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Philip Tam and Garry Walter

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Philip Tam   Staff Specialist Child and Adolescent Psychiatrist, Sydney and South Western Sydney Local Health Districts and Founder, Network for Internet Investigation and Research Australia (NiIRA), Sydney, NSW, Australia

Garry Walter   Professor of Child and Adolescent Psychiatry, University of Sydney and Clinical Director, Child and Adolescent Mental Health Services, Northern Sydney Local Health District, Sydney, NSW, Australia

Abstract

Objective: To describe the emergence of, and myriad issues pertaining to, problematic internet use in childhood and youth. In this overview and appraisal of a uniquely 21st century affliction, the focus is on youth and less on young adult perspectives.

Conclusions: We employed relevant literature-search methodology though EMBASE, Psychinfo and Web of Science, utilising the key terms of PIU, internet addiction and youth mental health, and present a selection of the pioneering and important research developments both nationally and internationally. We focused on the literature from the past 10 years, but we also included relevant early developments in the field going back to the 1990s. We also made reference, where appropriate, to major considerations of relevance to the general public, where these were reported in reputable international news and media organisations. The authors utilised common internet search engines to access these news reports. It was found that the complex, novel and at times controversial concept of 'problematic internet use' (PIU) – often popularly dubbed 'internet addiction' – has attracted much public, media and research interest, particularly over the past decade. In common with many other afflictions that have a prominent 'pop-cultural' component, often the commentary and debate has been polarising, unclear and sensationalist. At times, more light than heat appears to be generated.

Keywords: computer use, cybertechnology, internet addiction, internet safety, mental health, problematic internet use, youth

Introduction: early conceptualisations and development

From the first, speculative case reports of 'internet addiction' in the US in the mid-1990s[1] through to its current inclusion (conceptualised as 'Internet Gaming Disorder' (IGD)) in the research appendix of the *Diagnostic and Statistical Manual*, Edition 5 (DSM 5),[2] the global phenomenon of 'problematic internet use' (PIU) has been a topic of increasing interest to clinicians, researchers and stakeholders such as teachers, parents and community groups. It is notable that the first reports of PIU emerged very soon after the advent of the World Wide Web (WWW), which was made possible by developments, all in a short space of time, in *hardware* (improved microprocessor power), *software* (e.g. Windows 95) and content *delivery mechanisms/websites* (launch of Hotmail, Internet Explorer, Yahoo, etc.).

Since these initial explorations, an increasing number of instruments were devised to more objectively measure the prevalence, severity and characteristics of PIU in various populations, with much of the early research focus being on college youth.[3,4] These different instruments employ varied 'conceptualisations' of what could be the cognitive processes underpinning PIU, from a 'problem gambling' perspective,[5] to an impulse-control problem,[6] to a biological 'addiction'. This, coupled with a wide range of methodologies employed by groups researching PIU across various countries, led to difficulties in drawing firm, comparable conclusions from the ensuing data.[7] A key endeavour of the DSM 5 working group investigating IGD is to address this issue and offer standardised operational criteria that can be utilised internationally.

Correspondence:
Dr Philip Tam, Thomas Walker Hospital ('Rivendell'), Hospital Road, Concord West, NSW 2138, Australia.
Email: Philip.Tam@sswahs.nsw.gov.au

Since the early 2000s, we have witnessed the major rise of the 'social web', which has impacted society as a whole in at least as great a manner as the advent of the WWW itself. As well as social networking (SN), a huge increase in the popularity of online gaming (most notably the rise of Massively Multi-Player Role-Playing Games (MMORGs)) and adoption by businesses and educational institutions to utilise what has been called 'Web 2.0', has been observed across all societies, most markedly those with highly-integrated, efficient Internet systems.

It is with this background that PIU is viewed in some circles and countries as a potentially major public health issue, meriting a sustained, informed and coordinated response. The foregoing offers a brief review and discussion of some of the major developments in this complex and at times controversial field.

Prevalence and public health issues

The initial focus of research internationally was, quite reasonably, on establishing prevalence data on the emerging phenomenon. As noted above, methodological and survey differences, as well as variations in the specific population studied, led to problems with direct comparisons. However, despite these observations, the rates of PIU appeared to be broadly comparable across studies, countries and regions, at between 5% and 10%.[8,9]

One of the clear emergent issues following these initial investigations, alongside increasing clinical experience, is the potentially strong co-morbid associations with PIU. Subsequent studies attempt to elucidate those associated features, focussing on issues such as depression,[10] anxiety and loneliness,[11] bipolar disorder[12] and, less commonly, attention deficit hyperactivity disorder (ADHD) and Asperger's Syndrome. A more recent and intriguing area of investigation involves that of parenting styles, compared across countries.[13] For example, in one pioneering study, parenting styles for Japanese and Chinese students were compared alongside PIU rates: it was found that parenting styles, including factors such as perceived warmth, empathy and overall supervision/control, as reported by the teenagers, were important in the subsequent development of PIU, with warmth, empathy and 'healthy' supervision being protective, and over-control and emotional distance being predisposing. Interesting cross-cultural differences in the parenting styles of the two countries are also reported.

It is also to be noted here that the East Asian countries, most notably South Korea and Japan, have experienced major issues with PIU in their young people, including, according to news reports, over one dozen deaths of young males, after or whilst gaming for prolonged periods of time.[14] To date, there appears to be one reported death in a Western country, that of a 20-year old avid male gamer in England in 2011.[15] In the understandable absence of formal post-mortem findings being available publically, these deaths were initially attributed to dehydration, combined with physiological over-excitement and cardiac arrhythmias, or deep vein thrombosis leading to cardiopulmonary embolism.

It can thus be seen that PIU is a highly complex, interactional, malleable and potentially dangerous phenomenon. It may well turn out, once international comparisons give firmer conclusions, that PIU is best conceptualised not as a unitary mental health condition at all, but as a complex end-point behaviour of a plethora of underlying psychological, developmental, ecological and intra-familial factors.

Psychology of internet gaming and social networking: The Never-Ending Story

No deep understanding of PIU, let alone an attempt to treat it, can be complete without some grasp of the key psychological and cognitive underpinnings of what makes the phenomenon so compelling to many. This field, termed 'Internet Psychology', has become a major area of investigation[16] and some of the key developments will now be briefly discussed.

It is well-established that the gaming industry can be hugely profitable – the gross turnover of the industry now exceeding that of Hollywood – so there is great investment in making a game successful (or 'addictive'?) during the costly development process. There are three core factors that all successful games appear to share, from the simplest Smartphone applications (apps) to the MMORGs enjoyed by millions worldwide. These can be termed the 'Three Fs':[17]

1. **Flow:** the game must, from early on in play, be able to induce that elusive feeling of 'being in the zone', where a player's consciousness becomes highly focussed, there is a distortion of time and there exists a sense of well-being or elation.[18] For prolonged playing, a simple sense of enjoyment does not suffice: the challenges or difficulties must track along what is conceptualised as the 'engagement curve', where the challenge must match the skill of the player, whilst avoiding anxiety (if demands/challenges exceed the capacity of the gamer) or boredom (if the task, conversely, is perceived as too easy). In crude terms, there is always a bigger reward, a more challenging course or a scarier demon to overcome or slay in a successfully engaging game.

2. **'*Fiero*':** the Spanish term for 'fire' or 'fiery', this refers to the intense sense of satisfaction one gets within a game, upon completing a task. Put in neurobiological terms, this is the dopamine 'hit' when one achieves a strived-for goal, which can be immensely rewarding for the player.
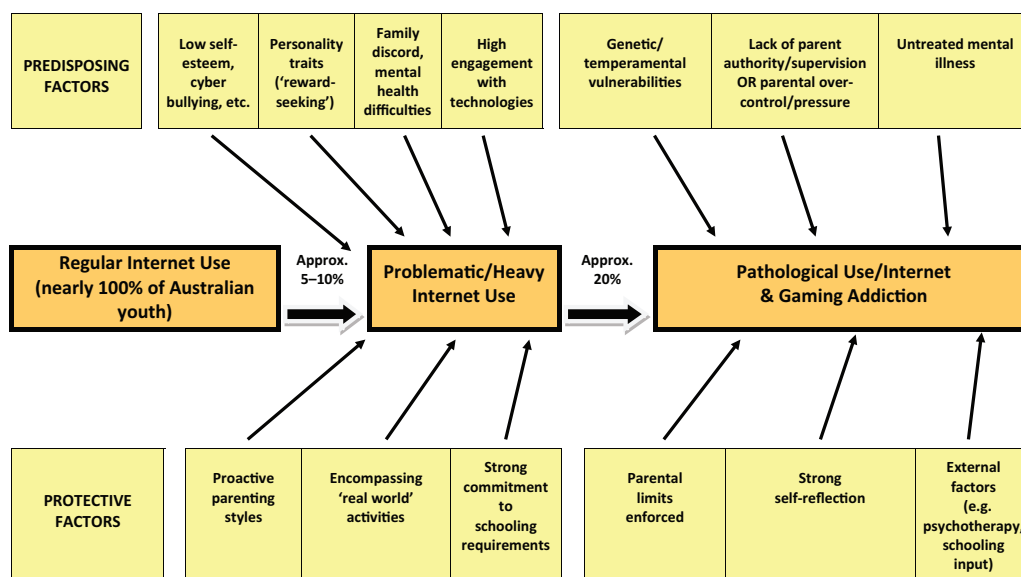
Figure 1. Basic model of PIU in youth.

PIU: problem internet use

3. **Fun failure (or frustration):** this key feature of a game's addictive potential refers to the 'near miss' experience whilst playing. Here, the player is aware he is close to achieving his goal or target, and endeavours to keep on trying to reach that target, whilst not becoming discouraged. The reader will recognise that this is also a key feature that can ensnare problem gamblers.

Overall, these features contribute to what may be termed a game's 'playability'. Put in systems engineering terms, the player/technology/programme triad forms a 'perfect cybernetic system' where input and output, observation and feedback are all finely tuned and coordinated in a compelling fashion, making it difficult to disrupt.

The compelling nature of social networking has also been extensively studied, and whilst it clearly shares many features with gaming, it has some unique ones, too, which are linked with its communications-based substrate. The most relevant appear to be what is termed the 'hyperpersonal effect',[19] which refers to the emotional power and cognitive salience that a comment made in cyberspace has for a person, often being more marked than if it was actually stated verbally to that person. Associated with this phenomenon is the 'Zeigarnik effect'.[20] First described in the 1960s, this refers to the key phenomenon of humans seeking to obtain a satisfying conclusion or closure to their social communications or other endeavours. If there is no sense of a logical ending, then frustration plus a desire to keep pursuing that activity until an ending may be reached, commonly ensues. It can be evident that many forms of social media, offering as they do the brief, unadorned or incomplete pieces of information about or from the

sender, can make users prone to the Zeigarnik effect, a common result being that SM 'conversations' often continue sporadically for many hours, with no sense of a beginning, middle or end.

Summarising the clinical experience and the emerging literature from Australia and internationally, we put together a 'basic model' of some of the key predisposing and potentially protective factors that may be important in the development and evolution of PIU (Figure 1).

Therapeutic options

It is beyond the scope of this article to provide a detailed overview of the therapeutic options trialled and/or proposed for PIU. This is a new field, hampered by a lack of agreed-upon definitions and operationalized criteria, an issue which, it is hoped, will be addressed by the formal inclusion of 'Internet Gaming Disorder' in the DSM-5. Furthermore, treatment studies are few, usually uncontrolled, and sample sizes have been small. Nevertheless, some areas showing initial promise include group cognitive-behavioural therapy (CBT),[21] individual CBT and interpersonal therapy.[22] Internationally, there is also a small but growing number of dedicated inpatient facilities and clinics, mostly in the private sector, for treating clients with entrenched PIU. A potential future treatment direction, employing targeted pharmacotherapy, is illustrated in a case report of naltrexone being successfully used for internet-mediated sex and pornography addiction at the Mayo Clinic,[23] the rationale being to attenuate the dopamine-mediated reward systems of the limbic system in an analogous fashion to the treatment of some substance-use disorders. These intriguing developments

may be considered in association with the emerging number of functional magnetic resonance imaging and positron emission tomography scanning studies, which compare the brain scans and activation patterns, particularly of the reward pathways, of 'hard core' or addicted gamers, as compared with non-affected controls.

Looking towards the future: The Matrix

It seems a banal truism to state that the rise of the internet and WWW has massively changed not simply the way we access entertainment, but also how we communicate, form new social connections, obtain education and engage in employment. It is also worth bearing in mind that the whole field of IT will *continue* to evolve and change, in ways that we may not currently foresee. Some major new developments, either just arrived or over the horizon, include Google Glass (a sophisticated web-enabled pair of glasses) and the use of other 'wearable technologies'. Further down the track, improved internet/brain interfacing (such as direct thought-control of devices) is likely to be a quantum leap forward into what is broadly termed 'enhanced reality'.

It is also clear that subsequent generations may not view the virtual world as distinguishable from the 'real' one, as current 'digital immigrants' (which includes most researchers) probably do. This will thus require a major paradigm shift in the way technology is researched and studied as a phenomenon: it will not be seen as an 'other', able to be analysed separately from 'reality'. Indeed, and this point cannot be overstated, it is possible that many in 'Generation Wired' will view the Virtual world as more 'real' (i.e. more *meaningful*) to them than what the preceding generation would term reality. The rapidly-changing technology landscape, and the way that youth access the WWW, means that many research studies, by the time they reach publication, are to some extent already out-dated.

Finally, it is evident as was briefly demonstrated above, that no single, simple viewpoint when studying PIU and internet psychology more broadly will suffice. A purely mental health-focussed perspective will need to be joined by ideas from education, the social sciences, philosophy and political domains. In this way, PIU can rightly be considered 'the ultimate post-modern affliction of the 21st century'.

Disclosure

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