Problematic Internet and mobile phone use in adolescents in Barcelona and London
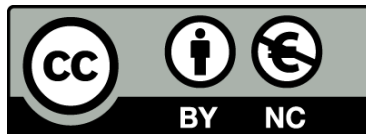
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DOCTORAL THESIS

Problematic Internet and mobile phone use in adolescents in Barcelona and London

by
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A Mª Luisa y Montse,

por animarme a empezar este camino en las adicciones comportamentales

A la Mª Luisa i la Montse,

per animar-me a començar aquest camí en les addicions comportamentals

To Mª Luisa and Montse,

for encouraging me to begin this way in the behavioural addictions

SUMMARY

This thesis focuses on the development and adaptation of psychometric scales to evaluate the problematic use of Internet and the mobile phone in adolescents in Barcelona and London. It aims to describe the characteristics and patterns of this use, to categorize problematic users of either technology and to test category validity by developing the *Problematic Internet Entertainment Use Scale for Adolescents* and adapting the *Mobile Phone Problematic Use Scale for Adolescents* (hereafter, PIEUSA and MPPUSA, respectively). It also proposes a statistical model to obtain predictive factors and estimates the prevalence of problematic users of both technologies so as to more effectively describe their psychological and social profile and examine the addictive nature of their use.

The thesis takes the findings of five selective studies using convenience samples of more than 1000 secondary school students in Barcelona and a similar sample size in London, who completed questionnaires. Although the study methods were mainly quantitative and used statistical analysis, one study adopted a mixed methods approach. The results allowed the researchers to validate the scales, which demonstrated excellent internal consistency and adequate factorial and construct validity, inasmuch as both scales were unidimensional. The participants were categorized and the prevalence of problematic users was estimated. The cut-off points were satisfactorily tested for sensitivity, specificity and diagnostic accuracy, and the results demonstrated the presence of addictive behaviour in users of both technologies, where user profiles were also defined according to characteristics, patterns of use and addictive symptomatology.

In conclusion, the thesis examined the border area between non-problematic and problematic Internet and mobile phone adolescent use, which international institutions like the American Psychiatric Association may begin to classify as mental disorders if the scientific and clinical evidence supports this.

RESUMEN

La presente tesis doctoral se centra en la elaboración y adaptación de escalas psicométricas para evaluar el uso problemático de Internet (conocido como *Problematic Internet Use* o PIU) y del teléfono móvil (*Problematic Mobile Phone Use* o PMPU) en adolescentes barceloneses y londinenses. Se pretende diversos objetivos específicos: describir las características y patrones de uso de ambas tecnologías en estudiantes de secundaria, elaborar la *Problematic Internet Entertainment Use Scale for Adolescents* (PIEUSA) y adaptar la *Mobile Phone Problematic Use Scale for Adolescents* (MPPUSA) para ambas culturas, establecer las categorías de usuarios en ambas tecnologías y comprobar la precisión en la clasificación propuesta, así como proponer un modelo estadístico para obtener los factores predictivos y, por último, estimar la prevalencia de los adolescentes problemáticos de ambas tecnologías para poder estudiar su perfil psicosocial y tratar de abordar la sintomatología subyacente de carácter adictivo.

Se realizan cinco estudios con metodología selectiva que se aplican a muestras por conveniencia de más de 1000 estudiantes de secundaria de cada país, en que se administra los cuestionarios. A pesar de que predominan métodos cuantitativos con análisis estadísticos, un estudio incluye metodología híbrida (*mixed methods research*). Los resultados principales permiten validar ambas escalas, que obtienen consistencia interna excelente y validez factorial y de constructo adecuadas, siendo unidimensionales. Se extraen las categorías de usuarios de ambas tecnologías, así como se estiman las prevalencias de los usuarios problemáticos. Asimismo, los puntos de corte extraídos de dicha clasificación se comprueban mediante la sensibilidad, especificidad y precisión global obteniendo resultados notables que garantizan su adecuación, así como demuestran la presencia de sintomatología adictiva en este tipo de adolescentes, cuyo perfil también se define según sus características y patrones de uso.

En conclusión, se ha tratado de aportar luz a la frontera entre el uso problemático y no problemático de estas tecnologías en adolescentes, que organismos internacionales como la *American Psychiatric Association* empiezan a valorar como posible desorden mental si la evidencia científica y clínica lo demuestra.

TABLE OF CONTENTS

1.   INTRODUCTION

This thesis focuses on the development and adaptation of adolescent psychometric scales to evaluate the problematic use of Internet and the mobile phone in secondary students in Barcelona and London. It starts by examining some of these uses as examples of technological addictions, which are themselves part of the well-known field of behavioural addiction. This field examines behaviour leading to an addiction sharing similarities with substance dependence, such as pathological gambling. It then describes the empirical work completed with adolescents in Barcelona and London who provided the samples to validate the scales themselves: the *Problematic Internet Entertainment Use Scale for Adolescents*, which the thesis has developed (hereafter, PIEUSA), and the *Mobile Phone Problematic Use Scale for Adolescents*, which the thesis has adapted (hereafter, MPPUSA). The thesis ends with a discussion of the findings, considered in the light of the literature, and conclusions.

1.1.   The problematic use of technologies

This section examines the problematic use of technologies as one of a series of disorders that clinical psychology has classified as behavioural addictions.

As Marks (1990) notes, behavioural addiction is non-chemical and does not involve substance consumption, and as Griffiths (1996; 1998) reports, it was first observed at the end of the 1970s and became more prominent during the 1980s and 1990s, in potentially addictive behaviours like gambling and videogame playing, exercise, eating and sex. But for Griffiths, substance addiction and behavioural addiction share a number of psychological, social and cultural traits (Griffiths, 1996). Psychologically, both are reinforced by use and both user types acquire tolerance and experience dependency, withdrawal, and affective mood swings (euphoria/dysphoria). In both cases, dependency also acts as a non-conditioned stimulus whose use can sustain a certain level of tension in the user. At a social level, substance addiction and behavioural addiction are often experienced by young people and result from similar perceptions of what constitutes meaningful social behaviour or from the pursuit of a similar lifestyle (e.g., limit testing). The two types of addiction share certain contextual factors, and are more prominent in certain user groups than in

others (civil status is an important variable, for example). Finally, cultural perceptions of substance addiction and behavioural addiction may also coincide: in certain contexts, the excessive use of substances and behavioural addiction are often considered to be equally undesirable and are understood as behaviour to be forbidden; in others, both are perceived to be of ambiguous value, offering users benefits in the short term but having serious repercussions over longer time periods. But although behavioural addiction has clearly become a serious problem in our society, we have yet to establish a reliable model for its etiology, diagnosis and treatment.

As Grant, Potenza, Weinstein and Gorelick (2010) reports, recent clinical studies have categorised the problematic use of Internet and the mobile phone as modes of behaviour that offer short-term rewards and can generate persistent effects even though users are aware of their adverse consequences. In other words, although they identify this problematic use as an addictive disorder, they argue that it can also be classified as an impulse control disorder. These authors then compare this problematic use with substance addiction and find similarities in natural history, phenomenology, tolerance, comorbidity, overlap with genetic contributions, neurobiological mechanisms and reactions to treatment. Both disorders are also understood to develop during adolescence or young adulthood, and studies of adolescent and adult populations reveal that the proportion of individuals experiencing one of these disorders is greater in the former group than in the latter. Kwong (2011) further observes that in studies on problematic Internet use, twice as many subjects are affected in adolescent groups aged 16 or above as in groups aged 9–15.

Finally, this thesis takes a particular approach to terminology. Although the term *Internet addiction* has been variously used since the mid-1990s (it first appeared in 1996 in the American Psychological Association's PsycINFO® database the *Thesaurus of Psychological Index Terms*, where it was used to describe an excessive and pathological pattern of the use of Internet) and although both *Internet addiction* and *mobile phone addiction* are frequent in the current literature, this thesis will avoid those terms. Our main reason is that neither term has yet been recognised by the World Health Organization (WHO) and behavioural addictions have not been singled out as an independent spectrum of mental disorders in the tenth review of the WHO's *International Statistical Classification of Diseases and Related Health Problems* (ICD-10). In the fifth review of the American Psychiatric Association (APA)'s *Diagnostic and Statistical Manual of Mental Disorders* (hereafter, DSM-5), however, the chapter *Substance related and addictive disorders* includes gambling disorder as a behavioural addiction (as the ICD-10 does); and Section III of the appendix

to the *Manual* also includes *Internet Gaming Disorder* (IGD) as a type of *Internet Use Disorder* (IUD; Petry & O'brien, 2013), which has raised the clinical legitimacy of the problem and has highlighted the need for further scientific research. To sum up, the addictive character of certain uses of Internet and the mobile phone is beginning to be recognised internationally but because at an institutional level these uses are not yet identified as addictions — and, furthermore, as technological addictions (Griffiths, 1998) — this thesis will refer to them simply as problematic (problematic Internet use or PIU, and problematic mobile phone use or PMPU).

1.1.1. Problematic Internet use

Since 1996 when the first research was published in this field (Young, "Internet addiction: the emergence of a new disorder", 104th annual meeting of the American Psychological Association), problematic Internet use or PIU has been described as a new clinical and social phenomenon that affects a number of adolescents and adults from distinct cultures and geographical areas and has been initially classified under the general term *Internet–related problems* (Young & de Abreu, 2011). The debate continues (Petry & O'brien, 2013), although research has stepped up exponentially (Carbonell, Guardiola, Beranuy & Bellés, 2009) in a number of different fields, especially in psychology and psychiatry.

Owing to the complexity of PIU, researchers have yet to establish reliable models for etiology, diagnosis and treatment. The most significant contributions come from researchers who have set out to design instruments for understanding problematic use in greater detail, for measuring it more accurately and, in some cases, for treating it. Davis (2001) offers a cognitive-behavioural model to identify the etiology, development and consequences associated with generalised and specific PIU subtypes. The generalised subtype identifies a pattern of cognitions and maladjusted behaviours that are associated with the overuse of any type of Internet content and that originate in other psychological disorders, while the specific subtype describes overuse of a particular function or application of the Internet (note that Davis's generalised subtype is accompanied by a multidimensional measure of PIU, the *Online Cognition Scale* [OCS; Davis, Flett & Besser, 2002]). Caplan (2002) also offers empirical evidence for this subtype with the *Generalized Problematic Internet Use Scale* (GPIUS) and in subsequent research, most psychometric instruments focus on generalised PIU, linking it to other facets of the individual (such as predictors [Caplan, 2005;

2007]), refining their own overall design (GPIUS2; Caplan, 2010), measuring the construct validity of new scales like the *Compulsive Internet Use Scale* (CIUS; Meerkerk, Van Den Eijnden, Vermulst & Garretsen, 2009) or generating new scales like those associated with the *Problematic Internet Use Questionnaire* (PIUQs; Demetrovics, Szeredi & Rózsa, 2008; Thatcher, Wretschko & Fridjhon, 2008).

1.1.1.1.   Evaluating problematic Internet use

Since its beginnings, the literature on PIU has been accompanied by proposals for diagnostic criteria and for new or newly-adapted PIU screening tools which, generally speaking, focus on adult users. However, researchers still lack standard definitions, clear clinical evidence and clinically validated scales with comparable cut-off points, which means that estimating the prevalence of PIU in a given community or diagnosing individual cases remain complex tasks. Of the few clinical interviews that include Internet use history is the model proposed by Beard (2005), which focuses on user readiness to change (RtC).

Screening tools are available, however. From the first empirical research on Internet addiction there is Young's *Internet Addiction Diagnostic Questionnaire* (IADQ) (Young, 1998a), which in an early version consists of eight dichotomous items for adults. Clinical screening uses at least eight criteria and considers the non-essential use of both Internet and computers. Use is considered to be problematic when, within a period of six months, users experience at least five of eight symptoms: preoccupation with the Internet; tolerance, unsuccessful attempts to control use; abstinence; being connected for longer periods than planned; less interaction with others and less engagement with life opportunities; lying to others; and avoidance. These correspond to the criteria diagnosing pathological gambling published in the previous review of the DSM (DSM-IV-TR), whose scale was psychometrically validated by multiple adaptations for cultures in different geographical regions (e.g., in Europe, Norway [Johansson & Götestam, 2004] and Greece [Fisoun *et al.*, 2012; Siomos, Dafouli, Braimiotis, Mouzas & Angelopoulos, 2008]; and in Asia, Taiwan [Yang & Tung, 2007] and China [Fu, Chan, Wong, & Yip, 2010; Gong, Chen, Zeng, Li, Zhou & Wang, 2009].)

The most widely-used scale is the *Internet Addiction Test* (IAT; Young, 1998b), also for adults, which consists of twenty items with Likert-scale type answers in which respondents report on the frequency of their recreational use of the Internet during a period of one year prior to completing the *Test*. The test was validated after its development (Widyanto & McMurran, 2004)

and a recently adapted version reduced to twelve items (Pawlikowski, Altstötter-Gleich & Brand, 2013) classifies four categories of user according to user score: normal, mild, moderate and severe. Although it has been adapted for use in several countries in Europe (in France; Khazaal *et al*., 2008) and Asia (in Iran; Ghassemzadeh, Shahraray, & Moradi, 2008), the distinct value of the factors that it appears to measure has prompted debate about its factorial structure and its adaptations (Chang & Law, 2008; Widyanto, Griffiths, & Brunsden, 2011).

Parallel to the Young's IADQ and the IAT, other adult PIU scales have also been developed and validated before publication, including the *Pathological Internet Use Scale* (PIU; Morahan-Martin & Schumacher, 2000), the *Internet Related Problem Scale* (IRPS; Armstrong, Phillips & Saling, 2000), the *Internet Addiction Scale* (IAS; Nichols & Nicki, 2004), the *Internet Over-Use Scale* (IOS; Jenaro, Flores, Gómez-Vela, González-Gil & Caballo, 2007), and the CIUS (Meerkerk *et al.*, 2009). In some cases, these scales have been adapted across cultures (the *CIUS* has received an Arabic validation [Khazaal, Chatton, Atwi, Zullino & Billieux, 2011]) and in others, studies have been conducted to examine psychometric properties (OCS; Jia & Jia, 2009; PIUQ: Kelley & Grüber, 2010; IRPS; Widyanto, Griffiths, Brunsden & McMurran, 2008).

But while the production of increasingly reliable, validated psychometric instruments for adults has increased, there is still a scarcity of clinically validated scales for adolescents (CIAS; Ko, Yen, Chen, Chen, & Yen, 2005a) or for young adults of a university-going age (Ko, Yen, Chen, Yang, Lin & Yen, 2009), probably because of the difficulty of studying patients in these younger age groups whose PIU has been clearly diagnosed (note that the exception here is the Taiwanese *Chen Internet Addiction Scale* or CIAS). Furthermore, each scale often uses its own criteria to establish the cut-off points that estimate PIU prevalence: the IADQ makes its PIU diagnosis when user behaviour matches a minimum number of criteria but IAT makes that diagnosis when the user obtains a certain score, and other scales use statistical criteria to categorise users (like the adolescent scale the *Problem Internet-Use Screening Tool* (SCREEN; Chow, Leung, Ng & Yu, 2009) or the CIAS, which categorises users from percentiles). Less commonly, the criteria used is the average, adding or subtracting half standard deviation, i.e., M ± ½ SD (OCS; Nalwa & Anand, 2003), or even establishing user category by means of a multivariate statistical grouping technique, like the cluster analysis applied to the adolescent *Internet Dependence Scale* (IDS; Gunuç & Kayri, 2010). Some authors confuse matters further (Johansson & Götestam, 2004; Siomos *et al*., 2008; Tsitsika, Cristeslis, Janikian, Kormas & Kafetzes, 2011) by combining the categories of at-risk users and

problematic users without any proper rationale. Because of this, note that with regard to the IAT and its adaptations the authors select distinct scores to determine PIU (e.g., 40: Kormas, Critselis, Janikian, Kafetzis & Tsitsika, 2011; 50: Wang *et al.*, 2011; 80: Liberatore, Rosario, Colón-De Martí & Martínez, 2011; 100: Bayraktar & Gün, 2011), which adds confusion to the relative interpretation of the estimate of prevalence. And finally, also note that different sources were used to generate these scales, which were mainly derived from substance abuse and pathological gambling in adults (DSM-IV-TR), immediately included in the results on PIU, as well as from proposals for diagnostic criteria based on typical addictive symptoms.

The various proposals for diagnostic criteria take their cue from Brown's conception of behavioural addiction in 1993, which establishes the symptoms salience, euphoria, tolerance, withdrawal, conflict, and relapse (as cited in Griffiths, 1996). Griffiths (2000) then replaces euphoria with mood modification and Beard and Wolf (2001) argue for a more rigorous modification of the IADQ's derivative criteria (namely, that user behaviour should match the first five parameters and then one more of those remaining, i.e., coping skills and interaction with other aspects of the user's life). Following Beard and Wolf but unlike these or previous researchers, Shapira *et al*. (2003) propose three criteria based on DSM-IV-TR's impulse control disorder: (i) maladaptive preoccupation with Internet use, (ii) the use of the Internet or the preoccupation with its use causes clinically significant distress or impairment in social, occupational, or other important areas of functioning, and (iii) the excessive Internet use does not occur exclusively during periods of hypomania or mania and is not better accounted for by other Axis I disorders [author's note: meaning depression, substance dependency, etc.]. Since Shapira *et al*., there have been further proposals. Block (2008) includes PIU in the spectrum of impulse-compulsive control disorders in the DSM-5, characterised as excessive use, with withdrawal, tolerance and negative repercussions derivatives of on- or offline computer use. But the most notable proposals have been Ko *et al.* for adolescents (2005a), Ko *et al.* for undergraduates (2009) and Tao *et al.* (2010) for adults, developed by professional clinicians and validated with clinical samples in Taiwan (Ko) and China (Tao). Tao *et al.* has been used by the APA to suggest criteria for the IGD (Petry & O'brien, 2013) and is one of the few proposals that tests the global accuracy of its symptoms: sensitivity, specificity and diagnostic accuracy (such as: Ko *et al.,* 2005a; Siomos *et al.*, 2008), positive and negative predictive values (Ko *et al.,* 2009), and the area under the receiver operating characteristic (ROC)

curve, the Youden index and the ratio of positive probability and refusal (false positive and negative, respectively).

1.1.1.2. Problematic Internet use in adolescents

Most currently available scales were designed for adults but have been validated with undergraduates and used in studies with adolescents. Furthermore, our work with adolescents reveals that most epidemiological studies conducted with this age group use scales or criteria for adults.

Although some authors argue that there are practically no differences in the clinical characteristics of PIU between adults and adolescents (Kwon, 2011), others have shown that: (1) there are certain differences in diagnostic criteria (Aboujaoude, Koran, Gamel, Large & Serpe, 2006; Ko *et al.*, 2005a; Ko *et al.,* 2009; Tao *et al.*, 2010); (2) the prevalence in adolescents appears to be twice as high as it is in adults (Aboujaoude *et al*., 2006; Acier & Kern, 2011; Bakken, Wenzel, Götestam, Johansson & Oren, 2009; Kuss, Griffiths & Binder, 2013); (3) PIU in adolescents tends to appear in aspects of personality and in certain psychiatric disorders (Choi *et al*., 2009; Ghassemzadeh *et al.*, 2008; Ha *et al*., 2007; Jang, Hwang & Choi, 2008; Kaltiala-Heino, Lintonen, & Rimpelä, 2004; Kelleci & Inal, 2010; Kim *et al*., 2006; Ko, Yen Yen, Lin & Yang, 2007; Lin & Tsai, 2002; Yen, Ko, Yen, Wu, & Yang, 2007; Van der Aa *et al*., 2009), while in adults it goes beyond personality characteristics (Armstrong, *et al*., 2000; Bakken *et al*., 2009; Bernardi & Pallati, 2009; Ceyhan & Ceyhan, 2008); (4) the groups have different sociodemographic characteristics (Hamburger & Ben-Artzi, 2000; Helsper, 2010) and academic characteristics (Iskender & Akin, 2010; Jackson *et al*., 2007); (5) the groups experience functional deterioration in different environments (adolescents in school and the family, and adults at work or with their partner or offspring (Fisher, 2010; Haddadain, Abedin & Monipoor, 2010; Lei & Wu, 2007); and (6) the sociological and cultural differences between the two groups explain the diversity of characteristics detected (e.g., Hofstede's cultural dimensions theory [1980, as cited in Ji, Hwangbo, Yi, Rau, Fang & Li, 2010] and differing cultural attitudes [Li, Kirkup & Hodgson, 2001]). Further reasons for studying the two groups separately involve a time factor: the ages of the adolescents (11−14 years compared with 15−18 years) and the fact that during the seventeen years in which PIU has been researched, Internet has not experienced the same growth or rate of growth in all the countries where it is used. To sum up, we should exercise caution (Chou, Condron & Belland, 2005) and note

that certain discrepancies may be explained by one or more of the differences described above or even by other methodological elements, such as sampling type, instruments or cut-off points.

Finally, adolescence can be understood as a period of psychosocial development in the human life cycle in which individuals are still becoming mature and consolidating the sense of their and others' identity without having completed any self-regulating process and in this context two Internet applications might have particularly addictive potential (Acier & Kern, 2011; Castellana Rosell, Sánchez.-Carbonell, Graner-Jordana & Beranuy Fargues, 2007): online role-playing games (especially the massively multiplayer on-line role-playing games, or MMORPGs) and social networking sites or SNSs. On the other hand, the popularity of MMORPGs and SNSs may simply indicate that the members of this generation of adolescents or 'Net geners' (Leung, 2004) are exercising their digital literacy and demonstrating their cultural integration with peers, albeit in an activity which they do not always control and which can have repercussions on life balance and quality.

1.2.1. Problematic mobile phone use

Research on problematic mobile phone use or PMPU began to appear in 2004, some ten years after the first studies on PIU, and the *Mobile Phone Problem Use Scale* (MPPUS; Bianchi & Phillips, 2005) quickly became its benchmark scale (Pedrero Pérez, Rodríguez Monje, & Ruiz Sánchez De León, 2012). Although research on PMPU is still at a relatively early stage (according to Carbonell, *et al.*, 2009), it has made considerable international progress and has benefitted by having more reliable measurement scales than PIU originally had and, in certain cases, diagnostic proposals including psychometric and clinical validity. On the other hand, PMPU still shares with PIU a need for greater conceptualization and suffers from the same disparity in the sources of the criteria and instruments and their cut-off points so that, as with PIU, the comparability of estimating the prevalence of problematic users remains difficult.

1.2.1.1. Evaluating problematic mobile phone use

PMPU has been measured with scales describing generalised use (i.e., the mobile phone and its functions) and, to a lesser extent, with scales describing specific use (e.g., text messaging). Sources of study include observation of user behaviour (*Mobile Phone Dependence Questionnaire*, MPDQ; Toda, Monden, Kubo & Morimoto, 2006), diagnostic symptoms of an addictive character

(MPPUS; Bianchi & Phillips, 2005), DSM-IV-TR disorder criteria (such as those from the pathological gambling [the *Cell-phone Over-Use Scale*, COS; Jenaro *et al*., 2007], substance use [the *Test of Mobile Phone Dependence;* Chóliz & Villanueva, 2011]), the IADQ (with the *Mobile Phone Addiction Index* or MPAI; Leung, 2007), amongst other dimensions (Billieux, Van der Linden & Rochat, 2008). In general, the scales have obtained high indexes of reliability and satisfactory factorial and construct validity.

As with PIU, the estimated prevalence of PMPU varies and one study obtained values of between 0% and 38% (Pedrero Pérez *et al*., 2012) in the adolescent and young adult population of different Asian (e.g., in Korea, the *Cell Phone Addiction Scale* [CPAS]; Koo, 2009), European (e.g., in Spain, the *Cuestionario de Experiencias Relacionadas con el Móvil* [CERM]; Beranuy Fargues, Chamarro Lusar, Graner Jordania & Carbonell Sánchez, 2009) and Oceanic (like in Australia, with the *Mobile Phone Involvement Questionnaire* or MPIQ; Walsh, White & Young, 2010) countries. Proposals for diagnostic criteria for PMPU have been scarce but the most notable comes from *Kaohsiung Municipal Hsiao-Kang Hospital* in Taiwan (Yen *et al*., 2009), whose PIU proposals are also considered the most reliable (Ko *et al.,* 2005a; Ko *et al.*2009). The Taiwanese team examined the prevalence of PMPU symptoms and established cut-off points according to the functional maladjustment that mobile phone use causes in some adolescents. Using sensitivity, specificity and Cohen's kappa coefficient they established that obtaining at least four of seven symptoms facilitated the detection of PMPU (the most predominant symptoms were, first, less frequent engagement in other activities because of mobile phone use, second, excessive mobile phone use despite user awareness that this use could lead to problems and, third, tolerance). At the time of writing, PMPU diagnostic criteria do not seem to differ across cultures (Bianchi & Phillips, 2005; Yen *et al*., 2009), even though cross-cultural studies will be needed to guarantee scale validity (Baron, 2010) and address cultural differences in mobile phone use in countries like Sweden, the US and Japan (Baron & Segerstad, 2010; Westlund, 2011).

In spite of the dispersion detected in certain studies (according to Pedrero Pérez *et al*., 2012), the psychological factors associated with PMPU are more closely linked to personality characteristics (Takao, Takahashi & Kitamura, 2009) than to psychopathological disorders and the most notable of these are: (1) self-attribution of this problematic use (Igarashi, Motoyoshi, Takai & Yoshida, 2004); (2) low self-esteem (Bianchi & Phillips, 2005); (3) high extraversion and low affability (Butt & Phillips, 2008; Phillips, Butt & Blasczynski, 2006); (4) high psychoticism

(Inyang *et al.,* 2010); (5) high impulsivity (Billieux *et al.*, 2008); (6) sensation seeking (Leung, 2007, 2008); (7) emotional instability (Augner & Gerhard, 2012); and (8) stress and sleep disorders (Thomée, Härenstam & Hagberg, 2011) (the most notable psychopathological disorders are depression, anxiety and PIU [Ha, Chin, Park, Ryu & Yu, 2008; Yen *et al*., 2009]). A number of sociodemographic and educational factors are also involved in adolescent (Sánchez-Martínez & Otero, 2009) or young adult (Beranuy Fargues *et al.*, 2009) PMPU (e.g., social class, type of educational centre, family environment, substance abuse) and, finally, there is the link between PMPU and certain patterns of user (texters and talkers) (Rettie, 2007), and number of calls and messages (Chóliz, 2010; Hong, Chiu & Huang, 2012; Yen *et al*., 2009).

The following user behaviours and sociodemographic variables (Koo, 2010; Labrador Encinas & Villadangos González, 2010; Walsh, White, Cox & Young, 2011) have been cited as notable PMPU predictors: frequently checking the phone for new calls, the number of text messages sent, the number of contacts being maintained, the time devoted to calls, the monthly expense of maintaining a phone, the use of specific applications (e.g., music applications), and user gender. At the time of writing, certain possibilities have been investigated more fully than others: for example, it may be that young female mobile phone users are at greater risk of PMPU than their male counterparts (Geser, 2006), although this has still not been clearly demonstrated; by contrast, it is very clear that secondary school students as a whole constitute the principal group of at-risk users (Kawasaki *et al*., 2006).

To sum up, although the scientific community has begun to consider the addictive potential of the mobile phone, it is true, that research is still in its early days and has not yet addressed specific aspects of PMPU or properly analysed certain psychological facets of the disorder according to Billieux (2012). On the other hand, this author also argues that although we have no solid theoretical framework to understand how PMPU develops and why it persists, we should adopt an integrative pathways model based on the adverse consequences of excessive or uncontrolled mobile phone use generating a vicious circle through the perpetuation of negative affection, and that this model should consider four possible pathways to PMPU: (1) the impulsive pathway; (2) the relationship maintenance pathway; (3) the extraversion pathway; and (4) the cyber-addiction pathway.

On the other hand and unlike PIU, PMPU research has focused on adolescents but the debate between the need for the mobile phone or PMPU continues to be more heated than the issue

of PIU, with some authors defending the notion of mobile phone abuse (Ahmed, Qazi & Perji, 2011; Beranuy Fargues *et al.,* 2009) and others supporting the hypothesis of mobile phone addiction (Chóliz, 2010).

1.2.1.2 Problematic mobile phone use in adolescents

Chóliz (2010) argued that the APA should include PMPU in its DSM-5 because the disorder especially affects adolescents whose problems are apparent in their social, affective and behavioural sphere. The symptoms Chóliz proposes are: number of calls and messages; problems with parents; interference with school or personal activities; tolerance; withdrawal; and the need to own a fashionable mobile phone. Beranuy Fargues, Sánchez Carbonell, Graner Jordania, Castellana Rossell and Chamarro Lusar (2006) observes that adolescents are made more vulnerable by not being in complete control of their impulses, by being more influenced by advertising campaigns, and by understanding the mobile phone as a status symbol and an object that can facilitate the construction of their individualisation and also manage their relationships with family and peers. Indeed, the mobile phone is already understood to be at least one of the media by which adolescents and their parents establish relationships (Weisskirch, 2011). But even though adolescence is one of the stages in the life cycle when there is a clear risk of PMPU, few scales cater exclusively to this group and researchers are still using whatever samples are generally available – meaning samples of different ages that also include this age group and young university students.

A Japanese study (Imamura *et al.*, 2009) has already observed the considerable effect that mobile phone email has on adolescents' emotional state, although this would also appear to be a foreseeable consequence of mobile phone use in a country where children begin to use this technology (named "keitai") at a very early age and for many different purposes (Kamibeppu & Sugiura, 2005). A similar rate of growth in young person mobile phone use has been recorded in the UK, where Madell and Muncer (2005) have observed a positive correlation between Internet email use and mobile text messaging (and the indication that users employ text messaging to complete certain functions they previously completed using Internet). Inevitably, the advance of smartphone technology will play an increasingly important role in PMPU research, especially in research on adolescents. Studies have already been conducted on smartphone dependency (Chae & Lee, 2011; Km, Park & Lee, 2011) but researchers still need to make provisions for cultural diversity and develop and validate scales with cut-off points that can guarantee comparability.

2.   RESEARCH IN THE FRAMEWORK OF THE DOCTORAL THESIS

The present study analyses and assesses the problematic use of Internet and the mobile phone in adolescents. The study selected Internet and the mobile phone because these are the two technologies most commonly used by this age group for recreational purposes. We are aware that Internet, the mobile phone and other related media and applications become particularly attractive to some adolescents but that their more than regular use need not generally indicate a disorder of any specific kind. On the other hand, as evidence has shown, these technologies can become addictive for certain individuals, who cross the border between non-problematic and problematic use.

This study seeks to describe the psychosocial traits and patterns of regular Internet and mobile phone use in adolescents in Barcelona, contrast these with patterns of abuse and, finally, understand the addictive character of patterns of abuse in order to distinguish between these and patterns of problematic use. With regard to problematic use, we also examined the symptoms of potential addiction in the maladjusted behaviour of certain adolescents and, in the case of mobile phone technology, we attempted to extract predictive factors about potential problematic use.

To measure the different types of Internet and mobile phone use, we selected psychometric instruments that could classify users and estimate the prevalence of adolescents considered to be problematic users. At the same time we also addressed the selection of criteria for establishing cut-off points with greater precision (a subject that is often neglected in the literature). We then took the study to an appropriate environment, meaning European countries where both substance abuse and behavioural addiction are common (according to international organisms, Spain and the UK occupy top positions in the use of various addictive substances (United Nations Office on Drugs and Crime, 2013) and have some of the highest gross incomes from gaming (European Commission, 2006), an indirect indicator of pathological gambling)

The Barcelona fieldwork study was carried out during the academic year 2008-2009 and the study in London was completed during the academic year 2009-2010[1].

2.1. Research aims

This thesis develops and adapts psychometric scales to evaluate the problematic use of Internet and the mobile phone in secondary-school students in Barcelona and London, and it has four principal aims:

1. to develop the *Problematic Internet Entertainment Use Scale for Adolescents* (PIEUSA) and adapt the *Mobile Phone Problematic Use Scale for Adolescents* (MPPUSA) to measure problematic use of the two technologies in adolescents in Spanish and English versions, in secondary-school students in Barcelona and London;

2. to describe the sociodemographic and educational characteristics and the patterns of use of both technologies in these students;

3. to establish user categories in both technologies with statistical criteria that can test the precision of the classification proposed by using sensitivity and specificity values, and to propose a statistical model to obtain predictive factors of problematic mobile phone use;

4. to estimate the prevalence of problematic users of both technologies, study their psychosocial profile and tackle underlying symptoms revealing the possibility of addiction.

2.2. Research methods

The research was completed using selective or survey methodology (De Leeuw, Hox & Dillman, 2009), which Anguera Argilaga (2003) describes as a methodology that makes suitable selections of subjects and variables.

The study was planned during the academic year 2006-2007 (the second year of the writer's doctoral programme) under the thesis title *The patterns of use of entertainment technologies in adolescents aged 11–18 from the city of Barcelona: An exploratory study*"[2]. During the academic year 2007-2008, a pilot study was completed to test the *ad hoc questionnaire,* which included the scales, and to test the external controls to guarantee its validity. In the academic year 2008-2009 the instrument was used in a non-probability sample of over 1000 secondary school students aged 12–18 in state and private centres in Barcelona. The data were collected during a class hour in self-applied and individual form without the presence of the teacher. During the academic year 2009-2010 the questionnaire was repeated in London, practically replicating the Barcelona conditions but with the class teachers present, as stipulated by the ethics committee of the institution that authorised the questionnaire (namely, the Tower Hamlets Research and Performance Development Team, East London).

All the participants in both studies gave voluntary consent to participate because of their interest in the subject and the confidentiality they had been guaranteed. Not all the students completed the questionnaire completely or correctly, however, and for this reason each study records a percentage of data (under 33% in both cases) that were excluded from the psychometric analyses. Moreover, the following year, each participating centre in Barcelona and London received a report with the main descriptive results.

In the two studies, analyses were completed to value the psychometric characteristics of the scales. We also applied typically epidemiological analyses (Freixa Blanxart, Guàrdia Olmos, Honrubia Serrano & Peró Cebollero, 1998) to test the precision of the classification proposed by using global sensitivity, specificity and accuracy values. We also tested the proposals for symptoms of PIU and PMPU from the results obtained in each of the categories established. Finally, we estimated the prevalence of problematic users and proposed a statistical model that could extract predictive risk factors for PMPU.

Finally, the PIU study in London included a qualitative analysis of students' construct conceptualisation, which yielded a great variety of answers and associations with the symptoms proposed by PIEUSA. These data were then analysed with the computer-assisted qualitative data

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analysis software ATLAS-ti, hereby ensuring that the study could use mixed methods research (Tashakkori & Teddlie, 2010) or third methodological approach beyond the quantitative and qualitative methodologies previously used (a practice which is extending quickly in the field of the social and behavioural sciences).

To sum up, the first two studies in this doctoral thesis bring together the work completed in Barcelona to create and validate the PIEUSA, to adapt and validate the MPPUSA and to estimate the prevalence of problematic users and test the appropriacy of their classification with regard to the symptoms proposed; and the second two studies bring together the work completed in London, to do the same with the English versions of PIEUSA and MPPUSA and to address the specific aims. Finally, the fifth study examines the statistical model proposed to find PMPU predictors.

3. PAPERS AND WORKING PAPER

The thesis is a compendium of papers and a working paper. Its various references and the information about its state are made clear and, and its impact factor in *ISI Web of Knowledge, Journal Citation Reports Social Science Edition* of each journal and its position according to the area in which it belongs is also recorded.

Paper 1: PIU in Barcelona

López-Fernández, O., Freixa-Blanxart, M. & Honrubia-Serrano, M. L. (2013). The Problematic Internet Entertainment Use Scale for Adolescents: Prevalence of problem Internet use in Spanish high school students. *Cyberpsychology, Behavior, and Social Networking, 16*, 108-118.

Paper accepted and published in *Cyberpsychology, Behavior, and Social Networking.* Impact factor 2012: 1.842 (17/60, in "Psychology, Social" area). See: http://www.liebertpub.com/cyber [Available online 19 December 2012]

Paper 2: PIU in London

López-Fernández, O., Honrubia-Serrano, M. L., Gibson, W. & Griffiths, M. D. (2014). Problematic Internet use in British adolescents: An exploration of the addictive symptomatology. *Computers in human behavior, 35,* 224-233.

Paper accepted and published in *Computers in human behavior.* Impact factor 2013: 2.273 (24/129, in "Psychology, Multidisciplinary" area). See: http://www.journals.elsevier.com/computers-in-human-behavior/ [Available online 27 March 2014]

Paper 3: PMPU in Barcelona

López-Fernández, O., Honrubia-Serrano, M. L. & Freixa-Blanxart, M. (2012). Adaptación española del "Mobile Phone Problem Use Scale" para población adolescente ["Spanish adaptation of the "Mobile Phone Problem Use Scale" for adolescent population"]. *Adiciones, 24*, 123-130.

Paper accepted and published in "*Adicciones*". Impact factor in 2012: 1.015 (21/30 in "Substance abuse" area). See: http://www.adicciones.es/ [Available online 25 January 2012]

Paper 4: PMPU in London

López-Fernández, O., Honrubia-Serrano, M. L., Freixa-Blanxart, M. & Gibson, W. (2014). Prevalence of Problematic Mobile Phone Use in British Adolescents. *Cyberpsychology, Behavior, and Social Networking", 17*, 91-98.

Paper accepted in *Cyberpsychology, Behavior, and Social Networking.* Impact factor in 2012: 1.842 (17/ 60 in "Psychology, Social" area). See: http://www.liebertpub.com/cyber [Available online 27 August 2013]

Working paper 5: PMPU in Barcelona and London

López-Fernández, O., Losada-López, J.L., Honrubia-Serrano, M. L. & Freixa-Blanxart, M. (working paper). A statistical model to analyse predictors of problem mobile phone use in European adolescents [Un modelo estadístico para analizar predictores del uso problemático del teléfono móvil en adolescentes europeos].

4. DISCUSSION AND CONCLUSIONS

This thesis has assessed the problematic use of Internet and the mobile phone in adolescents in Barcelona and London by investigating user category, estimating PIU and PMPU prevalence, checking the addictive symptoms and testing the accuracy of problem user classification. To do this we developed the *Problematic Internet Entertainment Use Scale for Adolescents* and adapted the *Mobile Phone Problematic Use Scale for Adolescents* (PIEUSA and MPPUSA, respectively) and began to establish adolescent PIU and PMPU profiles. In this last section, we will start by summarising and assessing the Barcelona and London studies and addressing our various findings. We will then examine the limitations of our work, consider future lines of research and draw our main conclusions.

In the Barcelona study the scales to evaluate PIU in adolescents were revised and assessed. The Spanish version of PIEUSA was developed and this version was then validated in Barcelona, where it showed excellent reliability (only improved by Canan, Ataoglu, Nichols, Yildirim & Ozturk, 2010; Gunuc, & Kayri, 2010; Ko *et al*., 2005a), a factorial validity that indicated its unidimensionality (as Gunuc, & Kayri, 2010) and construct validity through associations with patterns of use. The variance explained was of 31%, which was considered adequate though it was lower than other similar scales (this may be explained by the fact that the scale focused on just two types of recreational technology and readers should also note that Spanish adolescents had to wait until 2008 for a Spanish version of Facebook to be launched and that, until that time, they had access to only very basic applications, like Messenger or Fotolog). The cut-off points for each user category were then extracted and the user categories were tested according to the patterns of use observed in each one of the categories proposed (weekly frequency, maximum time per session, etc.). Five percent of the participants were identified as problematic users and the most notable aspect of their participation was that their online sessions were almost twice as long as regular users' sessions and they were aware that Internet affected their behaviour. The prevalence observed differed to the prevalence reported in other studies, possibly because of the diversity of the criteria employed to categorise users.

The London study, which recreated most of the conditions of the Barcelona study, aimed to establish the prevalence of PIU. The Spanish version of PIEUSA was adapted using a procedure of translation and back translation completed by experts in Spanish and English and by professionals

in the British education system. PIEUSA symptoms were examined in further depth and this helped to test the precision of the user classification proposed by (a) calculating the global sensitivity, specificity and accuracy of each possible symptom with regard to the categories established and (b) comparing problematic and non-problematic users. The London study used qualitative analysis, which enabled the researchers to investigate the respondents' own understanding of PIU. As with the Barcelona study, scale unidimensionality was observed although at 42% the explained variance was greater, possibly because this study was completed one year after the first study and because the scope of Internet technology in the UK was broader than it was in Spain. The internal consistency obtained by our scale was higher (α=.95) than consistencies reported by other adolescent studies. Five point two percent of the participants were identified as problematic users (this figure was similar to the figure in the Barcelona study and to the figure reported in a recent European study of Durkee *et al*. (2012), while it remained very different to figures reported in Asian studies [Kayri & Günuç, 2010; Ko *et al*., 2005a; Tsai & Lin, 2001]). Users with PIU were adolescents aged 11–14 whose online sessions were twice as long as regular users' sessions and who showed symptoms of potentially addictive behaviour. Both quantitatively and qualitatively, these symptoms included *loss of control* and *conflict* (in that order) as the main criteria, in contrast to the adult diagnostic criteria of Tao *et al.* (2010), which have been postulated as the classification of IGD in the DSM-5 (Pertry & O'brien, 2013).

The third study used Sánchez-Moreno *et al.* (2005) to adapt the MPPUS (Bianchi & Philips, 2005) to Spanish adolescents in the form of MPPUSA. A procedure of translation and back translation was completed by experts in Spanish and English language, in addictions and in education, and the sample took secondary-school teachers and students who were bilingual in Spanish and English and secondary-school students who were not bilingual. However, no clinical validation was made because of the difficulties of sampling this population. At the same time, the researchers reviewed existing PMPU scales and studies on adolescents and observed that there was an absence of scales either developed for or adapted to this age group. MPPUSA obtained a factorial validity that shows that a factor explains 61% of the variance when one item is eliminated and reliability is the highest found in PMPU scales (α=.97). The estimated prevalence of problematic users was 14.9% and these users were generally older adolescents who made extensive use of mobile phones and who obtained the highest scores in almost all the items, offering an indirect measure of the presence of the symptoms of the scale. Researchers observed that female

participants scored highest in excessive but not necessarily problematic mobile phone use, as other studies have reported (Geser, 2006; Kawasaki *et al*., 2006). And finally, new or controversial variables that appeared to be linked to problematic use were also detected (e.g., parents' level of studies, usual consumption of substances, etc.).

The fourth study was a replica of the London study (the adaptation to English of MPPUSA) and obtained practically identical psychometric results, including the elimination of the same item. On the other hand, the prevalence of problematic users was lower (10%) and these users were generally younger teenager adolescents who made extensive use of mobile phones. The purposes of this study were to propose symptoms of potential addiction for MPPUSA and to test the classification for global sensitivity, specificity and accuracy. An interesting finding was that withdrawal appeared to be a key symptom (Walsh, White & Young, 2010; Yen *et al*., 2009), and this is also supported by the PMPU literature.

Unlike the first four, the fifth study offered a statistical model for predicting PMPU in the adolescents sampled in Barcelona and London. The researchers considered generating normed grades for the total MPPUSA score so as to dichotomise this variable from three possible statistical criteria. Two models were proposed. The first was based on sociodemographic predicting variables, which yielded statistical differences in the third and fourth studies, and the second was based on the patterns of use of mobile phone as predictors. Binary logistic regression determined that the first model was the best model for extreme scores as a criterion of dichotomization (the 25th and 75th percentiles; as Jenaro *et al.*, 2007), obtaining good sensitivity, specificity and classificatory precision, indicated in the ROC curve. Thus, older adolescents (Beranuy Fargues *et al.*, 2009) completing their schooling in a private centre and having a parent or parents who were educated to university level, and adolescents who consumed alcohol or tobacco (Ko *et al*., 2009; Sanchez-Martinez & Otero, 2009) were prime candidates for higher scores of excessive mobile phone use. As far as we are aware, this is original research and has not been considered by other authors.

Our most serious limitation to date is that the clinical validation of the scales proposed is still pending. In the case of PIU only Ko *et al*. (2005a) and Ko *et al*. (2009) and in the case of PMPU only Yen *et al.* (2009) have completed validation, perhaps because there are many more cases in their culture (Asian countries) than in others (note that the figure is five times larger than our Western countries: Cheung & Wong, 2011; Ko *et al*., 2005b; Ko *et al.,* 2007; Yen *et al*., 2007; Yen *et al*., 2009) and because their social health care system facilitates collaborative research with

professional clinicians (psychiatrists, psychologists, etc.). Our second limitation was methodological, inasmuch as our studies were developed with convenience samples and this made it more difficult for us to generalise from our findings. However, did attempt to ensure substantive representativeness by selecting secondary-school students from different types of centre and city district, as well as from different geographical regions and cultures; and we also believe that the similarity of the results in the two cities constitutes a type of foundation for the representativeness of the findings. Our third limitation was technical and ethical because the instrument we administered was a self-report and yet in the case of the London study, teachers were present in the classroom during the completion of the questionnaire. Therefore, although the questionnaire was voluntary and the respondents answered in an appropriate context, teacher presence may have affected answers even while the students had been assured confidentiality and anonymity, and we should bear this in mind when analysing our findings. Our fourth limitation is related to the study of symptoms of potentially addictive behaviour: although the study used indirect indicators (e.g., weekly frequency of use, time per session) we had no direct external criterion to calculate positive and negative predictive value or establish cut-off points by means of ROC curves (Ko *et al*., 2005b), and additionally more in-depth research is needed to establish whether the symptomatology differs in relation to other variables such as age.

At the time of writing, PIEUSA and MPPUSA are two of the very few scales that have been validated for adolescents in more than one European cultural environment. In the immediate future, however, we propose that the comparative work in Barcelona and London should be continued, using differential item functioning (DIF; Hidalgo & Gómez-Benito, 2010). We consider that similar studies should be conducted in other parts of Spain and the UK (to compare rural with inner-city areas, for example) and that adapted questionnaires should be prepared in the same languages but for other countries (for Mexico or Peru in the case of the Spanish version, for example, and for the US or Australia in the case of the English version) and for countries with other cultures (for like France, Italy and Portugal for western cultures, and for countries like China and Japan for eastern and Asian cultures). At a methodological level, studies conducted with probability samples could be followed up to determine changes in Internet and mobile phone use. Studies could also be conducted in more specific subject areas (e.g., personality characteristics, experience in these types of technology) and projects could also propose other indices for measuring the variability detected in the indicators of online session time or mobile phone use time and in the answer to the items of

the scales. (On this subject, note that problem of the variability in time of use has also been reported in other studies on the problematic use of technologies [Gentile, 2009]). Researchers should focus more on obtaining qualitative data about problematic users' own perception of PIU and PMPU (Beranuy, Carbonell & Griffiths, 2013; Tsai & Lin, 2003) and on analysing the differences in symptoms that indicate potential addiction for adolescents and for adults. Finally, researchers should also bear in mind that the increasingly generalised use of smartphone technology will be important to the kind of research conducted.

To conclude, although PIU and PMPU are both examples of problematic use of technologies, the differences between them are also clear (at least where adolescents are concerned) and each has its own set of characteristics. On the other hand and as Griffiths has observed (Griffiths, 1996), like other types of behavioural addiction PIU and (to some extent) PMPU both also create repercussions at the same three levels: at a psychological level, where the symptoms are similar but have been studied very little; at a social level, inasmuch as these symptoms appear in the life cycle as early as adolescence (although research should also be conducted with other adolescent groups) and their perceived meaning or value for adolescents is often similar; and at a cultural level, as our review indicates, where there are notable cross-cultural differences between western and Asian users and environments. For example, according to Tao (2005, as cited in Young, Yue & Ying, 2011), in China the education system constitutes the main cultural factor for PIU in adolescents because it is that system which pressurises adolescents to excel academically and enter university and which therefore often acts as situational factor trigger. At this level the causes for problematic use in the western adolescents may derive from other psychological and contextual factors (e.g., the trend towards self-entertainment with video games, the use of SNSs to relate to peers and the repeated or prolonged absence of parents and carers from the home). And although certain variables may coincide in the two cultural settings (e.g., adolescents' use of technology to compensate for what they perceive as personal inadequacies [Griffiths, 2000]), we propose that there should be differential markers for the western and eastern or Asian adolescent groups. Finally, however, in both cases we are dealing with a generation of adolescents whose environment since childhood has been characterised by these technologies and this need not mean that in overall terms problematic use must increase. Indeed, although the advance of entertainment technology in the form of 3D animation or new social networks might lead a certain number of adolescents to addictive behaviours, problematic Internet use or problematic mobile phone use as such may

22

actually decrease, given that new generations of adolescents are learning to these technologies more effectively.

Last of all, our objective was to evaluate PIU and PMPU in adolescents in Barcelona and London using scales that we either developed ourselves or adapted (PIEUSA and MPPUSA), and these proved to be effective for the task at hand. The scales allowed us to establish user categories according to very strict statistical criteria providing high global sensitivity, specificity and classificatory accuracy. The prevalence of problem users presented the addictive symptoms proposed in each scale, where the symptoms that stood out most were *loss of control* and *conflict* in PIU, and *withdrawal* in PMPU. Additionally, we offered a first profile of this type of adolescent problem user in two European cities. All in all, we noted that the factors they shared at a sociodemographic level were the factors that most clearly explained excessive mobile phone use. To sum up, this thesis has conducted a psychological study to explain in greater detail the border area between the problematic and non-problematic use of technologies in adolescents, and to hereby contribute to the advances made in this research field of "technological (behavioural) addictions".

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