Self-Efficacy and Self-Control in Partial Simulated Seizures

Gwenievere A. Birster

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Justin J. Couchman, PhD

Keith Feigenson, PhD

Matt Fotis, PhD

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Printed Name of Author: Gwenievere A. Birster

Street Address: 1620 Main Street, PO BOX 603

City, State, Zip Code: Bloomsburg, PA 17815

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Gwenievere A. Birster

Albright College

Thesis Advisor: Justin J. Couchman, Ph.D.

Abstract

This study examined the extent to which self-efficacy influences overall controllability when a simulated visual distortion is applied while trying to complete a task. We hypothesized that those who reported having higher self-efficacy would have a lesser galvanized skin response (GSR) and rate higher on the controllability scale after being exposed to a visual distortion than those who rated having lower self-efficacy. The manipulation was created using Stereoscopic Multiplexer and imparted a 300ms delay and visual blur; this visual augmentation was then implemented using the Oculus Rift virtual reality headset. We also hypothesized that those reporting an external locus of control would have a higher GSR than those reporting an internal locus of control and that those in the control group would perform significantly better on a ball task than those in the manipulation group. The results trended in the direction hypothesized but were not significant. However, we were successful in simulating partial seizure and accuracy results from a behavioral task showed that it did indeed impair cognitive and motor function.

Self-Efficacy and Self-Control in Simulated Partial Seizures

Self-agency refers to an individual's belief of control over his or her own behavior. For example, a gymnast performing a complicated routine would need to have high self-agency because she has to meticulously control her movements to perform the routine flawlessly. In cases of epilepsy, a neurological disorder characterized by lapses or excesses in neuronal firing, often resulting in a disruption of consciousness and perception, one experiences a deficit in his or her self-agency. The subjective experience of a lack of self-agency and uncertainty is central to the qualia of epilepsy and applies to seizures. It is associated with a lack of bodily control, decreased internal locus of control (LoC) and an increased external LoC (Amir, Roziner, Knoll, & Neufeld, 1998).

Internal LoC is the perception of one's ability to control his or her own life while external LoC refers to the belief of an individual that his or her life is controlled by fate. It has been previously shown that epileptics have higher external LoC, which has been correlated with more signs of psychopathy. Higher ratings of internal LoC have been correlated with higher self-efficacy in coping with the disorder as well as higher quality of life (Amir, Roziner, Knoll, & Neufeld, 1998). Research conducted by Cull, Fowler, and Brown (1996) found that competent mastery of epileptic symptoms is correlated with the ability of epileptics to both induce and inhibit a seizure to some degree, suggesting that self-control and self-efficacy may present important contributions to not only disease management but also quality of life. To investigate the effect of simulated partial seizures, we used measures of self-agency and self-efficacy, two concepts that may mediate intensity and inhibition of symptoms.

Theory of reasoned action assumes most human action is caused by free will and therefore by intention alone (Ajzen, 2002). Despite this, there are circumstances in which individuals may have a complete lack of volitional control such as during a seizure (Ajzen, 2002; Wegner, 2003). To account for instances where complete volition over the desired behavior is not achievable, the theory of planned behavior was derived. The theory of planned behavior states that it is not just the volition of the individual but also the attitude towards the behavior, subjective norms, and perceived control that together determine the overall success of the action (Azjen, 2002).

Evidence presented by Wegner (2003; Wegner, Sparrow, & Winerman, 2004) supports the hypothesis that the principle of causal inference does not describe actual causal relations but rather the perceived causality derived from principles separate from reality. Wegner (2003) proposed that causal relationships are perceived as the result of three principles: priority, consistency, and exclusivity. Priority is the thought of consciousness before the action, consistency is when the thought is consistent with the action, and exclusivity is when the thought is accompanied only by the action. Wegner also suggests that the perception an individual has of creating a desired outcome is enhanced by the mere frequency of the outcome. For example, a baseball player may wear the same socks every game and subsequently win every game he wears the socks in. Therefore, he believes that his socks caused him to win when in fact, his team's success when in fact the socks themselves probably contribute little to his team's success.

Later research examining authorship processing reinforced this idea by finding that an individual creates a causal inference when it is attributed to themselves as an agent, with agents being the origin from which the action's ownership can be assigned. The results of one study suggested that the experience of consciously willing one's own actions may arise from causal inferences drawn from the preview the individual has of the world (Wegner, Sparrow, & Winerman, 2004), suggesting that one's rankings on scores of internal and external locus of control (LoC) influences one's perception on self-control. By further extension, the perception one has of his or her body and personal identity substantially contributes to the regulation of human behavior (Duschek, Werner, Reyes del Paso, & Schandry, 2015). Through research on the subjective experience of epilepsy, a better understanding may be able to be provided to show how the diagnosis contributes to the behavior of the individual. Since epilepsy as a disorder relies on manipulations of self-control in individuals, it is important to understand this contribution to be able to better develop personalized treatment plans for increased quality of life in patients with this chronic illness. Specifically, epilepsy undermines self-control by putting the patient into a set of motor functions that was not initiated by their conscious will, though epileptics sometimes report having control of seizure symptoms if they are trained to notice them early enough. By understanding how epilepsy affects a person’s self-control and how he or she accepts it as part of his or her identity, it may also show to be useful for the development of advocacy programs.

Not to be confused with self-agency, perceived control refers to an individual's appraisal of an event as being caused by his or her own ability to change it (Kotwas et al., 2015; Endler, Speer, Johnson, & Flett, 2001). For example, a gymnast would also be considered to have high perceived control because she would appraise her performance in the competition as being caused by her own ability. These two abilities could result in marked differences, for although objective control affects perceptions of control, objective and perceived control are not the same. This is important to note because self-efficacy – your confidence in your own competence – predicts behavioral intent but not actual behavior; perceived control predicts behavior but not intent (Endler, Speer, Johnson, & Flett, 2001). The concept of perceived behavioral control was introduced into the theory of planned behavior in an effort to accommodate the non-volitional elements that potentially exist within all behaviors. Perceived behavior is likely to affect intention, suggesting that, in higher levels, it should strengthen a person's intention to perform the behavior and increase effort. It has also been suggested that perceived behavioral control can indirectly affect behavior by impacting intention (Ajzen, 2002). Perceived behavioral control is influenced by two distinct expectations: efficacy expectation and outcome expectation. Efficacy expectation is the perceived ability to perform a behavior while outcome expectation is the perception of the performed behavior to produce the expected outcome. Perceived behavioral control can be measured by asking direct questions about the perceived ability the person has to perform a task (Ajzen, 2002).

Ajzen (2002) states that human behavior is guided by three kinds of considerations: behavioral beliefs (pertaining to the likely consequences of behavior), normative beliefs (the social expectations of behavior), and control beliefs (beliefs about factors that either improve or hinder the performance of a behavior). Together these beliefs form behavioral intent. The combined influence of these considerations creates the feeling of perceived internal locus of control. However, because volition changes depending on the situation, behavioral control as well as intention should be taken into consideration when assessing perceived LoC. For example, a man deciding to file his tax return is guided by these three considerations. The probable consequence of filing his taxes would be a tax return check and he would be avoiding going to jail at the expense of the IRS. The social expectations pressure him to file his tax return and his own control beliefs including his belief in his own competence to file his taxes together contribute to him ultimately complete his tax return. It should also be noted how difficult it is to perform a specific behavior is conceptually independent of internal versus external LoC. In this man's case, the actual difficulty of filing a tax return is independent from his internal and external beliefs about completing it. Despite this, the perceived difficulty in the performance of a behavior reflects the internal beliefs about the presence of internal as well as external factors that may further or impede progress within that behavior (Ajzen, 2002).

To assess the specific distortion in consciousness experienced in epilepsy, the Ictal Consciousness Inventory was designed specifically (Hanoglu, Ozkara, Yalciner, Nani, & Cavanna, 2014). Hanoglu, et al. suggest that although there is not an efficient way to evaluate individual differences between the qualia experienced in seizures, a classification much like the Ictal Consciousness Inventory may provide insight into the nature of consciousness. In recreating epileptic qualia, the subjective symptoms that are more frequently elicited by stimulation of the medial temporal lobe, including ictal aphasia, forced attention, and disturbances of sensory processes and memory may be mimicked. In the present study, we disrupted the sensory process by manually controlling the camera of a virtual reality head-mounted display to simulate the loss of sensory control experienced in a partial seizure. This type of seizure was chosen because it is the most relevant manipulation to recreate as part of the epileptic qualia.

Self-efficacy has three main properties: magnitude, strength, and generality. Magnitude refers to the belief about a specific task performance as it becomes increasingly difficult. Strength is the effort an individual expends in the effort to maintain the behavior despite the magnitude, and generality refers to the broadness with which the individual applies the belief of competence (Endler, Speer, Johnson, & Flett, 2001). For example, in the alterations of an auditory feedback paradigm, participants were asked to perform a melody on a piano with delayed auditory feedback (they heard each note slightly after they pushed each key). Then participants were asked to rate whether what they had heard was coming from them. In the alterations of auditory feedback paradigm, the magnitude of the disruptive effects on perception are most disruptive when they result in an intermediate similarity level between the produced sequence and the sequence of feedback events (Couchman, Beasley, & Pfordresher, 2011). Bandura (2013) in his studies suggested that the perception of efficacy was influenced by four factors including mastery experience, vicarious experience, verbal persuasion, and somatic and emotional states. For the purpose of the present study the influences of mastery experience and vicarious experience was specifically targeted as important influences of self-efficacy and controllability. As stated by Duschek, Werner, Reyes del Paso, & Schandry (2015), the perception an individual has of his or her body and of his or her personal identity substantially influences his or her behavior. Since self-efficacy is your belief in your own competence and controllability is the belief that outside factors influence your behavior, we chose to focus on these two opposing, influential factors to determine how each predicts seizure severity in a controlled, simulated setting.

Vicarious experience is the process of observing the failures and successes of people like one's self. For instance, when playing on a sport's team, despite sitting on the bench the entire game, a player may still feel joy even when his team wins or disappointment when his team losses. This emotional reaction is equated to the vicarious experience of the benched player succeed or failing through the actions of his teammates. By observing the accomplishment of others, Bandura (1994) suggests that it would motivate the individual to attempt increasing his or her self-efficacy and inversely when observing the failures of others like us threatens our self-efficacy. Wegner, Sparrow, and Winerman (2004), when investigating the control over others' actions (vicarious agency), found that the authorship emotions experienced by the individual that are linked with the body's actions influence the sense of embodiment. Manipulations of authorship indicators have been found to distort agent perception; these include both environmental and body clues, direct bodily feedback, visual and other indirect sensory feedback, and action consequences. In the current study the manipulation of the visual feedback received by the participant is meant to mimic the agentic loss of control experienced as part of epileptic qualia.

Mastery, as defined by Bandura (2013) is the ability for an individual, after performing a task, to view it as successful. For example, someone who is a beginner at baseball may have a hard time hitting the ball and may strike out often. However, after playing for many years, he or she will develop the ability to hit the ball frequently and accurately and therefore has developed a mastery of the skill of playing baseball. Further investigation by Lee and No (2004, p. 102) found that nearly 80% of epileptic patients interviewed reported using effective self-inhibition methods to stop seizure activity, with 12 patients reporting the techniques they had developed were “very effective”. Results of a study conducted by Miller, Galisto, Tremont, Bryant, Roch, La France, and Blum (2016) found that the cognitive impairments experienced by older epileptic patients include specific functioning deficits in memory, attention and executive function, visuospatial skills, and verbal memory and language. For the purpose of the present study, we examined the specific impairments of self-control brought on by visuospatial manipulation due the available literature surrounding the subjective experience of visual seizure experience as.

Chronic beliefs of an individual surrounding the self and control reflect the key components of an individual's worldview and the ability he or she must function within it. Using self-reporting measures, stress has been identified as one of the largest precipitators of seizures among epilepsy patients (Cull, Fowler, & Brown, 1996, Endler et al., 2001). This self-reported precipitant factor may be difficult to accurately determine, however, as it is unclear whether the fear of a potential seizure is the cause of stress and anxiety. Stress and anxiety might cause the fear of a potential seizure, or both might work in tandem. Despite this uncertainty, it has been suggested that alert symptoms do not determine the feelings of control. Rather they provide experiences that the patient can use to identify alert symptoms, giving the patient a higher perception of seizure control (Kotwas et al., 2015).

Substantial evidence suggests that perceived self-efficacy differs markedly from perceived controllability, however no independent research has been found to support the idea that self-efficacy reflects internal barriers while perceived controllability (self-agency) reflects beliefs about external factors (Ajzen, 2002). The present study aimed to separate the two distinct features by comparing self-efficacy before the manipulation and controllability after the manipulation. By measuring self-efficacy beforehand, we predicted that self-efficacy would identify how internally in control the participant felt in general situations. Then, by placing the participant in a situation completely externally controlled and asking them to rate the extent to which they believed the situation was caused by them. Research conducted by Ajzen (2002) revealed a strong and significant path to intention but not behavior while controllability had no effect on intention but was a significant predictor of actual behavior supporting our hypothesis that those with a higher self-reported self-efficacy will rate higher on the controllability scale.

Bandura (1994) stated that people are more likely to attempt things they believe they can accomplish and people with high self-efficacy are more likely to report that they can accomplish difficult tasks because they view difficult them as a challenge rather than a potential threat to be avoided. This informs our hypothesis that participants who rate higher in self-efficacy will rate higher in controllability after the manipulation because they will view it as a challenge to be overcome versus something that should not be attempted. Supporting our hypothesis that those who will rank lower in self-efficacy, Bandura (1994) also states that people who doubt their abilities are more likely to give up in the presence of difficulties.

Amir, Roziner, Knoll, and Neufeld (1998) showed the importance of mastery in epilepsy with regards to both self-efficacy and locus of control. From their study, we can inference that self-efficacy is important to quality of life because it provides the patient with a strong sense of power over his or her coping skills as well as diagnosis. This control correlates positively with self-management, supporting Bandura's theory that self-efficacy is a powerful variable in human behavior and by further extension, and supports our theory of higher self-efficacy being positively correlated with high controllability.

The present study aimed to examine how measured self-efficacy correlated with the feelings of loss of control when presented with the situation of a partial psychic seizure induced via visual distortion. We hypothesized that those who scored high on self-efficacy and a related measure of personal resolve called GRIT, would be less affected by the manipulated partial seizure by scoring higher on the controllability scale. We also predicted that those having identifying as having an external locus of control would have higher galvanic skin response than those identifying an internal locus of control. We also hypothesized that those in the manipulation group would perform significantly worse in the ball task than those in the control group.

Methods

Participants

Twenty-two students (18-22 years old) from Albright College participated in exchange for course credit in psychology courses. Through a process of random assignment, eleven were assigned to the control condition and eleven were assigned to the experimental condition. All procedures were approved by the Institutional Review Board.

Materials

The programs of Stereoscopic Multiplexer (3DTV.at) and Oculus Rift (Oculus, Inc.) were utilized in the augmented reality similar to the partial seizure. In Stereoscopic Multiplexer, a 300ms visual delay was used as well as a visual blur distortion to recreate the augmented reality. Participants were also connected to a galvanic skin response monitoring system through two iWorx electrodes on their pointer and ring fingers, which measured the electrical conductivity produced by the skin, and to a pulse oximeter to measure their blood oxygenation and heart rate which recorded through the LabScribe physiological recording program.

Measures

Self-efficacy. Self-efficacy was measured using the General Self-Efficacy Scale developed by Schwarzer and Jerusalem (1995). This ten-item scale uses a total of 40-point scoring system with the higher the participant's score being, the greater his or her self-efficacy. Participants rank statements on a 4-point scale from "not at all" to "exactly true" such items include "I can always manage to solve difficult problems if I try hard enough" and "I can solve most problems if I invest the necessary effort."

Locus of Control. Locus of Control was measured using Rotter's Locus of Control Scale developed by Rotter (1966) which assess an individual's locus of control through a 29-point scale to determine whether they have an internal or external locus of control. The scale consists of a series of contrasting statements participants select from that they agree from most. Using a predetermined key, select answers are assigned points; a resulting high score yields an external locus of control while a low score yields an internal locus of control.

GRIT. GRIT was measured using the 12-Item Grit Scale developed by Duckworth, Peterson, Matthews, and Kelly (2007). This scale assesses a participant's individual perseverance using a twelve-point scale; through the use of regular and reverse coding, an individual point value is assigned to each question. At the end of the scale, the average is found with those who have a higher average being grittier and those with a lower average being less gritty.

Procedure

Participants were brought into the lab and randomly assigned to either the control or experimental conditions using a random list generator. They were instructed to sit in the chair closest to the Oculus Rift and to complete the informed consent. Upon completion, participants were asked to complete a packet of questionnaires including the General Self-Efficacy Scale and Rotter's Locus of Control Scale. While participants were completing the packet, they were asked for their non-dominant hand, where the physiological recording equipment was attached to measure oxygen saturation and galvanic skin response. Physiological recordings were taken during 3 intervals: During the orientation phase when participants put on the headset, during the ball task, and then during the mirror task. Galvanic skin response is the measure of electrical conductivity produced by the skin based on the body's condition, usually used to measure stress. A purple lead was placed on the participant's pointer finger and an orange lead was placed on the participant's middle finger. A pulse oximeter was placed on the participant's thumb to record their pulse. Physiological measures were recorded during the initial questionnaire completion to develop a baseline of biological homeostasis for comparison. We recorded the physiological data for all 3 tasks by taking the average reading for each participant during that time, as well as the maximum minus minimum value (a measure of overall change).

Participants in the control condition were asked to place the Oculus Rift over their heads and fit it comfortably. A ball was placed in the participant's dominant hand and they were given instructions to throw it up and attempt to catch it a total of five times; this information was recorded and used to analyze the efficacy of the visual manipulation between conditions. Upon completion of the ball task, participants were instructed to turn and look in the mirror that was placed at a 90-degree perpendicular angle from their sitting position in the chair.

After completion of the mirror task, in which the participants were asked to turn perpendicular to their starting position and look at themselves in a mirror, the headset was removed and participants were instructed to complete the 12-Item Grit Scale; at this point the physiological recording was finalized and saved as an individual file. Upon completion of the Grit Scale, the participant was debriefed and asked if they would like their participation to count toward extra credit in one of their psychology classes. In this event, they were referred to a separate form, detailing the instructor and course number. The experimental group followed the same procedure except at the time the participant was instructed to place the Oculus headset on their heads, they were exposed to an augmented reality featuring a delayed visual feedback. This feedback was created using Stereoscopic Multiplexer where a 300ms delay as well a blur was applied to the visual input of the Oculus headset.

Results

Independent *t*-test were performed to determine the significance of both the relationship between each measure (self-efficacy, GRIT, and locus of control) and the participant's GSR response. Contrary to our proposed hypothesis, no significant relationship was found between participants perceived higher self-efficacy and GRIT and a lower GSR response. Concurrent with our hypothesis, we found a significant relationship between participants who identified as having external locus of control and a higher oxygen saturation level during the ball catching task. Specifically, we split this self-reported quasi-independent variable into two groups, internal and external, and found higher SPO2 levels for the external group only for the ball task, $t(20) = 2.19$, $p < .05$. However, due to increased activity during the ball catching activity this could be attributed to the increased activity experienced by the participants, rather than the manipulation. No other times provided significant results for either GSR or SPO2. Despite not yielding overall significant results, the data did show an upward trend in the GSR response of participants during the manipulation groups, indicating that given replication and a larger participant pool, the study may yield significant results. Also, concurrent with our hypothesis, participants in the experimental condition performed significantly worse than those in the control group $t(20) = 2.16$, $p < .05$. Figure 1 shows the accuracy results. Performance on the accuracy task was measured by the amount of times, out of five, a participant successfully could throw a ball in the air and catch it.

Means for these intervals for SPO2 during the control condition were 96.78%, 96.72%, 97.36%, compared to the seizure condition means of 96.14%, 97.80%, 98.09%. GSR means for the control condition were 273.81µS, 279.18 µS, 282.11 µS, compared to seizure condition means of 254.37 µS, 265.76 µS, 272.81µS. Figures 2 and 3 show these results.

Discussion

Generally speaking, it is difficult to replicate such difficult phenomenological experiences as epileptic seizures without experiencing them oneself. Even when being presented with a wide breadth of literature that considers the subjective experiences of epileptic patients through interviewing and surveil methods, the recreation of such an individualized and complicated neurological and conscious experience can be complex. This experiment and its findings could be, and should be, considered a predecessor for future research within the field of virtual reality to understand its place as a clinical tool. By using programs that have the capabilities to alter our visual field, we can begin utilizing such programs, like those created by Oculus, to study and treat neurological and psychological disorders. Although, as stated earlier, it is difficult to replicate such individualized qualia as a partial seizure, by using technology to our benefit, we may be able to come one step closer to replicating and, by extension, understanding such complex disorders as epilepsy.

This extensive process of replicating a seizure does not come without its setbacks. Previous studies have used alterations of auditory feedback to examine how alterations of sensory feedback impact feelings of self-agency (Couchman, Beasley, & Pfordresher, 2011). Although this present study addressed the concerns of how self-efficacy, GRIT, and locus of control could impact an individual's overall controllability in a partial seizure, it could be argued that, due to the complexity, focus should have been given to one of the self-related measurements and studied more in-depth, rather than immediately relating them to other measurements. This is not to say that the study has no methodological advances that could benefit the future of clinical psychology; rather, the methodology has the potential to be nuanced and refined to become tailored to study more specific types of seizures and other psychological and neurological disorders. For instance, with the addition of auditory equipment, the experience of auditory and visual overstimulation could be used to study autism. In its current state, it is a prototype, meant to be studied more in depth by specialists in their prospective fields.

Aside from the promise of the methodologies of this experiment, the results of this experiment are contradictory to what one might expect given the current literature surrounding the topic. Research by Amir et al. (1998) found that when researchers measured the self-efficacy of patients diagnosed with epilepsy using the Epilepsy Self Efficacy Scale, measures of high self-efficacy were found to be positively correlated with self-management behaviors. This correlation was found by assessing the patient's belief of self-efficacy in relation to epilepsy behaviors, including medication adherence and seizure control, suggesting that the higher self-efficacy a patient, the greater controllability he or she feels over his or her diagnosis. This research, although supporting our hypothesis, contradicts our findings and suggests that our participant pool may have been too small to elicit a significant result.

Further research by Endler, Speer, & Johnson and Flett (2001) suggests that the control experienced by the patient does not necessarily have to be real, but rather only perceived by the patient to reduce stress and external locus of control. Perceptions of a lack of control have also been shown to correlate with increased anxiety levels and an inverse-relationship with self-efficacy has been shown with the state of anxiety during a stressful event. Research regarding the impact of self-efficacy and academic performance has shown that students with a high sense of self-efficacy display more persistence and effort suggesting that self-efficacy influences performance accomplishments both directly and indirectly by making self-set goals (Zimmerman, Bandura, & Martinez-Pons, 1992). This research also helps to explain the upward trend in GSR that we saw within those who identified as having an external locus of control, as the experiment progressed, they experienced a trending but not significant overall higher GSR than those reporting an internal locus of control.

It would also have been beneficial to add a post-test stress measure such as the PANAS rather than just the GRIT scale. It is possible that the simulation was not stressful in the way we anticipated, though many participants anecdotally reported that it was disorienting and uncomfortable.

Further directions in this area of research may yield promising results in terms of the way psychology understands the cognitive implications as well as the way psychological and neurological disorders are treated. Bandura (1993) stated that the stronger one's perceived self-efficacy, the higher challenged goals he or she sets for his or herself and therefore the firmer commitment he or she has. He also stated that the belief people have of their own efficacy influences the way that a person constructs and rehearses a scenario; those high in self-efficacy visualize success, providing a positive guide and support for a performance. Those with low self-efficacy often visualize failure and may ruminate on things that go wrong, providing difficulties in achievement because of impending self-doubt. By using methodology like that used in this study, we, as a field, may be able to better understand how self-efficacy changes per a patient's current mental and physical state. Also, by understanding the implications of deviations in the self-efficacy of patients, clinicians will be able to create more personalized care for their patients that target not only the physical attributes of their disorders but also the cognitive facets as well. Virtual reality has the potential to revolutionize the way that clinicians study, analyze, and practice and through refinement and repetition companies like Oculus can change the way that we view healthcare.

References

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology 32*(4), 665-683

Amir, M. (1999). Self-efficacy and social support as mediators in the relation between disease severity and quality of life in patients with epilepsy. *Epilepsia, 40*(2), 216-224.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist, 28*(2), 117-148

Bandura, A. (1997). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215 doi:10.1037/0033-295X.84.2.191

Couchman, J. J., Beasley, R., Pfordresher, P. Q. (2011). The experience of agency in sequence production with altered auditory feedback. *Consciousness and Cognition*, *21*, 186-203. doi:10.1016/j.concog.2011.10.007

Cull, C. A., Fowler, M., & Brown, S. W. (1996). Perceived self-control of seizures in young people with epilepsy. *Seizure*, *5*(2), 131-138.

Duschek, S., Werner, N. S., Reyes del Paso, G. A., & Schandry, R. (2015). The contributions of interoceptive awareness to cognitive and affective facets of body experience. *Journal of Individual Differences*, *36*(2), 110-118. doi:10.1027/1614-0001/a000165

Endler, N. S., Speer, R. L., Johnson, J. M., & Flett, G. L. (2001). General self-efficacy and control in relation to anxiety and cognitive performance. *Current Psychology: A Journal for Diverse Perspectives on Diverse Psychological Issues*, *20*(1), 36-52.

Giovagnoli, A. R. (2013). Awareness, overestimation, and underestimation of cognitive functions in epilepsy. *Epilepsy & Behavior*, *26*(1), 75-80. doi:10.1016/j.yebeh.2012.11.001

Hanoğlu, L., Özkara, Ç., Yalçiner, B., Nani, A., & Cavanna, A. E. (2014). Epileptic qualia and self-awareness: A third dimension for consciousness. *Epilepsy & Behavior*, *30*, 62-65. doi:10.1016/j.yebeh.2013.09.010

Kotwas, I., McGonigal, A., Trebuchon, A., Bastien-Toniazzo, M., Nagai, Y., Bartolomei, F., Micoulaud-Franchi, J. (2016). Self-control of epileptic seizures by nonpharmacological strategies. *Epilepsy & Behavior, 55*, 157-164. doi:10.1016/j.yebeh.2015.12.023

Lee, S., & No, Y. (2005). Perceived self-control of seizures in patients with uncontrolled partial epilepsy. *Seizure*, *14*(2), 100-105. doi:10.1016/j.seizure.2004.11.002

Miller, L. A., Galioto, R., Geoffrey, T., Davis, J., Bryant, K., Roth, J., LaFrance, W. C., Blum, A. S. (2016). Cognitive impairment in older adults with epilepsy: Characterization and risk factor analysis. *Epilepsy & Behavior, 56*, 113-117. doi:10.1016/j.yebeh.2016.01.011

Rotter, J. B. (1966) Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs: General and Applied, 80, 1-28.

Wegner, D. M. (2003). The mind's best trick: how we experience conscious will. *TRENDS in Cognitive Science, 7*(2). doi:10.1016/S1364-6613(03)00002-0

Wegner, D. M., Sparrow, B., Winerman, L. (2004). Vicarious agency: Experiencing control over the movements of others. *Journal of Personality and Social Psychology, 68*(6). doi:10.1037/0022-3514.86.6.838

Zimmerman, B. J., Bandura, A., Martinez-Pons, M. (1992) Self-motivated for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal, 29*(3), 663-676.

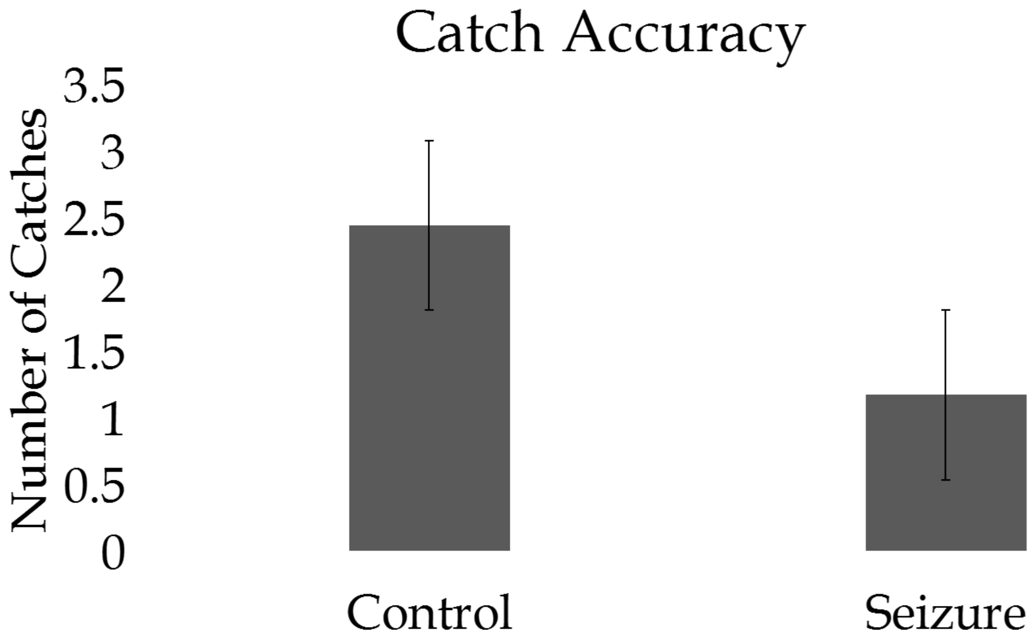

Figure 1. Accuracy results for the ball task in terms of number of successful catches.

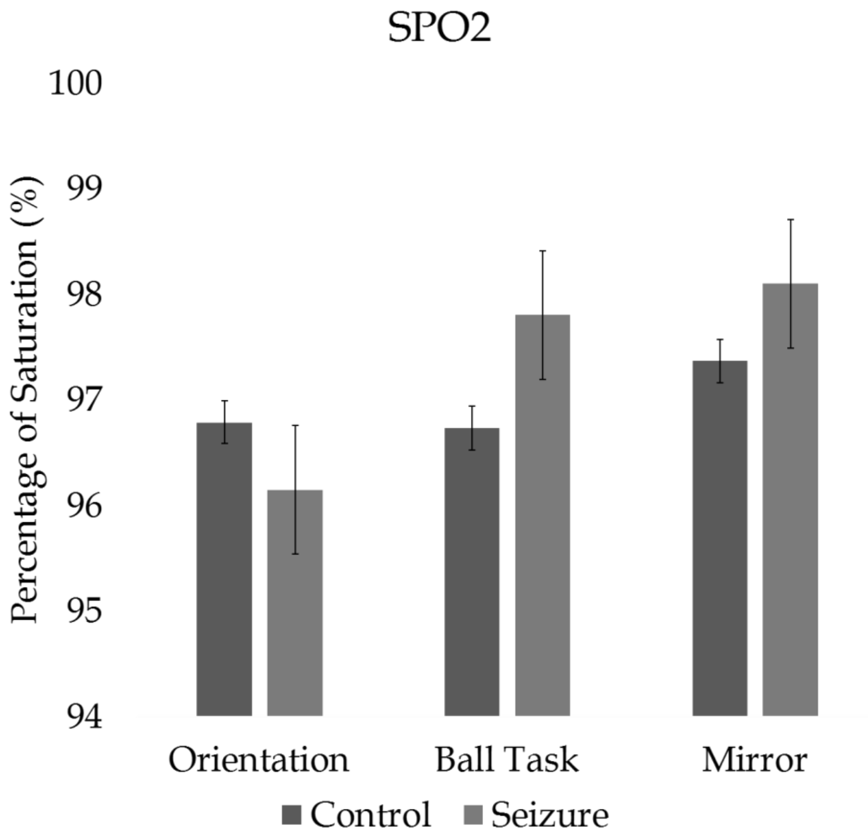

Figure 2. SP02 means for the two conditions at the three task intervals. Means for these intervals for SPO2 during the control condition were 96.78%, 96.72%, 97.36%, compared to the seizure condition means of 96.14%, 97.80%, 98.09%. The results were not significant.

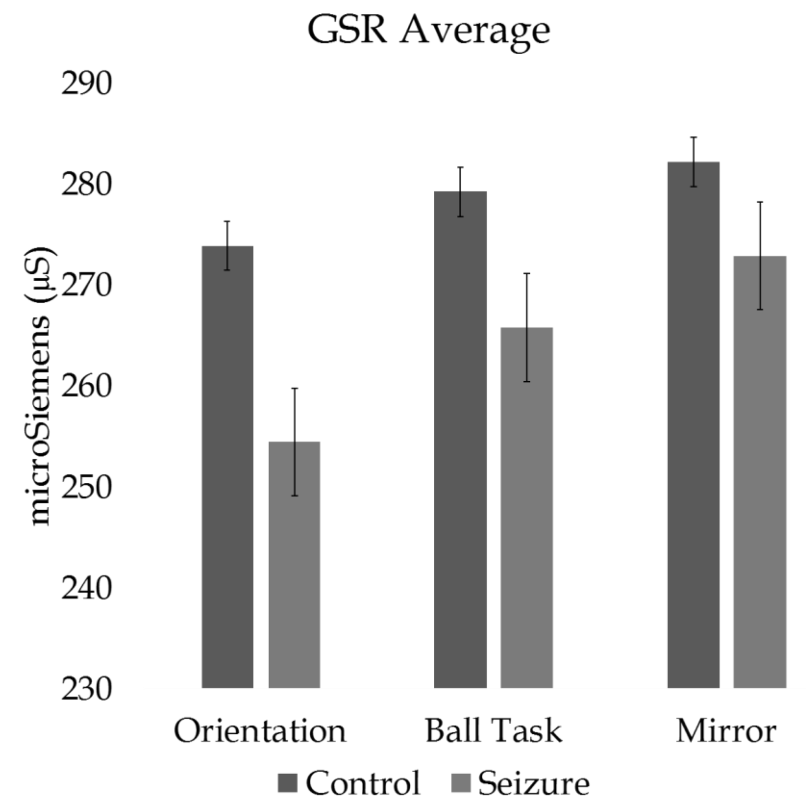

Figure 3. GSR means for the two conditions at the three task intervals. GSR means for the control condition were 273.81µS, 279.18 µS, 282.11 µS, compared to seizure condition means of 254.37 µS, 265.76 µS, 272.81µS. These results were not significant.