

THE SOLUTION SPACE: An Immersive Environment to Increase Creativity

Amy Jorgensen
Dynamic Media
MassArt
621 Huntington Ave.
Boston, MA
info@amyjorgensen.org

Tony McCaffrey
Innovation Accelerator, Inc.
95 Prescott Street
Worcester, MA
tony@innovationaccelerator.
com

ABSTRACT

The Solution Space provides a solution to the problem described by Albert Einstein: “One cannot solve a problem with the same mind that created it”. It is an immersive environment designed to change participants’ mental state by altering the sense of space and entraining the brain into an alpha brainwave state. This heuristic experience is generated by a 27 foot tall immersive art installation, a chair modeled after the anti-gravity chair, and an audio track encoded with binaural beats. The desired result of the interaction is an increase in creativity, precipitated by a decrease in stress level and a shift from analytic thought to associative thought (which corresponds to the meditative alpha state).

Author Keywords

Creative cognition, creativity support tools, Default Mode Network, insight, immersive environment, brainwave entrainment, associative thought, binaural beats, ganzfeld

INTRODUCTION

Thomas Edison was well known for his napping. When confronted with a problem he couldn’t think his way through, he would sit down with a handful of bullets. He would hold his quandary in mind and start to nod off. As he lost consciousness, he would lose motor control and all the bullets dropped to the floor. When the noise shook him awake, he would have a solution to the problem. It was this shift in consciousness and complete immersion in a different state of mind that likely provided his solutions.

In the modern day university or office environment, there are very few opportunities that foster a shift in state of mind. During our initial interviews, we found that business executives prefer to take walks, ‘sleep on it’, ride the subway or go for a drive in order to come up with creative solutions to work-related problems. All of these actions involve a shift in thought mode and/or an opportunity to daydream or ‘space out’. The Solution Space provides an easily accessible and novel way to accomplish the same goals.

Based on Maslow’s hierarchy of needs, the mind is only available for creative pursuits when all basic needs are met

and stress levels are low. A proven method of stress reduction is meditation because it causes a lengthening of brainwaves (from beta to alpha) [3][15], however not everyone finds sitting still and intentionally shifting their awareness a viable or attractive option. Sitting inside an art installation requires little effort to achieve shifted awareness.

THE VALUE OF ASSOCIATIVE THOUGHT

The ability to switch from analytic thought mode to associative thought mode is critical to creativity, a skill known as *contextual focus* [12]. When a person is in need of a solution, he/she must defocus attention and enter into more associative form of thought in order to make new connections [4]. Howard-Jones and Murray (2003) suggest that associative thought ensures originality and suggests that expanding the focal point of attention may improve creativity and overcome fixation, a condition that occurs when one is unable to move beyond a known problem solving approach in order to develop a new one [7]. In this expansive state, one loosens thought structure to allow new ideas or insights to occur. It is in this daydreaming state that creative thought happens.

The Default Mode Network is one of five different resting-state neural networks that is activated during daydreaming and is more active in creative people [6]. The mind obliquely solves problems while daydreaming, a phenomena known as “The Shower Experience”, which is a common experience of cognitive inspiration involving drifting thought patterns. Smith (1995) states that insight occurs “while the conscious mind temporarily retreats” [10] and a spike in alpha brain wave production occurs during these experiences. Many studies have shown conclusive evidence that creative thought is associated with the alpha brain wave state [9]. Jung-Beeman et al (2004) observed this “alpha effect” during subjective experience of the ‘A-Ha!’ moment. It is during moments of insight that brainwave frequency drops into the 8-12 Hz alpha range. Additionally, Fink et al (2007) [12] found that the more creativity-related a task is, the stronger is the synchronization of alpha activity.

AUDIO-VISUAL STIMULI TO ALTER STATE

One of the characteristics of altered states of consciousness is a *joint* alteration in the experience of time and space [1]. Gazing at a *ganzfeld* promotes the alteration of sense of space because there is no perceptible edge to the visual field. When the brain cannot tell where it is in space, the frequency of hallucinations increases and altered states are more easily achieved [14]. Another accessible technique to alter state is to listen to binaural beats. Binaural beats have been well documented to promote an alteration of brain wave state [13]. These specific audio tones are perceived as a subtle auditory beat and can be used to entrain specific neural rhythms through the frequency-following response (FFR). FFR is the tendency for cortical potentials to resonate at the frequency of an external stimulus.

DESIGNING THE EXPERIENCE

The experimental environment had a physical structure, a visual field design and an audio component.

Physical Structure

In order to promote the mental relaxation and the most effective alteration of brainwave state, the body must be as relaxed as possible. We built a chair based on the schematics for the anti-gravity chair by Hammacher-Schlemmer, a chair designed to make you feel like you are floating. The chair was positioned at the bottom of a 12'w x 27' h x 8' d oblique cone shaped tent sewn out of lightweight Tyvek. At the top of the tent was a 4-way mirror. The door hung at the foot of the chair so subjects could see the entrance, feel safe and entirely immersed.

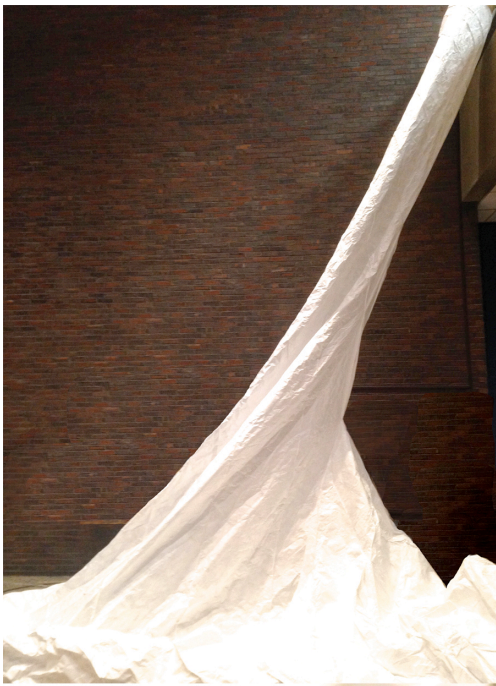


Figure 1: Visual Field Manipulation

Audio Component

We programmed our external stimulus with binaural beat generating software, Gnaural. Base frequency was set to 220Hz and tone frequency was set to 10Hz, which correlates to the middle of the spectrum of the alpha state (8-12Hz). We also incorporated a track of white noise to enhance the immersive experience and help participants shut out the outside world.



Figure 2: Positioning of Subjects

Visual Component

The Solution Space is a *ganzfeld* (a visual field with no perceptible edge) created with ambient light and reflection. The 4-way mirror at the top of the white monochromatic tent helped to warp sense of space.

DATA COLLECTION METHODS

We collected both qualitative and quantitative data to assess whether The Solution Space had any effect on subjects' stress level, state of mind, and creativity.

Qualitative Data

Each subject was given a paper questionnaire upon exiting the environment. We used a Likert Scale of 1-10 (1= "No, not at all" and 10= "Yes, A lot") and asked subjects to rate themselves on three categories:

1. Did you notice a change in your state of mind?
2. Did you have any new ideas or insights?
3. Do you feel less stressed?

To gather further data on subjective experience, we added a Free Association Task wherein subjects had to write down three words to describe their experience.

Quantitative Data

We chose to measure the biometric of Electrodermal Activity (EDA), a measure of electricity moving on the skin, with the Neuma stress test cuff. Subjects were asked

To test creativity, we used Guilford's Alternative Uses Task (1967), a testing method that has been used reliably since its inception. Subjects were asked to name as many alternative uses for an object, an opaque white beach ball, for 3 minutes before and after the manipulation. The manipulation period was 15 minutes; the control group chatted and snacked in a classroom setting and the experimental group sat inside the Solution Space.

The experimental group then spent 15 minutes in The Solution Space tent while the control group engaged in normal activities (i.e., talking/snacking in a classroom). After the 15-minute session, both groups again worked on creating more alternative uses for the same object that they worked on before. The control and experimental groups' means and standard deviations were the following: (Control: mean = 6.88, sd = 3.26; Experimental: mean = 9.38, sd = 2.58). Based on a t-test, their performances were statistically different: $t(28.48) = 2.40$, $p\text{-value} = 0.02$. Because the $p\text{-value}$ is less than the standard cut-off for statistical significance (0.05), this experiment provides evidence that the The Solution Space leads to the creation of significantly more alternative uses for the object. The experimental group produced 2.5 more alternative uses than

the control group ($9.38 - 6.88 = 2.5$ uses), which is a 36% improvement in performance ($2.5/6.88$).

Because the Alternative Uses Task is a classic measure of creativity (Guilford, 1967), we have evidence that The Solution Space increases creativity as measured by this well-established task.

CONCLUSION

This kind of environment can be useful in any arena requiring creative thought production, such as ad agencies, art schools, or corporate think tanks, especially since these environments can be stressful. Based on both qualitative and quantitative data, The Solution Space succeeded in lowering stress levels. Quantitative data also provide evidence that time spent in The Solution Space led to greater creative cognition. Lowered stress and creative cognition may be causally linked, since both require alpha brain wave production. Manipulation of the visual field and audio entrainment increased creativity. It is difficult to determine whether it was the audio stimulus, the visual stimulus, or both that delivered this result. Further investigation is required to pinpoint the cause. Based on qualitative feedback, the Default Mode Network appeared to be activated and a shift in consciousness did occur, however, further research with more advanced equipment, such as EEG and/or MEG is required to quantify the impact of the experimental environment.

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