

Motivation and the Brain:

How incentives affect the brain and motivation

Kurt Nelson

Abstract

The purpose of organizational incentives is to change worker's behavior. Ultimately this is done through impacting their motivation and goal-based decision processes which have an underlying neurological component. This paper outlines the neurological components that are activated and influence this motivational process as they relate specifically to incentive rewards. Specifically, motivational theories are reviewed and correlated to neurological stimuli with an emphasis on the nucleus accumbens, ventral tegmental area, brain-lateralization, executive functions in the amygdala and hippocampus and the mesolimbic dopamine system's effect on motivation. It is suggested that while all of these systems play a role in incentive salience and subsequent behavioral impact, the dopamine system is the most robust and has the largest role. Through association and classical conditioning, incentive stimuli connected to dopamine release can modify and reinforce specific behavior. The amount of dopamine released by specific incentive stimuli is dependent upon the subjective perception of the magnitude of reward and the rewards salience (Depue & Collins, 1999).

Understanding how Organizational Incentives Neurologically Impact Motivation

Motivational theorists believe that there is an underlying "cause" for every action or behavior and that if we can understand those "causes" we can better predict and impact the related behaviors (Franken, 2002). Those "causes" and the correlated components that are associated with them are some of the most studied aspects of psychology. Ultimately, these motivational "causes" can be reduced to a neurological component where chemical and electrical actions in the brain initiate, moderate and maintain specific human behaviors through positive reinforcement and sensitization processes.

We are all motivated to obtain rewards at some level, whether to obtain food, secure shelter, or to reproduce. However there are individual variations to the extent that people are motivated by, and the degree to which, different stimuli motivate. The physiological aspects of motivation have a great impact on these individual behavioral differences (Konkle, Bielajew, Fouriez, & Thrasher, 2001). One of the guiding principles of psychology is that people are generally motivated to perform actions that lead to positive feelings. This positive affect helps people learn many adaptive behaviors that are necessary for survival such as finding food when it is scarce, looking for a strong mate, and pursuing social power (Franken, 2002).

Positive reward effects are brought about by a variety of stimuli such as food, water, sexual advances, gambling, stimulant drugs, high-risk activities, and opportunity to win money or merchandise.

These stimuli create anticipatory as well as consummatory reward responses in various brain regions often called the reward pathway (Ikemoto & Panskepp, 1996). The same stimuli can create different motivational intensities depending upon one's neural network configuration and sensitivities (Depue & Collins, 1999). The reinforcing effects of stimulating the rewarding pathway are thought to give rise to human motivation and goal seeking behaviors based on the individual sensitivity to these stimulating effects (Dreisback & Goschke, 2004).

The purpose of this paper is to outline the neurological components that are activated and influence this motivational process as they relate specifically to incentive rewards used in organizational work to increase the performance of employees.

Motivational Research Theory

Research on motivation has been going on since the early beginnings of psychology. William James first explored the concepts of emotion, motivation and drive in the late 1800's (Berridge & Winkielman, 2003). In the 1930's and 1940's Skinner's operant conditioning looked at motivation and performance from a behavioral perspective. In the 1950's work in drive theory postulated that hedonic behavior was influenced by needs states – in other words, a person will eat to reduce a need (i.e. hunger) (Berridge & Winkielman, 2003). However, this did not accommodate why people eat tasty food even after they are full. From the 1940's to the 1960's Maslow presented and expanded on his "hierarchy of needs" outlining human motivation as a stepped process that began with the motivation for safety, shelter and food and worked up through self-actualization (the desire to reach one's full potential) (Maslow, 1943; Shermerhorn, Hunt and Osborn, 2003; Stajkovic & Luthans, 2003). Current motivation theory has progressed and grown from all of these histories.

Recent work has focused on intrinsic versus extrinsic goals, goal congruency, situational motivation, expectancy-value, goal setting, avoidance approaches and self-efficacy (Cameron & Pierce, 1994; Stajovic & Luthans, 2001; Franken, 2002; Schermerhorn, Hunt & Osborn, 2003). Much of motivational theory has developed out of a focus for the location of the stimuli for that motivation – either intrinsic or extrinsic. In other words, is a person intrinsically motivated from something internal to them (i.e. some aspect of their personality or self-concept that drives their actions) or is the locus of motivation external to the individual thus extrinsic (i.e. action is a result of wanting to avoid punishment or earn some reward). Incentives used by organizations to increase the performance of individuals are for the most part extrinsic. However, research indicates that both intrinsic and extrinsic motivational cues affect similar, if not the same, neurobiological structures and systems (Depue & Collins, 1999).

Contingent rewards

According to behavioral management theory, contingent rewards drive performance. In a meta-analysis of a variety of organizational studies, contingency (or incentive) pay has been shown to have a positive impact on organizational performance, increasing that performance by an average of 23% (Stajkovic & Luthans, 2003). Behavioral management theory postulates that the unique motivational effect of this contingent pay is based on its (a) outcome utility, (b) informative content, and (c) regulatory

mechanism. Stajkovic and Luthans (2003) suggest that rewards that account for all three aspects of outcome utility, informative content and regulatory mechanism will lead to higher overall performance.

Research by Mitchell (1999) on money's meaning has shown that different people perceive money in different ways and that its motivating effect is moderated by these individual differences. Deci, Ryan and Koestner (1999) point out that rewards may have both positive and negative effects on motivation, with some aspects of rewards being perceived as controlling thus decreasing intrinsic motivation, and some aspects being seen as providing evidence of competence and thus increasing intrinsic motivation. The theories imply that behavior can be positively influenced by external influencers and extrinsic rewards, however if the reward is seen as controlling, the long-term effect on intrinsic motivation (thus long-term behavior change) can be negatively impacted.

Most research on extrinsic motivation has been focused on money, however some more recent work has focused on non-cash types of rewards. It has been suggested that people are more likely to respond to contingent tangible rewards (i.e. trips and merchandise) than they are to cash (Jack, 1994; Lang, 2000). A comparison study using non-cash and cash rewards to increase car sales showed non-cash rewards increasing sales 15% compared to 2% for cash. Non-cash rewards are hypothesized to elicit more goal imagery than cash rewards, thus activating more and different motivational channels in the brain that lead to higher performance (Jack & Colby, 1996; Schultheiss & Brunstein, 1999).

Brain Research

The complex interactions between neurochemical and neurological systems in the brain and motivation make deriving definitive conclusions regarding their exact correlation very difficult. Indeed, most researchers now believe that more than one brain area and more than one neurotransmitter are involved in the psychological underpinnings of behavior (Panskepp, 1986). However, work over the past three-decades has shed an immense amount of light on the subject giving us a much better understanding of the brain systems involved in human motivation.

Evolutionary psychology suggests that the euphoria that makes us feel good while eating or pursuing a mate is a competitive advantage that helped us survive and pass on our genetic code. Activating this system makes us feel flush and euphoric and acts as a reinforcing agent to encourage us to repeat the behavior that brought us the initial high (Nestler and Malenka, 2004). These pathways are also activated by a variety of other stimuli other than just food and sex, and thus influence our behavior in a number of ways (Depue & Collins, 1999). The reward pathways in the brain have been shown to have a significant role in motivation.

Research done in the 1950's by Olds and Milner (1954) found that animals would respond and learn to activate mechanisms in order to receive electrical stimulation in septum areas of the brain referred to as reward centers. Rats in this study would receive the electrical stimulation by pressing a lever. Some rats were recorded pressing the lever over 2,000 times in an hour and continuing with this behavior until they could no longer press the lever due to exhaustion. Further research indicated that the electrical stimulation caused the release of the neurotransmitter dopamine that resulted in the reinforcement of the behavior (Kalat, 2004).

Incentive motivational theory explores how goal-directed behavior (i.e. pushing a lever to receive an electrical stimulation) is elicited by specific incentive stimuli or their representations (Panskepp, 1986; Depue & Collins, 1999). This reinforcement of behavior is thought to occur in three separate but simultaneous processes: (a) an individual encounters an unconditioned stimuli that activates the brain network for pleasure, (b) through classical associative learning, the experience of pleasure is associated with a neutral stimuli (this could be behaviors, objects, events, places, people, etc.), which then becomes conditioned (i.e. incentive stimuli) to elicit the pleasure network, and (c) the incentive stimuli is encoded for its intensity and salience, thus creating a motivational value linked to the incentive stimuli (Berridge and Robinson, 1998; Depue & Collins, 1999). Later exposure to the incentive stimuli creates a positive affect (activating the pleasure network) and leads to approach behaviors to a goal unless mediated by other overriding systems.

Dopamine System

One of the main components of the brain's reward system is the mesolimbic dopamine system mentioned above. Dopamine's release in the brain's Ventral Tegmental Area (VTA) and particularly the nucleus accumbens act as a general facilitative agonist for pleasure and is related to the reinforcement of behaviors. Increased dopamine in these areas creates such feelings as euphoric sensations, added energy, and an increase in focus ability. These feelings are dependent upon the level of dopamine released or active in the system, the timing of the release and the number of neural receptors and their respective configuration (Panskepp, 1986). Research indicates that dopamine is one of the key elements in almost all addictive drugs including cocaine, heroin, and amphetamines.

The dopamine system is comprised of specific dopamine neurons and the neurotransmitter dopamine and begins in the VTA and is comprised of the medial forebrain bundle of axons. This system is connected to various other areas of the brain including the frontal cortex and particularly the nucleus accumbens and accumbens-related circuitry (Nestler and Malenka, 2004). When the medial forebrain axons are stimulated in the VTA they release dopamine from their axon tips into the synapse cleft in the nucleus accumbens. The dopamine then attaches itself into receptors in the nucleus accumbens neurons and sends a message to those cells. This process is what causes the "rush" of a stimulant drug (Panskepp, 1986). The release of dopamine into the nucleus accumbens has been noted to positively affect the reinforcement of behaviors associated with the dopamine's release and is associated with the sensitization that can lead to wanting and addiction (Walton, Bannerman, & Rushworth, 2002; Berridge & Robinson, 2001). This same overall process is thought to impact other areas of motivation and goal setting.

While stimulant drugs highlight the effect of the dopamine system, other types of stimuli also activate this area. As noted before, Darwinian evolutionary forces designed this system to help ensure that we would eat and engage in sexual reproduction in order to survive and pass on our genes. Most of our evolutionary advances have the capacity to be used for other things beyond influencing the specific behaviors that they were designed for, this extended adaptation allows for the dopamine system to work as a motivational agent for other results that include more than just food and sex (Nicholson, 1997).

Studies have indicated that activities such as high-risk adventure (e.g. rock climbing, parachuting, race-car driving), watching action movies, competition, gambling, and goal-directed behavior (e.g. making a sale, finishing a project, creating an object, etc...) all increase the release of dopamine in the VTA (Blum, 1997; Franken, 2002; Carlson, 2004).

Higher levels of dopamine in the limbic system have been correlated with an increase in activity and in response to incentive rewards. This activity is specific to promoting initiation and response actions in processes related to both positive incentives and negative incentives. Thus dopamine is seen as actively promoting goal-directed behavior and goal-initiation activities (Panskepp, 1986). Dopamine is released both in the anticipation of incentives and in the consumption of incentives, with typically higher doses of dopamine being released during the anticipatory stage (Berridge & Winkielman, 2003). Research done with animals demonstrates that differences in individual neurological functions influence dopamine functioning and contribute to variations in incentive motivated behavior. Research studies showed that lesions to animal's dopamine system in the VTA and the nucleus accumbens created a reduction in motivation to work for reward (Depue & Collins, 1999). Different research showed that injecting dopamine antagonist into animals also reduced motivation to work for reward while injecting dopamine agonist had the opposite effect (Panskepp, 1986; Depue & Collins, 1999).

Executive functions

Motivation isn't all dopamine induced reinforcement it is also impacted or moderated by other brain systems and functions. Executive functions such as our memory system, the hippocampus, and the amygdala also play a role in determining individual motivation (Franken, 2002). Stimulation to the nucleus accumbens has been shown to come from these different areas and is thought to be "a major point of convergence of motivational information from many limbic structures" (Depue & Collins, 1999, p. 503).

The human memory system must interact with other functions in determining value and significance of any behavior and expected outcome. In other words, memory of stimuli's intensity and valiance interact to moderate or facilitate motivational behavior. Thus individual memory gives rise to moderating or enhancing effects to different neutral stimuli and these effects are different for different people (Taylor et al. 2004). The hippocampal system is also involved in the formation of relationships and understanding of cause-effect and determining linkages and encoding values between stimuli. Franken (2002 p. 42) states "From a motivational perspective, this system [hippocampal] is valuable because it allows us to engage in 'win-shift' behavior. Should I run out of food in one location, I can shift to another..." The amygdala system is important in our approach and avoidance response conditioning. This is often associated with Pavlovian type response where a neutral stimuli is paired with a conditioned stimuli to elicit a conditioned response. Motivation is impacted by these types of associations (Franken, 2002).

Right and Left Brain Lateralization

The right and left hemispheres of the brain have been associated with different levels or abilities surrounding emotional and functional processing. While both hemispheres work together, research has

shown that the processing of different types of information is dominated by one of the two hemispheres. The left-hemisphere is typically described as analytic, detailed, linear, and temporal and is involved in logical reasoning and functions such as math and sentence structure. The right-hemisphere is associated with more spatial, holistic, emotional, and pattern recognition that is typically involved in visual and creative ventures such as understanding meaning and perceptual processing (Borod, 1992). Research on patients with head injuries has shown that there is often a lack of motivation or apathy associated with damage to either hemisphere. Lack of goal-orientation is more highly correlated with damage to the right hemisphere and lesions in this area have been related to a lack of initiation in routine and other activities (Harrington & Salloway, n.d.).

Work by Schultheiss and Brunstein (1999) explored the role of goal imagery and implicit motivation. They found that goal imagery enhanced the strength of implicit motivation and an individual's commitment to a goal. They also state, "...thinking about an emotionally significant situation in concrete, imagelike ways produces more brain activity characteristic of emotional processing and more pronounced mood changes than thinking about it in abstract, analytical manner" (p. 6). While their work did not specifically explore right or left brain phenomena, work on brain lateralization would suggest that visualization of specific goals would be heavily influenced by the right-hemisphere as opposed to the more linear processing left-hemisphere.

Incentives and the Brain

Incentives as used in business are designed to elicit specific behavior that normally would not be done and thus impact subsequent human performance. Individuals are thought to be influenced by incentives in their choice between two or more different behaviors with the incentives enhancing the probability of the individual choosing the one that is in line with the company objectives. In other words, the reward stimulus that a company offers (e.g. cash, recognition, merchandise, staying employed, trips, etc...), are designed to act upon workers goal setting and motivation in order to "pull" them towards the desired behavior. For instance, a company may offer a cash bonus for a specific operational target such as a sales goal, this cash bonus is designed to change an individual's behavior so that he or she sells more in order to achieve that reward. The stimulus, in this case, cash, creates some neurological changes that create this "pull." The specifics around those neurological changes are interesting and complex and primarily involve both the nucleus accumbens and the dopamine system and are moderated by various other brain systems.

Extrinsic incentives have been shown to increase dopamine and blood flow in the ventral tegmental and nucleus accumbens areas of the brain (Knutson, Adams, Fong, & Hommer, 2001; Zald et al., 2004). The increase in dopamine transmission is higher in the anticipation phase of the reward than in the subsequent consumption phase. In a study by Berridge & Robinson, (1998) it was found that dopamine systems were not needed in order to moderate the pleasure of consumption or to link the associations involved in hedonic reward learning. Instead dopamine was thought to increase the incentive salience attributions of reward-related stimuli. In other words, dopamine is involved in "wanting" incentives, but not for "liking" incentives or for that matter, learning to "like" new incentives.

Dopamine release has also been shown to increase when rewards are not guaranteed. A study using PET imaging studies to track dopamine transmission by Zald et al., (2004) showed that dopamine levels were increased over a control group in a monetary task situation. What is interesting is that they had subjects conduct those tasks in three scenarios: (a) variable ratio (VR) reward payout schedule, (b) a fixed ratio (FR) payout schedule and (c) a control group. Under the variable ratio situation, the participants selected one of four cards and knew a monetary reward of \$1 was possible but did not know when it would occur. During the fixed ratio schedule, subjects knew they would receive a reward with every fourth card they selected. Under the control situation, participants chose cards but did not receive or expect any rewards. While the experiments with a reward component (both FR and VR) showed an increase in dopamine transmission, the VR schedule showed a significant increase in dopamine transmission in the left medial caudate nucleus as compared to both the control group and the FR group.

Levels of dopamine released vary by individual and by the specific incentive offered. Depue and Collins (1999) state, "The magnitude of both unconditioned and conditioned incentive stimuli is strongly associated with the quantity of DA [dopamine] release in the NAS [nucleus accumbens] and with graded increase in frequency and duration of VTA DA [dopamine] neuronal activity" (p. 515). This magnitude is different in different people. In addition dopamine release is affected by the salience that an individual places on a particular incentive stimulus.

The nucleus accumbens is activated during the anticipation of incentives. Measuring the blood flow to specific areas of the brain, Knutson et al., (2001) showed that the anticipation of rewards showed both an increase in nucleus accumbens activation as indicated by blood oxygen levels as well as in self-reported happiness of participants. This is in contrast to what happens in anticipation of punishments in which the nucleus accumbens is not activated. In addition, as would be suspected, self-reported happiness did not increase in the punishment situation.

Another part of the brain that is interconnected to the nucleus accumbens, the medial frontal cortex (MFC) is also thought to influence motivation. In effort-based decision making in rats, it was shown that after lesions were made to the MFC rats chose the option that required less effort even when it meant getting significantly less reward. Walton, Bannerman, and Rushworth (2002) did a study using a T-maze where rats could choose either to climb a barrier and receive a high-reward or choose no barrier and get a low-reward. Prior to surgery, the rats were all choosing to climb the barrier and get the high-reward. After lesions were made to the MFC, rats shifted their behavior to choosing the low-reward arm of the T-maze. This suggests that the MFC has an impact on effort based decision making.

Discussion

Organizational incentives act as stimuli to various neurological areas in the VTA area brain. These changes are similar to the changes that stimulant drugs cause which include an increase in dopamine transmission in the nucleus accumbens area of the brain and higher blood oxygenation in that area. The purpose of these organizational incentives is to change workers behavior. This is done through impacting their motivation and goal-based decision processes that have a neurological component.

Research has shown that dopamine release in the VTA and nucleus accumbens result in a pleasure state that can act as a reinforcing agent on incentive stimuli (Depue & Collins, 1999; Nestler & Malenka, 2004; Carlson, 2004; Panskepp, 1986). Through association and classical conditioning, incentive stimuli connected to dopamine release can modify and reinforce behavioral actions. The level of dopamine released by specific incentive stimuli is dependent upon the subjective perception of the magnitude of reward and the rewards salience (Depue & Collins, 1999). Perception regarding the magnitude and salience of rewards is impacted by the hippocampus, the amygdala and the memory system (Franken, 2002; Taylor et al. 2004). Differences in these neurobiological systems create different responses to incentive stimuli in different people.

It is thought that extrinsic and intrinsic motivational cues both have similar neurological components (Depue & Collins, 1999). This does not mean that they are the same and more research needs to be done in exploring differences in dopamine release and other neurobiological aspects as they relate to motivational salience and impact of extrinsic versus intrinsic stimuli. Behavioral management theory suggests that the motivational component of incentives is moderated or facilitated by its (a) outcome utility, (b) informative content, and (c) regulatory mechanism (Stajkovic and Luthan, 2003). This correlates to neurological understanding of incentive motivational brain processes in that the first two (outcome utility and informative content) are thought to impact incentive valiance while the regulatory mechanism is related to the executive moderating function of the hippocampus, amygdala and memory systems (Franken, 2002).

Cash has been shown to have different salient meanings for different individuals and different effects on dopamine release in incentive situations. Zald et al., (2004) showed that variable ratio reward schedules had significantly higher dopamine release in the VTA when compared to no reward or a fixed reward payout schedule. This suggests that variable reward incentives would probably have a higher impact on motivational influence than a fixed ratio incentive. More work on how this translates into actual performance and effort should be undertaken.

In addition, the anticipation phase of incentive motivation has been shown to typically have a higher dopamine release than the consumption phase. This suggests that an incentive can be used to drive behavior, even if that behavior is not liked, by creating a want for the rush that the anticipatory phase creates (Berridge & Robinson, 1998).

While there is some evidence to link non-tangible rewards to processes in the right brain and thus higher motivational impact, the neurological component of this is not well understood, and further research in this area should be undertaken (Jack & Colby, 1996; Schultheiss & Brunstein, 1999). This is an area of research that could be very beneficial in understanding specifically how organization's incentive efforts can be best designed to have the highest impact.

Incentive motivation has a neurological component that is significant to our understanding of how organizational incentives work. The information reviewed in this paper suggests that while we understand much of that neurological component, there is much that still needs to be learned. Obviously, with advances in brain research technology and the continued reduction in the costs associated with brain

research, more and better research will be conducted. This research should give us a better understanding of the relationships between stimuli and neurobiological functions. It should also create more and better links between "causes" and correlated behaviors.

However, this also raises some ethical issues that have not been addressed so far. If we develop an understanding of motivational causes to the point where we can predict specific behavior as a result of inducing certain incentive stimuli, how can we insure that this will not be used by companies or the government to change our behavior in ways that we do not desire? Is there a point where we could be turned into non-thinking drones, responding to such well placed stimuli that we have little or no free-will? While probably not likely, we should be aware of the possibility.

References

- Berridge, K. C., & Robinson, T. E. (1998). What is the role of dopamine in reward: hedonic impact, reward learning, or incentive salience? *Brain Res Brain Res Review*, *28*, 309-369. Retrieved June 11, 2004, from <http://www.capella.edu.library>
- Berridge, K. C., & Robinson, T. E. (2001). Mechanisms of action of addictive stimuli: Incentive-sensitization and addiction. *Addiction*, *96*, 103-114. Retrieved June 1, 2004, from <http://www.capella.edu.library>
- Berridge, K. C., & Winkielman, P. (2003). What is an unconscious emotion? (The case for unconscious "liking"). *Cognition and Emotion*, *17*, 181-211. Retrieved May 28, 2004, from <http://www.capella.edu.library>
- Blum, D. (1997). The plunge of pleasure. *Psychology Today*, 47-49. Retrieved May 13, 2004, from <http://www.capella.edu.library>
- Borod, J. C. (1992). Interhemispheric and intrahemispheric control of emotion: a focus on unilateral brain damage. *Journal of Consulting and Clinical Psychology*, *60*, 339-348. Retrieved June 2, 2004, from <http://www.capelle.edu.library>
- Cameron, J., & Pierce, D. W. (1994). Reinforcement, reward, and intrinsic motivation: A meta-analysis. *Review of Educational Research*, *64*, 363-423. Retrieved May 14, 2004, from <http://www.capella.edu.library>
- Carlson, N. R. (2004). *Physiology of behavior* (8th ed.). Boston, MA: Allyn and Bacon.
- Deci, E. L., Ryan, R. M., & Koestner, R. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, *125*, 627-668. Retrieved September 3, 2003, from <http://www.capella.edu.library>
- Depue, R. A., & Collins, P. F. (1999). Neurobiology of the structure of personality: dopamine, facilitation of incentive motivation, and extraversion. *Behavioral and Brain Sciences*, *22*, 491-569. Retrieved June 1, 2004, from <http://bbsonline.cup.cam.ac.uk/Preprints/OldArchive/bbs.depue.html>
- Dreisback, G., & Goschke, T. (2004). How positive affect modulates cognitive control: Reduced preservation at the cost of increased distractibility. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *30*, 343-353. Retrieved May 23, 04, from <http://www.capella.edu.library>
- Franken, R. E. (2002). *Human Motivation* (5th ed.). Belmont, CA: Wadsworth.
- Harrington, C., & Salloway, S. (n.d.). The diagnosis and treatment of post-stroke depression. *Clinical Neurosciences*. Retrieved June 11, 2004, from http://www.brown.edu/departments/Clinical_Neurosciences/articles
- Ikemoto, S., & Panskepp, J. (1996). Dissociations between appetitive and consummatory responses by pharmacological manipulation of reward-relevant brain regions. *Behavioral Neuroscience*, *110*, 331-345. Retrieved May 29, 04, from <http://www.capella.edu.library>
- Jack, J. (1994). *The trouble with money*. Minneapolis: BI Worldwide.
- Jack, J., & Colby, C. B. (1996). *Testing the popular wisdom: a comparative study of the effectiveness of incentives*. Minneapolis: BI Worldwide.

- Kalat, J. W. (2004). *Biological psychology* (8th ed.). Belmont, CA: Thomson / Wadsworth.
- Knutson, B., Adams, C. M., Fong, G. W., & Hommer, D. (2001). Anticipation of increasing monetary reward selectively recruits nucleus accumbens. *The Journal of Neuroscience*, *21*,. Retrieved June 3, 2004, from <http://www.jneurosci.org>
- Konkle, A. T., Bielajew, C., Fouriez, G., & Thrasher, A. (2001). Measuring threshold shifts for brain stimulation reward using the Method of Limits. *Canadian Journal of Experimental Psychology*, *55*, 1950-1961. Retrieved June 1, 2004, from <http://www.capella.edu.library>
- Lang, P. (2000). Emotion and motivation: Attention, perception and action. *Journal of Sports and Exercise Psychology*, *20*,. Retrieved July 29, 2004, from <http://www.capella.edu.library>
- Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, *50*, 370-396. Retrieved September 13, 2003, from <http://www.psychclassics.yorku.ca/maslow/motivation>
- Mitchell, T. R. (1999). The meaning of money: and individual-difference perspective. *Academy of Management Review*, *24*, 568-579. Retrieved May 28, 2004, from <http://www.capella.edu.library>
- Nestler, E. J., & Malenka, R. C. (2004). The addicted brain. *Scientific American*, *290*, 78-86.
- Nicholson, N. (1997). Evolutionary psychology: toward a new view of human nature and organizational society. *Human Relations*, *50*, 1053-1078. Retrieved June 11, 2004, from http://maagar.openu.ac.il/opus/static/binaries/editor/bank63/nicholson_1.pdf
- Olds, J., & Milner, P. (1954). Positive reinforcement produced by electrical stimulation of the septal area and other regions of the brain. *Journal of Comparative and Physiological Psychology*, *47*, 419-427. Retrieved June 11, 2004, from <http://www.psychclassics.yorku.ca/olds/brain>
- Panskepp, J. (1986). The neurochemistry of behavior. *Annual Review of Psychology*, *37*, 77-107. Retrieved May 28, 2004, from <http://www.capella.edu.library>
- Pecoraro, N. C., Timberlake, W. D., & Tinsley, M. (1999). Incentive downshifts evoke search repertoires in rats. *Journal of Experimental Psychology*, *25*, 153-167. Retrieved June 2, 2004, from <http://www.capella.edu.library>
- Schermerhorn, J. R., Hunt, J. G., & Osborn, R. N. (2003). *Organizational behavior* (8th ed.). New York: John Wiley and Sons, Inc.
- Schultheiss, O. C., & Brunstein, J. C. (1999). Goal imagery: Bridging the gap between implicit motives and explicit goals. *Journal of Personality*, *67*. Retrieved May 14, 2004, from <http://www.capella.edu.library>
- Stajkovic, A. D., & Luthans, F. (2003). Behavioral management and task performance in organizations: conceptual background, meta-analysis, and test of alternative models. *Personnel Psychology*, *56*, 155-195. Retrieved September 1, 2003, from <http://www.capella.edu.library>
- Taylor, S. F., Welsch, R. C., Wager, T. D., Luan, P. K., Fitzgerald, K. D., & Gehring, W. J. (2004). A functional neuroimaging study of motivation and executive function. *NeuroImage*, *21*, 1045-1055. Retrieved June 11, 2004, from <http://www.capella.edu.library>

Walton, M. E., Bannerman, D. M., & Rushworth, M. S. (2002). The role of rat medial frontal cortex in effort-based decision making. *The Journal of Neuroscience*, 22, 10996-11003. Retrieved May 22, 2004, from <http://www.capella.edu.library>

Zald, D. H., Boileau, I., El-Deared, W., Gunn, R., McGlone, F., Dichter, G. S., et al. (2004). Dopamine transmission in the human striatum during monetary reward task. *The Journal of Neuroscience*, 24, 4105-4112. Retrieved June 3, 2004, from <http://www.jneurosci.org>

Author:

Kurt Nelson, MBA

Kurt is the founder and owner of The Lantern Group – a consulting company that focuses on "igniting brilliance" within companies. He is a nationally recognized leader in human motivation, team development, and meeting design. For over twelve years, Kurt has worked on developing and delivering motivational programs, training sessions, team building events, strategy initiatives and interactive meeting sessions that get people to work more productively and effectively.

Kurt's recent work has focused in on helping pharmaceutical companies increase the motivational level and subsequent performance of their sales forces. Kurt has also done significant work in the area of improving large and small group meeting dynamics by integrating experiential activities, expert lectures, styles inventories and gap analysis work. Kurt facilitates both small and large group processes using a variety of methods including Future Search, Collaborative Assessment, Appreciative Inquiry, and Force Field Analysis. He has developed several experiential team development initiatives including "The Quest for the Red Planet™" and "Captain Wits Treasure." He has utilized a variety of methods and processes in conducting a wide range of corporate and team assessments.

Over 40,000 people have participated in programs that Kurt has designed. Although much of his work has focused on the telecommunications, finance and pharmaceutical industries, he has worked with variety of different companies from around the world including: ADC, American Express Financial, Astra Zeneca, AT&T, Best Buy, BI, Getinge Castle, Johnson & Johnson, The Junior League of America, Nextel, Norstan, Novartis, Organon Pharmaceuticals, Pecos River, TCF Banks, Wells Fargo, and Xerox and many more.

Kurt earned his MBA from the University of Iowa in 1992. Kurt is currently enrolled in the doctoral program at Capella University working on his PhD in Industrial / Organizational Psychology.

Contact Info:

Phone: 612-396-6392

E-mail: kurt@lanterngroup.com

The Lantern Group
2404 Pleasant Ave South
Minneapolis, MN 55404

Web site: www.lanterngroup.com