet uses involves the distinction between social use vs. process (i.e., non-social) use (Song, LaRose, Eastin, & Lin, 2004), a categorization used in the smartphone use literature as well (Elhai et al., 2017c; van Deursen et al., 2015). Mixed results have been found regarding whether these broad types of smartphone use are differentially associated with levels of PSU. Some studies found that PSU was more related to social use (Lee, Chang, Lin, & Cheng, 2014; Lopez-Fernandez, Honrubia-Serrano, Freixa-Blanxart, & Gibson, 2014; Zhitomirsky-Geffet & Blau, 2016), while other studies supported non-social use (Elhai, Hall, Levine, & Dvorak, 2017b; Elhai et al., 2017c; van Deursen et al., 2015).

An additional theory, Compensatory Internet Use Theory (CIUT) (Kardefelt-Winther, 2014), could be viewed as an extension of UGT. CIUT proposes that people attempt to alleviate their negative emotion by using (or overusing) technology. Thus in CIUT, negative emotion (an individual difference variable) can be viewed as the antecedent to technology (e.g., smartphone) use. And increased or excessive technology use is viewed as the compensatory behavior aimed at regulating negative emotion. Several studies thus far have supported CIUT in explaining PSU (Elhai, Tiamiyu, & Weeks, in press; Long et al., 2016; Wang, Wang, Gaskin, & Wang, 2015; Wolniewicz et al., in press; Zhitomirsky-Geffet & Blau, 2016).

Thus in UGT and CIUT, psychopathology can be conceptualized as motivating increased and excessive smartphone use. And such increased use can be conceptualized as a strategy for compensating for and regulating psychopathology.

1.2. Research model

Prior studies have used research models that would fit with UGT and CIUT in explaining PSU. Such models have used demographic and psychopathology variables to explain increased frequency of smartphone use. In turn, smartphone frequency is modeled to explain PSU, because increased use is conceptualized to translate into problematic use (Oulasvirta, Rattenbury, Ma, & Raita, 2012; van Deursen et al., 2015). Such integrated models of demographics, psychopathology, smartphone use frequency and problematic use have been tested and supported in recent papers (Elhai et al., 2017c; Elhai, Tiamiyu, & Weeks, in press; J. Kim et al., 2015; J.-H. Kim, 2017; van Deursen et al., 2015).

We used a similar model in the present paper, though with different statistical methods (See Fig. 1). We measured smartphone use frequency with LCA, to uncover latent subgroups of individuals based on their reported frequency of using various smartphone features. We modeled proximal demographic covariates of the smartphone use LCA, including age and gender. Younger people engage in more smartphone use compared to older people (Lu et al., 2011; van Deursen et al., 2015). Furthermore, women use smartphones more frequently than men do (Jeong, Kim, Yum, & Hwang, 2016; Wang et al., 2015). We also included psychopathology-related proximal covariates of the smartphone use LCA, including emotion regulation deficits and rumination. Finally, we modeled PSU using several PSU subscales as the dependent variables associated with the smartphone use LCA.

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