Physiological Reactions to Stress Induced by Gaming

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Worksheets for Multimodal Perception and Cognition

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Chapter 1

Physiological Reactions to Threats

In this chapter, we will discuss the physiological reactions happening in the body and mind when put in a stressful situation. The chapter begins with a section about the perception of threats and how the autonomic nervous system reacts to the perceived threat. The next section will describe the cognition related to the perception of threats, and the last section will go through the motor reactions related to this.

1.1 Perception of Threats

Animals as well as humans have a build in sensor system to perceive threats to their survival. The sensor system uses the senses of the body as well as the mind in its aspect of memorizing a similar situation and the evaluation of the magnitude of the threat. We humans have through the years developed a much more detailed sensor system, and we are able to use it not only to perceive situations threatening our survival, but also recognize situations which might compromise even just our social status. The most common way of experiencing the evolved sensor system, is when being put in a stressful situation, as this would activate the autonomic systems of the body in a physiological reaction. These situations could be forgetting to deliver a report at work and be pointed out by your boss, or just general being stressed because of the current workload.

1.1.1 Changes in Behaviour due to Perception

It is believed that emotions have been developed to affect our behaviour when put in a stressful situation for better identification and reaction to a perceived threat increasing our survival rate. Evidence show that emotions can change our behaviour in a positive or negative direction dependant on the situation. This also gives us the opportunity to prepare for stressful situations by training the control of our emotional response to a threat. A reaction to the current situation can this way be altered by past event, which could be the aforementioned training of emotional control or recall

of a similar situation. As the action or motor performed by the individual is directly linked to the emotional state, which is dependant on our past memories or physiological reaction. The reaction time in humans is directly related to how we perceive a emerging threat. If the threat is pointed towards us as for a gun pointed towards the viewer, our reaction time is slowed, as where a gun pointed towards another person will increase our reaction time compared to a neutral state. This gives evidence of our perception of the threat changes how the body reacts to the situation. [3]

1.1.2 Bodily Changes as Result of Threat Perception

When a threat is perceived, the first reaction of the brain is to activated the amygdala part, which processes emotions, memory and decision-making. The information about the situation is send to hypatalamus, which creates Adrenocorticotropt hormon (ACTH). This makes the production of the stress hormone cortisol and adrenaline making the body respond by increasing heart rate, blood pressure, decrease the immune system functionality and other negative changes also making a constant stressful environment harmful to the health. If the amygdala is constantly negatively stimulated, it can lead to depression and other anxiety, altering the reaction to stressful or harmful situations. Depression can in this sense also be helped by changing the way the amygdala reacts to stressful situations as it has a direct relation to the information send further to the autonomic nervous system (ANS) regulating the autonomic body functions. One of the primary parts of the ANS is the sympathetic nervous system, which is sometimes referred to as the fight or flight system, as it automatically alters the autonomic body functions to create a sense of anxiety or aggression. The anxiety or aggression creates a bias for what action is made in a stressful situation, and the next section will further dig into the action taken dependant on the physiological changes in the body when put into a stressful situation.[8] [6] [7]

1.2 Cognitive Respond to Threats

The main aspect of the cognitive aspect of responding to a threat, is the evaluation of the physiological changes as described in 1.1. As we gain information from the brain and body because of how we perceive a threat, we start to evaluate the autonomic bodily changes to respond with the best possible reaction. Mainly we look at the two categories which are fight and flight, the oldest principle, dating back to 1929 [2], described as reactions of anxiety and anger. An example where anxiety is created, would be a situation where you are late for a meeting or a class, where you experience every body else is getting ready for a test or presentation, which you yourself did not remember to prepare for. This situation creates a sense of anxiety, where the heart rate rises together with blood pressure, respiration, and other autonomic bodily changes as a reaction to the perceived threat, inducing a flight reaction, fleeing the location where the situation occured. On the other hand, if you were dependant on another colleague or student, and it were their fault you

did not get the information about the test or presentation, you would be more biased towards an emotion of anger, wanting to fight, in either a physical or verbal action. [2]

1.2.1 Changes in Cognitive Response

The feeling of anxiety or anger when put in a situation of perceived threat, is dependant on the individual and their past memory of equal situations and their teaching of the reaction and changing of specific emotions. A great example of the cognitive process is a fire alarm situation. When a fire alarm goes of, the normal view of the situation would give you the perception of harm or threat. This initialises the cognitive process, which can decide the reaction to the event dependant on previous knowledge. If you for instance are at home, hearing the fire alarm, you would first evaluate the situation dependant on the people present. If you for instance are alone, the actions you have taken in the last couple of moments would influence your reaction, shower steam could set of the alarm, or burned food, and you would not flee but rather fight in the aspect of stopping the events setting off the alarm. On the other hand, does the alarm go off in the work place or university, you would be more biased to flee if it is the first time the alarm goes of, taking the action of flight. These are also dependant on the feelings of anger, as you just burned the food, or anxiety, as you do not know what set of the alarm at work.[2]

1.2.2 The Reactions According to Fight/Flight

As shortly exemplified in the above section 1.2.1, the two main reactions referred to in literature when describing actions in a stressful situation, is often the fight/flight reactions. These are often seen as opposites, as the one is taken if situations creating anger, the fight, and the other in situations of anxiety. Emotions created from physiological changes bias the individual in either direction, which involves many of the autonomic bodily reactions from 1.1 but also other hormones comes into play, as the testosterone, oestrogen and dopamine. These reactions are thought as the two main actions taken in stressful situations, but others have started to show up in research, the freeze (tensing of muscles to unable to act to the situation), fright (becoming afraid), faint (automatic shut down to get away from the situation) and tend/befriend (social awareness reaction, most seen in women). We have decided to look more into the fight, flight, freeze and tend/befriend reaction, and described them further in the section below as motors to the cognitive response of a stressful

situation [5] [1] [4]

Chapter 2

Tests

Bibliography

[1] H. Stefan Bracha. *Freeze, Flight, Fight, Fright, Faint: Adaptationist Perspectives on the Acute Stress Response Spectrum*. CNS SPECTRUMS, 2004.

[2] Walter B. Cannon. *Bodily Changes in Pain, Hunger, Fear and Rage*. New York and London D. Appleton and Company, 1927.

[3] Orlando Fernandes Jr., Liana C. L. Portugal, Rita C. S. Alves, Rafaela R. Campagnoli, Izabela Mocaiber, Isabel P. A. David, Fatima C. S. Erthal, Eliane Volchan, Leticia de Oliveira and Mirtes G. Pereira. *How You Perceive Threat Determines Your Behavior*. Journal, Frontier in Human Neuroscience, 2003.

[4] Shelley E. Taylor, Laura Cousino Klein, Brian P. Lewis, Tara L. Gruenewald, Regan A. R. Gurung, and John A. Updegraff. *Biobehavioral Responses to Stress in Females: Tend-and-Befriend, not Fight-or-Flight*. Psychological Review, Vol. 107, No. 3, 2000.

[5] Joohyung Leeand Vincent R. Harley. *The Male Fight-Flight Response: A Result of SRY Regulation of Catecholamines?* Journal, Bioessays 34, WILEY Periodicals, Inc., 2012.

[6] Ned H. Kalin. *Perspectives in the Management of Anxiety Disorders*. Session of Char Summit; Master Class for Neuroscience Professional Development, 2014.

[7] Arthur S. P. Jansen, Xay Van Nguyen, Vladimir Karpitskiy, Thomas C. Mettenleiter and Arthur D. Loewy. *Central Command Neurons of the Sympathetic Nervous System: Basis of the Fight-or-Flight Response*. Magazine, Science, Vol. 270, No. 5236, 1995.

[8] Gilian Pocock. *Human Physiology*. Oxford University Press, 2006.