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The Initiation and Development of Cybersex Addiction: Individual Vulnerability, Reinforcement Mechanism and Neural Mechanism

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Abstract

Cybersex is extremely popular among whole population. A lot of people who consume excess cybersex report social problems and mental distress, this renders studies on cybersex addiction practically significant. Here we elucidate initiation and development of cybersex addiction from the perspective of individual vulnerabilities, reinforcement mechanism and neural mechanism. It turns out some people are vulnerable to cybersex addiction because of specific personalities, cognitions and biopsychological constitutions. Personalities include personal traits tightly associated with cybersex addiction such as narcissism, sexual sensation seeking, sexual excitability, dysfunction use of sex and other common personality disorders like nervousness, low self-esteem, etc. Cognitions consist of problematic thoughts about the self, problematic thoughts about the world and cybersex-related cognitive bias. Biopsychological constitution refers to biological factors, early childhood experiences and psychopathologies like depression, anxiety, etc. Initiation and development of cybersex addiction have two stages including classical conditioning and operant conditioning. Firstly, individuals use cybersex occasionally out of entertainment and curiosity. On this stage, use of internet devices is paired with sexual arousal and that results in classical conditioning, further leads to sensitization of cybersex-related cues which trigger intense craving. Individual vulnerabilities also facilitate sensitization of cybersex-related cues. On the second stage, individuals make use of cybersex frequently to satisfy their sexual desires or relieve negative emotions. During this process, cybersex-related cognitive bias like positive expectation of cybersex and coping mechanism like using it to deal with negative emotions are positively reinforced, those personal traits associated with cybersex addiction such as narcissism, sexual sensation seeking, sexual excitability, dysfunction use of sex are also positively reinforced, while common personality disorders like nervousness, low self-esteem and psychopathologies like depression, anxiety are negatively reinforced. Meanwhile, executive function deficits occur due to long-term cybersex use. Interaction of executive function deficits and intense craving promotes development and maintenance of cybersex addiction. Researches using electrophysiological and brain imaging tools mainly to study cybersex addiction found that cybersex addicts may develop more and more robust craving for cybersex when facing cybersex-related cues, but they feel less

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and less pleasant when using it. Additionally, those studies provide evidence for intense craving triggered by cybersex-related cues and impaired executive function. In conclusion, people who are vulnerable to cybersex addiction can't stop cybersex use out of more and more intense craving for cybersex and impaired executive function, but they feel less and less satisfied when using it. Therefore, they search for more and more original pornographic materials online at the cost of plenty of time and money. Once they reduce cybersex use or just quit it, they would suffer from a series of adverse effects like depression, anxiety, erection dysfunction, lack of sexual life, attention deficit, etc., which compel them to continue using cybersex. After reviewing studies which concentrate on cybersex, it was found that some directions of this field warrant more attention in the future. Important individual vulnerabilities like genetics and stress vulnerability should be discussed. Apart from internal factors, external factors which promote development of cybersex addiction like surrounding environment, social culture should also be addressed. Lastly, previous studies primarily focus on heterosexual male cybersex addicts while ignoring other groups of people who are susceptible to cybersex addiction like heterosexual female cybersex addicts, homosexual addicts, people with sexual dysfunction, which should be further studied to provide implications for clinical intervention and treatment.

Keywords

Cybersex Addiction, Individual Vulnerability, Reinforcement Mechanism, Neural Mechanism

网络色情成瘾的发生、发展：个体易感因素、强化机制及神经机制

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摘　要

网络色情使用在人群中极为普遍，不少个体因过度沉迷网络色情，身心健康、社会功能受到严重损伤，因此对网络色情成瘾发生机制的探索具有重大意义。文章从个体易感因素、强化机制及其神经机制三方面对其进行了阐述。结果发现某些个体因为其独特的人格、认知、生理心理因素成为易感人群。长期的网络色情使用经验导致该类人群对网络色情相关线索敏化，由此诱发的渴求感愈来愈强，在渴求感的诱惑及执行功能损伤的双重因素下强迫性使用网络色情，又因从中获得的满足感越来越弱，于是需要越来越多的网络色情行为维系先前的情绪状态以致成瘾。未来研究应对个体易感因素中遗传、压力易感性等要素及外部诱发因素进行探论，并深入探讨不同易感人群的网络色情成瘾发生机制，为临床预防、治疗提供参考。

关键词

网络色情成瘾，个体易感因素，强化机制，神经机制

1. 引言

网络的出现改变了人们的色情消费方式。在过去人们主要通过浏览纸质色情书刊，观看脱衣舞等色情表演进行色情消费(Hilton, 2013)，而现今传统色情消费逐渐被以下网络色情活动替代：浏览色情图片、色情视频、色情小说等色情材料；与他人通过网络谈论性话题、进行性互动；寻找线下性伴侣或获取性服务信息等(Daneback, Ross, & Månsson, 2006; Griffiths, 2001; Young, 2008) (本文主要讨论过度浏览网络色情材料所导致的网络色情问题)。网络的快速发展和全面覆盖极大地促进了色情消费，相比于上世纪七十年代的年轻男子，二十一世纪的年轻男子因为在青少年时代就开始接触网络，其色情消费量增加了16%，而在女性中相应色情消费量增加了8% (Jacobs, 2015)。网络提供给人们源源不断地浏览新奇色情材料的机会，相较于已被反复浏览的色情片，当男性看到一部新的色情片时，他的性兴奋度和阴茎勃起度都有明显增加(Koukounas & Over, 2000)。这种现象主要与被称之为库利奇效应(Coolidge effect)的生物基础有关——男性在射精后不能和同一个女性马上再次发生性行为，而如果能获得不同的女性，则射精后的不应期会缩短或者彻底消失(Hergenhahn & Olson, 2003)。库利奇效应和网络上大量新颖色情题材的提供加速了网络色情成瘾(cybersex addiction, CA)的发生——网络色情行为成为个体生活中最重要的活动，尽管其使用已对个体的社会功能、职业功能、休闲生活造成侵害，但个体仍无法克制自己卷入网络色情活动的冲动，并且需要越来越多的网络色情使用才能摆脱消极情绪。一旦停止或减少网络色情的使用便会产生生理和心理上的严重不适(Cavaglion, 2009; Griffiths, 2004)。(下文出现的“网络色情使用问题”、“问题网络色情使用”或是研究中根据网络色情相关量表进行划分，或者被试自我报告有网络色情使用困扰，在本文中认为他们是CA倾向者或CA患者)。2000年的数据表明，在网络色情使用人群中约有1%的人因过度沉迷网络色情而患网络色情成瘾(Cooper, Delmonico, & Burg, 2000)。而近年研究发现女性中4.9%的群体，男性12.9%的群体有轻度网络色情使用问题，1.8%的女性，4.9%的男性有严重网络色情问题(Ross, Mansson, & Daneback, 2012)。从这两项数据我们可推测由于网络的飞速发展，患CA的人数在今后将不断激增。为此，探究CA的发生机制，对于CA的预防和治疗极为迫切。过往研究主要围绕着网络色情在人群中的使用情况，CA对个体性观念、性行为、性功能、婚姻、家庭、工作等的负面影响及CA倾向个体的个体特质等展开了激烈讨论(Cavrieli, 2013; Majeres, 2016; Manning, 2006; Owens, Behun, Manning, & Reid, 2012)；而探讨其发生机制的研究却寥寥可数，直到近年来一些学者开始集中探究此问题。本文随后通过对相关实证研究及理论模型的梳理从个体易感因素、强化机制、神经机制三方面来探讨CA的发生、发展，最后提出对未来研究的展望。

2. 网络色情成瘾的个体易感因素

2.1. 人格因素

CA个体的易感人格因素包括CA相关的特异性人格特质和一般性紊乱人格特质(Brand, Young, & Laier, 2014; Brand, Young, Laier, Wolfling, & Potenza, 2016)。前者包括自恋人格、性感觉寻求(sexual sensation seeking)、性兴奋性(sexual excitability)、性滥用(dysfunctional use of sex)倾向等特质，后者指神经质、低自尊等人格特质。

Milam (2015)发现网络色情使用时间与个体自恋程度呈正相关。而自恋人格的形成可能与个体不幸的

童年成长经历如父母照顾不周，致使其情感上被忽视，甚至受到性虐待等有关(Milam, 2015)。Perry 和 Accordino 等人(2007)发现在性感觉寻求量表得分高的大学生色情成瘾量表得分也高。高性感觉寻求者往往需要更多的性刺激来达到自己的最佳唤醒水平(Larsen & Buss, 2008)，因此是 CA 的易感人群。Brand 等人(2011)发现个体对色情图片的性唤醒评分和个体的心理健康程度预测着 CA 症状的发展。进一步地，该研究团队发现性滥用特质和性兴奋性特质与 CA 倾向相关，并且性滥用特质对性兴奋性特质和 CA 倾向有中介调节作用(Laier & Brand, 2014; Laier, Pekal, & Brand, 2015)。具有性滥用倾向和高性兴奋性的个体可能无法掌控自己的性行为，有通过性行为来缓解自己的负面情绪或减少压力的倾向，而当其无法直接进行性活动时，便可能通过网络色情使用满足自身需求。此外，神经质、低自尊等特质的个体可能由于对自己的负面评价以及缺乏社会支持，处于社会孤立状态等借助网络色情摆脱自己的负面情绪(Grubbs, Stauner, Exline, Pargament, & Lindberg, 2015; Kor et al., 2014)。

2.2. 认知因素

认知因素主要包括了个体对自我、外部世界的不合理认知(maladaptive-cognition) (Davis, 2001)以及对网络色情使用的认知偏见。上文提到的一般性紊乱人格特质的个体通常因缺乏社会支持，感到孤独，对自我怀疑，而在心中形成对自我和外部世界的不合理认知，认为自己在现实生活中不被人欣赏和重视转而转向网络，通过网络色情使用来逃避现实，寻求解脱。而此过程又导致网络色情与积极情绪的内隐联结(Snagowski, Wegmann, Pekal, Laier, & Brand, 2015)。CA 倾向者往往对网络色情使用有较高期望——网络色情能使他们获取性满足、缓解压力、消除负面情绪体验等；于是习惯于将网络色情消费作为一种应对机制。

2.3. 生理心理构造

生理心理构造主要包括了个体早期童年经历、生物因素、精神病理学因素等诱发要素。与性成瘾个体有相似生理心理构造的个体可能更易患 CA (Cooper, Putnam, Planchon, & Boies, 1999; Putnam, 2000)，因网络的便利性(accessibility)、匿名性(anonymity)、可负担性(affordability) (Carter & Tiffany, 1999)使这类个体可能随时随地卷入危险性网络性行为中，继而频繁使用网络色情至成瘾。此类个体往往有不幸的童年成长经历——受到物理、性、家庭、社会创伤(Blain, Muench, Morgenstern, & Parsons, 2012; Howard, 2007)；血清素(serotonin)、睾丸素(testosterone)等水平异常(Kafka & Prentky, 1992; Rickards & Laaser, 1999; Samenow, 2010)，及患有心境障碍、焦虑障碍(Nair, Pawar, Kalra, & Shah, 2013)或药物依赖等(Antonio et al., 2017; Hartman, Ho, Arbour, Hambley, & Lawson, 2012)。

3. 网络色情成瘾症状的强化机制

CA 症状的发生、发展可分为经典条件反射和操作性条件反射两个阶段(Putnam, 2000)，前者伴随着网络色情使用相关线索的逐渐敏化，前述所言个体的易感因素——人格因素、认知因素、生理心理构造则可能加强个体对网络色情相关线索的敏化(Brand, Young, et al., 2016)，这些相关线索的敏化进一步诱发个体对网络色情使用的强烈渴求感(craving)；后者伴随着个体执行功能的损伤，并导致个体易感因素的强化。而线索诱发的渴求感和个体下降的执行功能间的相互作用则共同推动着 CA 症状的发展。

最初个体偶尔利用网络设备搜寻、观看色情材料，网络设备使用作为一个中性刺激，在与色情刺激的多次联结后，其与性唤醒(sexual arousal)之间建立起刺激－反应联结，形成经典条件反射(Snagowski, Laier, Duka, & Brand, 2016; Putnam, 2000)。频繁使用网络色情的经历加强了网络色情使用相关线索和性唤醒生理、心理反应间的刺激－反应联结，导致这些线索更能诱发个体性欲(Laier, Pawlikowski, Pekal,

Schulte, & Brand, 2013; Laier, Pekal, & Brand, 2014; Young, 2008)。Laier 和 Pawlikowski 等人(2013)采用线索暴露(cue-reactivity)范式以异性恋男性为被试，发现问题网络色情使用者相较于健康网络色情使用者在观看色情图片后表现出更强的性欲唤醒和自慰需求。Prause 和 Pfaus (2015)也发现浏览色情材料越频繁的异性恋男性在观看色情电影后体验到更强的性欲唤醒。在异性恋女性群体中，相较于不使用网络色情的女性，使用网络色情的女性认为色情图片具有更高性唤醒度，并且在观看色情图片后报告有更强的性欲唤醒和自慰需求(Laier, Pekal, et al., 2014)。

此后个体一使用网络设备即容易产生性唤醒生理反应，性唤醒进一步促进个体的网络色情消费，在个体反复使用网络色情达到目的的过程中，对网络色情的高期望和这种应对机制得到正强化；个体的自恋人格、性感觉寻求、性兴奋敏感性、性滥用心理特质等 CA 相关的特异性人格特质获得正强化；而精神病理性素质如焦虑、抑郁等和一般性紊乱人格特质因为网络色情的使用而暂时弱化(负强化) (Brand et al., 2014; Laier & Brand, 2014)。这一系列强化过程伴随着个体执行功能的损伤。研究表明，网络色情引发的性欲唤醒会干扰个体的工作记忆、决策能力等一般认知、执行功能(Laier, Pawlikowski, & Brand, 2014; Laier, Schulte, & Brand, 2013)。Schiebener 和 Laier 等人(2015)的研究发现在 CA 症状量表(s-IAT sex)上得分高的个体相较于得分低的个体在卷入有关色情的认知任务时，其执行、控制能力下降更显著。除此，这项研究和另一项研究(Snagowski & Brand, 2015)都发现高 CA 倾向的个体要么趋近要么远离色情材料，这种趋近/远离倾向正好印证了色情材料诱发的渴求感与个体执行功能之间的竞争。

4. 网络色情成瘾的神经机制

神经机制方面的研究主要发现了个体对网络色情使用渴求感的增强与其使用网络色情时愉悦感的下降推动着 CA 症状的发展，同时对网络色情使用线索诱发渴求感、CA 倾向个体执行功能下降提供了证据支持。

首先，Steele 等人(2013)发现与观看中性图片相比，有过度观看色情材料问题(viewing of visual sexual stimuli, VSS)的个体在观看色情图片时大脑诱发了更大波幅的 P300 成分。该结果似乎印证了网络色情使用线索会诱发个体对网络色情使用的渴求感这一观点，但 Steele 的研究中缺少正常被试作参照；另外，相比 P300 成分，出现时间更晚的 LPP 成分(late positive potential)与刺激显著性材料加工有关，能更好地反映个体渴望观看色情材料的心理动机(Hilton, 2014) (当个体越渴望观看色情材料时，LPP 波幅越大)。对此，Prause 和 Steele 等人(2015)在改进实验中加入了较少浏览色情材料的个体与 VSS 个体作对照，发现有过度浏览色情材料问题并且报告有更强性欲的被试在观看色情图片时诱发的 LPP 波幅更小，这一结果看似与网络色情相关线索诱发渴求感这一观点相悖，实际后有学者指出 Prause 和 Steele 等人的研究中使用的色情图片可能本身是一种成瘾消费品，而非成瘾线索(Gola et al., 2017; Gola, Wordecha, Marchewka, & Sescousse, 2016)。所以根据药物成瘾中的刺激显著性理论(Incentive-Salience Theory, IST)理论——随着成瘾程度的加深，成瘾相关线索能诱发成瘾个体对成瘾物越来越强的渴求感(Berridge, 2012; Robinson, Fischer, Ahuja, Lesser, & Maniates, 2015)，但成瘾物给成瘾个体带来的愉悦感却逐渐降低，此处 LPP 波幅的降低表明了 CA 可能与药物成瘾有某些相似特点，随后 Gola 等人(2017)的研究支持了这一观点。实验以 28 名因为问题色情使用(problematic pornography use, PPU)而寻求治疗的异性恋男性与 24 名没有 PPU 症状的异性恋男性作被试，要求他们完成奖励延迟任务(Incentive delay task)，发现在向被试呈现预测色情图片线索时，PPU 被试的腹侧纹状体(ventral striatum) (大脑中与奖赏反应机制和动机性行为有关的区域，反映了被试对网络色情的心理渴求)得到了更大程度的激活，而且腹侧纹状体的激活程度也与 PPU 严重程度和被试每周色情使用时间、每周自慰数量有关；但在呈现色情图片时，两组被试相关脑区激活没有显著差异。Kuhn 和 Gallinat (2014)在研究健康成年男性的网络色情使用情况时也发现，观看色情影片越多

的人，其纹状体的另一块会对性刺激做出反应的区域——壳状核(left putamen)激活越弱，且纹状体中的尾状核(right caudate)容量越小。IST 理论揭示了 CA 症状发展的重要动力。当 CA 倾向者频繁浏览网络色情时，不断反复的多巴胺激增让大脑一直处于兴奋状态，长此以往使大脑反应迟钝并萎缩；但相关环境的诱惑却使他们对网络色情的渴求越来越强。而一旦普通色情材料不能引起 CA 患者的“性趣”，他们则可能花费更多的时间、金钱来搜寻更重口味、更新异的网络色情材料以唤起性欲。如研究发现，相比观看普通的色情图片，健康成年男性在观看更偏爱的色情图片时，腹侧纹状体的激活程度更大，且个体报告的 CA 症状越严重，这两种情况下腹侧纹状体激活的差异程度就越大(Brand, Snagowski, Laier, & Maderwald, 2016)。并且研究表明，观看色情影片越多的健康成年男性，其大脑右侧尾状核与左侧背外侧前额叶皮质(left dorsolateral prefrontal cortex, DLPFC) (与认知控制有关)的功能连接越差(Kuhn & Gallinat, 2014)。如此，由频繁色情使用导致的认知控制力的下降更可能使 CA 倾向者使用网络色情至瘾。

5. 小结与展望

鉴于网络色情使用的普遍性及过度网络色情使用对个体乃至社会的严重危害，对网络色情成瘾发生机制的探索具有重大现实意义。本文从个体易感因素、CA 症状的强化机制、CA 的神经机制三方面对其进行了阐述。结果发现某些个体因为其独特的人格、认知、生理心理因素而成为 CA 的易感人群。一方面个体易感因素促进了网络色情相关线索敏化，另一方面其反复使用网络色情满足自身需求的经验反过来又强化了个体易感因素。同时线索诱发的渴求感愈来愈强，易感个体在渴求感的诱惑及执行功能损伤的双重因素下，付出大量时间搜寻新异网络色情材料，但这种满足感却越来越弱，于是恶性循环，他们需要更大量的新颖网络色情材料满足其生理、心理、感官需求。在减少或戒除网络色情后，个体短期内可能出现抑郁、焦虑、勃起困难、缺乏性生活、神志不清、难集中注意力等戒断症状(Ballester-Arnal, Castro-Calvo, Gil-Llario, & Giménez-García, 2014; Carvalheira, Traeen, & Stulhofer, 2015; Grubbs et al., 2015; Park et al., 2016; Poulsen, Busby, & Galovan, 2013)。为逃避这些戒断症状，又或由于其他生活压力事件，个体深陷网络色情的深渊无法自拔，逐渐对生活其他事务丧失兴趣。

通过对现有研究的梳理与归纳，我们发现目前有关 CA 形成机制的某些研究领域尚未得到研究者的集中关注，但却具有重要研究价值，可以在未来研究中进行更全面、深入的探讨。

一是在本文概括的个体易感因素中缺乏遗传、压力易感性等重要因素的研究以及诱发 CA 的外部因素如环境因素方面的研究。尽管已有研究表明网络成瘾中 48%的个体差异可归于遗传方面的因素(Deryakulu & Ursavaş, 2014; Li, Chen, Li, & Li, 2014; Vink, van Beijsterveldt, Huppertz, Bartels, & Boomsma, 2016)，但 CA 的形成与遗传的相关性并未得到研究证实，且不同网络成瘾子类型的易感人群可能有其特异性遗传表征。除此，已有研究证实压力易感性是网络游戏成瘾的潜在前置因素，网络游戏成瘾者报告更严重的日常慢性压力体验，由此推断压力易感性也可能是促进 CA 发展的重要因素(Kaess et al., 2017; Yu, Mao, & Wu, 2018)。另外，外部因素如个体所居住的社会环境——是否独居、居住的社会环境对网络色情的认可程度等也可能影响 CA 症状的发展。

二是探讨 CA 发生机制的研究主要关注异性恋男性群体，而异性恋女性、同性恋、双性恋群体以及更易受网络色情侵害的性功能受损群体，其 CA 发生机制可能异于异性恋男性，需要未来研究给予更多关注。首先，在问题网络色情使用者中性别差异较为明显。研究表明，在男性中有网络色情使用问题的人数比例是女性中相应人数比例的三到五倍(Ballester-Arnal et al., 2014)。造成这种性别差异的原因是什么呢？男女的生理差异可能是原因之一。动物实验表明，导致 CA 形成的库利奇效应在雌性动物上虽也有表现，但强度弱于雄性(Lester & Gorzalka, 1988)。此外，视听刺激的敏感性差异也可能是导致网络色情使用性别差异的原因。大量网络色情视听信息的输入可能为大脑中的性幻想(sexual fantasy)提供来源，而性

幻想能唤醒和提高性欲，因此可能促进网络色情消费。研究表明男性对于视觉色情材料会做出更强烈的反应(Rupp & Wallen, 2007; Wehrum et al., 2013)，他们的性幻想倾向于集中在视觉后像(visual imagery) (Bhintade, 2006)上；而女性性幻想集中在头脑中假想的性刺激上(Joyal, Amélie, & Vanessa, 2015)。一项听觉事件相关电位研究(Oliver, Meana, & Snyder, 2016)发现，对于男性而言，完成刺激序列任务(oddball paradigm)时听觉中的 N1 成分与因观看色情电影而产生的性唤醒呈正相关(完成刺激序列任务与观看色情电影同时进行)；对于女性，听觉中 P3b 成分与色情消费情况呈负相关。这暗示了男女使用网络色情的神经加工机制可能相异，未来研究可从视听刺激的敏感性差异角度探讨网络色情使用中性别差异的原因。另外，性取向不同的群体使用网络色情的目的、情况不同(Green, Carnes, Carnes, & Weinman, 2012)，其成瘾的发生机制也可能有差异。而那些身体发生畸变、有未治愈的性功能障碍者是 CA 的高危人群(贺金波，李兵兵，郭永玉，&江光荣，2010)。该类特殊人群由于无法进行正常的性活动，可能将网络色情消费作为他们正常性生活的替代，其独特的生理、心理成因导致的 CA 症状值得深入研究。

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