

**PORNOGRAPHY:**  
A PUBLIC HEALTH CRISIS

HOW PORN FUELS  
SEX TRAFFICKING,  
CHILD EXPLOITATION, &  
SEXUAL VIOLENCE

*Pornography and the Brain*  
*Public Health Considerations*

Donald L. Hilton, Jr., MD, FAANS

Adjunct Associate Professor  
Department of Neurosurgery  
University of Texas Health Sciences Center at San Antonio

*Speech given at a Congressional Symposium on July 14, 2015,  
hosted by*

NATIONAL CENTER  
————— *on* —————  
SEXUAL EXPLOITATION

For too long, pornography has been protected as a First Amendment right, with little consideration for the rights of those who might be harmed in its production and consumption. The time has come to consider pornography from the perspective of public health. As a medical doctor, I would like to address two considerations regarding pornography that have been largely ignored in the past, and which now warrant our attention.

First, pornography is a biologically addictive medium that alters brain reward and motivation systems in a negative way. In the past, addiction was defined only from the perspective of the behavioral sciences, whereas the definition of addiction is now increasingly informed by the biological sciences. For instance, drug addiction has long been associated with shrinkage in key brain areas important in valuing and processing reward and judgment. It has also been associated with negative metabolic, or functional, changes in how the reward system works. Based on an evolving understanding of how the chemistry of the brain changes with both drug addiction and with behavioral addictions such as to food, sex, and gambling, Dr. Clark Watts and I predicted in a paper published in the journal *Surgical Neurology International* in 2011 that pornography would be associated with shrinkage in the brain's reward areas, and that it would also demonstrate similar metabolic changes in these same reward areas, both of which are seen in drug addiction<sup>1</sup> (see second attached paper). This hypothesis was based on our understanding that similar DNA mechanisms are involved with craving states associated both with drug addiction and with natural rewards as well. I was involved in a study

---

<sup>1</sup> Hilton, D. L., & Watts, C. (2011). Pornography addiction: A neuroscience perspective. *Surgical Neurology International*, 2, 19.

published in the *Proceedings of the National Academy of Sciences (PNAS)* which demonstrated that one of the most basic natural drives, the craving for salt, is driven by the same DNA transcripts which drive drug craving. Our paper summarized that addiction ‘usurps’ these natural craving pathways.<sup>2</sup> In an article about this paper, *National Geographic* used the work ‘hijack’ to describe how addiction changes the perspective of the brain’s reward mechanism.<sup>3</sup>

In the last year, our prediction that these changes would be associated with pornography addiction have been verified. A study published in the *Journal of the American Medical Society Psychiatry (JAMA Psychiatry)* out of the Max Planck Institute in Germany demonstrated that pornography is associated both with shrinkage in the brain’s reward center as well as with impairment in connectivity with the frontal judgment and control areas.<sup>4</sup> This shrinkage was more pronounced in the heaviest users. While this was a correlational study rather than a longitudinal one, causation must be inferred based on other prospective data. However, the fact that the shrinkage was more pronounced in heavier pornography users verses those with less hours per week is certainly supportive of causation when considering what we know about how our brains change with learning.

---

<sup>2</sup> Liedtke, W. B., McKinley, M. J., Walker, L. L., Zhang, H., Pfenning, A. R., Drago, J., et al. (2011). Relation of addiction genes to hypothalamic gene changes subserving genesis and gratification of a classic instinct, sodium appetite. *Proceedings of the National Academy of Sciences*, 108(30), 12509\_12514.

<sup>3</sup> Brian Handwerk, Cocaine Addiction Uses Same Brain Paths as Salt Craving. *National Geographic Daily News*. July 19, 2011.

<sup>4</sup> Kuhn S., Gallinat J. (2014). *JAMA Psychiatry*, May 28

For instance, until the mid 90's we all thought that learning did not change the physical structure of the brain. However, in 1995 a study published in the journal *Science* in 1995 demonstrated that the part of the brain that controls hand function is enlarged in violin players, and that this effect is increased the earlier they begin playing.<sup>5</sup> Other learning modalities have been found to cause physical enlargement in the brain, with a diversity encompassing taxi cab drivers and even jugglers. One study published in the *Journal of Neuroscience* in 2006 showed that medical students' brains show enlargement in key learning areas when scanned before and after a three-month period of studying for exams.<sup>6</sup> These are prospective, rather than correlational, and thus support a causative role for learning in changing the structure of the brain. For instance, in a study in the journal *Nature* on learning and juggling, the authors summarize: "This discovery of a stimulus-dependent alteration in the brain's macroscopic structure contradicts the traditionally held view that cortical plasticity is associated with functional rather than anatomical changes."<sup>7</sup> Another study in *Behavioral Brain Research* voices the same conclusion: "Contrary to assumptions that changes in brain networks are possible only during critical periods of development, modern neuroscience adopts the

---

<sup>5</sup> Elbert, T., Pantev, C., Wienbruch, C., Rockstroh, B., & Taub, E. (1995). Increased use of the left hand in string players associated with increased cortical representation of the fingers. *Science*, 270, 305\_307.

<sup>6</sup> Draganski, B., Gaser, C., Kempermann, G., Kuhn, H. G., Winkler, J., Buchel, C., et al. (2006). Temporal and spatial dynamics of brain structure changes during extensive learning. *Journal of Neuroscience*, 26(23), 6314\_6317.

<sup>7</sup> Draganski, B., Gaser, C., Busch, V., Schuierer, G., Bogdahn, U., & May, A. (2004). Neuroplasticity: Changes in grey matter induced by training. *Nature*, 427, 311\_312.

idea of a permanently plastic brain.”<sup>8</sup> Zatorre et al., in the journal *Nature Neuroscience* said in 2012: “The brain is the source of behavior, but in turn it is modified by the behaviors it produces...learning sculpts brain structure.”<sup>9</sup>

Kaeur and Malenka, in a paper in *Nature Neuroscience Reviews* looking at how brain cell connections are affected by addiction said, “Addiction represents a pathological, yet powerful, form of learning and memory.”<sup>10</sup> Given what we now know about how learning changes the brain, would we expect to see physical changes in the brain in addiction? We would, and we do. Virtually every study looking at addiction has shown shrinkage and abnormality in the reward areas and in judgment centers. These include addictions to drugs such as cocaine,<sup>11</sup> methamphetamine,<sup>12</sup> and opiates,<sup>13</sup> and to behavioral addictions such as to food,<sup>14</sup> sex,<sup>15</sup> the Internet,<sup>16</sup> and as we have discussed,

---

<sup>8</sup> Draganski B, May A (2008) Training-induced structural changes in the adult human brain. *Behav Brain Res* **192**:137–142.

<sup>9</sup> Zatorre, R. J., Field, R. D., & Johansen-Berg, H. (2012). Plasticity in gray and white: Neuroimaging changes in brain structure during learning. *Nature Neuroscience*, 15, 528-536.

<sup>10</sup> Kaeur JA, Malenka JC: “Synaptic plasticity and addiction.” *Nature Reviews Neuroscience* 8, 844-858 (November 2007)

<sup>11</sup> Franklin, T. E., Acton, P. D., Maldjian, J. A., Gray, J. D., Croft, J. R., Dackis, C. A., et al. (2002). Decreased gray matter concentration in the insular, orbitofrontal, cingulate, and temporal cortices of cocaine patients. *Biological Psychiatry*, 51(2), 134\_142.

<sup>12</sup> Thompson, P. M., Hayashi, K. M., Simon, S. L., Geaga, J. A., Hong, M. S., Sui, Y., et al. (2004). Structural abnormalities in the brains of human subjects who use methamphetamine. *Journal of Neuroscience*, 24(26), 6028\_6036.

<sup>13</sup> Lyoo, K., Pollack, M. H., Silveri, M. M., Ahn, K. H., Diaz, C. I., Hwang, J., et al. (2005). Prefrontal and temporal gray matter density decreases in opiate dependence. *Psychopharmacology*, 184(2), 139\_144.

<sup>14</sup> Lyoo, K., Pollack, M. H., Silveri, M. M., Ahn, K. H., Diaz, C. I., Hwang, J., et al. (2005). Prefrontal and temporal gray matter density decreases in opiate dependence. *Psychopharmacology*, 184(2), 139\_144.

pornography.<sup>17</sup> When we look at the Kuhn study showing shrinkage with pornography, and interpret the results in the context of the other studies, we would have to come to the ludicrous conclusion that if pornography does not cause at least some of the shrinkage seen, it is the only learning to which the brain is immune!

Incentive sensitization is where the brain's reward center is hypersensitive to cues associated with addiction. For instance, when a person with a cocaine addiction is shown a picture of a line of cocaine, the brain's reward center lights up more than a person who is not addicted and shown the same picture. Voon et al., in a study done at Cambridge University and published in two papers in the journal *PlosOne* last year found that the brains of those addicted to pornography light up just like the cocaine addicts when shown pornography cues as compared to normal controls. They also found that pornography addicts demonstrate a wanting/liking split, where the addict craves the drug or behavior of choice, but does not even like it anymore. This is a hallmark of addiction. They summarize: "These studies together provide support for an incentive motivation theory of addiction underlying the aberrant response towards sexual cues in CSB."<sup>18</sup>

---

<sup>15</sup> Schiffer, B., Peschel, T., Paul, T., Gizewshi, E., Forshing, M., Leygraf, N., et al. (2007). Structural brain abnormalities in the frontostriatal system and cerebellum in pedophilia. *Journal of Psychiatric Research*, 41(9), 754\_762.

<sup>16</sup> Yuan K, Qin W, Wang G, Zeng F, Zhao L, et al. (2011) Microstructure Abnormalities in Adolescents with Internet Addiction Disorder. *PLoS ONE* 6(6): e20708. doi:10.1371/journal.pone.0020708

<sup>17</sup> Voon, V., Mole T.B., Banca P., Porter L., Morris L., Mitchell S., Lapa T.R., Potenza M.N., Irvine M. (2014). Neural Correlates of Sexual cue Reactivity In Individuals with and without Compulsive Sexual Behaviors. *Plos One*, July 11, 2014 DOI: 10.1371/journal.pone.012419

<sup>18</sup> Mechelmans, D.G., Irvine, M., Banca, P., Porter, L., Mitchell, S., Mole, T.B., Lapa, T. R., Harrison, N. A., Potenza, M. N., Voon, V. (2014). Enhanced Attentional Bias

Pornography, particularly as presented via the Internet, is a supranormal stimulus. Nicholas Tinbergen, a Nobel Prize winning biologist, coined the term. He did an experiment where he painted plaster bird eggs bigger and brighter than normal eggs and found that the birds would try to roost their plaster eggs and ignore the real eggs. Even more relevant to the present discussion, he did another experiment with a butterfly species where the males were attracted to the females based on the color of their wings. He painted paper butterfly wings bigger and brighter than normal, and when given the choice between the real and the artificial, the males chose and tried to mate with the artificial females and ignored the real females.

We are seeing a generation of adolescent males conditioned to prefer the endless novelty of porn to actual females. As feminist Naomi Wolfe said, “For the first time in human history, the images’ power and allure have supplanted that of real...women. Today, real... women are just bad porn.”<sup>19</sup> I described this phenomenon in a paper on pornography as a supranormal stimulus and on its potential to invoke a neuroplastic response.<sup>20</sup> (see attached paper)

The second issue is exploitation. Pornography conditions men to view women as objects to exploit and use. It conditions women to become those objects. The brain’s mirror systems are involved in this conditioning process. One functional MRI study

---

towards Sexually Explicit Cues in Individuals with and without Compulsive Sexual Behaviours. *PlosOne*. DOI: 10.1371/journal.pone.0105476

<sup>19</sup> Naomi Wolfe, The Porn Myth, *New York Magazine*

<sup>20</sup> Hilton, D.L. Pornography Addiction: A Supranormal Stimulus Considered in the Context of Neuroplasticity. *Socioaffective Neuroscience and Psychology*, Vol 3 (2013) incl Supplements

looking at the brain's mirror systems found that "...the mirror-neuron system prompts the observers to resonate with the motivational state of other individuals appearing in visual depictions of sexual interactions."<sup>21</sup> What is that motivational state? Male pornography performer Bill Margold described it as follows: "I'd like to really show what I believe the men want to see: violence against women. I firmly believe that we serve a purpose by showing that."<sup>22</sup> We should not be surprised, then, that sexual assault on college campuses and in the military are becoming rampant. Pornography apologists such as Milton Diamond and Anthony DeAmato published correlative data with no prospective perspective in the past claiming that because sexual assault was decreasing and pornography was increasing, men would watch violent pornography and then be content not to go and do likewise. If this is true, car advertisers must beware, as consumers will be more inclined to admire the advertised cars instead of buy! However, no one today is trying to claim that rape is decreasing, and recent papers such as that by Cory Yung published in the *Iowa Law Review* expose their discredited studies. He summarized, "Instead of experiencing the widely reported "great decline" in rape, America is in the midst of a hidden rape crisis."<sup>23</sup>

Adolescents are more vulnerable to the molding and addicting power of pornography. They elaborate DeltaFosB, a brain protein important in addiction, more

---

<sup>21</sup> Mouras, H., Stoleru, L., Moulier, V., Pelegriani-Issac, M., Rouxel, R., Grandjean, B., et al. (2008). Activation of mirror-neuron system by erotic video clips predicts degree of induced erection: An fMRI study. *NeuroImage*, 42(3), 1142\_1150.

<sup>22</sup> Bill Margold, pornography performer, as quoted by Gail Dynes, *Pornland: How Porn Has Hijacked our Sexuality*. Beacon Press, Boston 2010, pg xxvi

<sup>23</sup> Young, *Iowa Law Review*, 2014, Volume 99:1197-1255.



potently than adults. Their frontal reward and control areas are not fully pruned and myelinated until the mid to late 20s, yet we allow pornographers to ruin the lives of countless 18 year old girls who are consumed and discarded by the pornography industry, which is primarily fueled by men using vulnerable women to make money from other men. We got rid of Joe Camel and the marketing of tobacco to kids. We decided that the tobacco industry's right to free speech infringed on the emerging generations right to live. Can we not do the same with pornography and our youth? The allure of the toxic sex of pornography to our emerging adults has much more in common with Joe Camel than we thought. It is time to protect the vulnerable. We need to be as serious about keeping pornography out of their eyes as we are about keeping tobacco out of their lungs, and pass Internet 'op-in' protection for youth. It is time to stop this harmful cultural conditioning.

Our brains are marvelous, and are designed for a much richer human experience than the cheap food of toxic porn sex. We are designed to experience pleasure, but also to think, feel, and to love. We can do better. Let us reclaim our humanity for ourselves and for future generations.