

A PROPOSED PROCESS FOR EXPERIENCING VISUAL IMAGES OF TARGETS DURING AN ESP TASK

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ABSTRACT. Experiencing a visual image of a target occurs in ganzfeld and remote viewing experiments as well as in spontaneous cases. However, little is known about how participants generate these images. At the beginning of an ESP task, participants try to imagine and anticipate seeing a target. This leads to the priming of the representation of the target's ostensible properties in the brain. The primary visual cortex serves the function of binding perceptual information across different areas of the brain to construct an image of the target. Next, the frontal lobe processes the stored structure in memory's cortical areas and sends a signal to the inferior temporal lobes to activate a representation of the target, creating a visual image. This image is formed when visual memories are activated, which is a precursor of the visual experience. Activation of area V1 is followed by activation of the higher visual areas, which creates the visual ESP experience. Conclusions and suggestions for future research are provided.

Keywords: ESP, visual imagery, primary visual cortex, V1, higher visual cortex, memory

Extra-sensory perception (ESP) is sometimes assumed to be active all the time (e.g., Carpenter, 2005). It has been suggested that ESP is an ability through which one might perceive a stream of subtle and weak information units from a variety of sources, resulting in a meaningful representation (Carpenter, 2004; Roll & Persinger, 1998; Schmeidler, 1991; Stanford, 1990; Stevens, 2002). ESP is commonly manifested as visual images, and the available evidence indicates that the experience of target-related visual imagery plays a crucial role in ESP performance. For instance, participants are asked to image remote targets when exposed to ganzfeld stimulation (Bem & Honorton, 1994; Bem, Palmer, & Broughton, 2001; Palmer, 2003; Storm & Ertel, 2001; Utts, 1995), in remote viewing (Dunne & Jahn, 2005; Puthoff & Targ, 1976), and in dream research (Sherwood & Roe, 2003). Spontaneous cases also commonly involve visual impressions (Honorton, Tierney, & Torres, 1974; Roll & Persinger, 1998; Stanford, 1974, 1990; Stevenson, 1970).

Two main approaches, Irwin's (1978a, 1978b, 1979) information processing model and Carpenter's (2004, 2005) first sight model, illustrate what is involved in participants' visual experience of targets. There are two stages. In the first stage, ESP information enters the brain via unknown

sensory mechanisms. In the second stage, this information interacts with target-relevant memories, resulting in the experience of targets-related visual images. This process is likely similar to the process of creating visual information in the brain in nonpsi contexts. However, a full theoretical account of the possible neural and biophysical mechanisms that underlie the experience of target-related visual images has never been proposed. Below, I propose a process to explain visual ESP experiences.

A Proposed Process for Visual Experience in ESP

ESP and Memory

One component of ESP is retrieved memories (Blackmore, 1980; Roll, 1966; Stanford, 1970), especially long-term memories (Irwin, 1979). Many studies confirm the positive relationship between memory and ESP (Rao, Kanthamani, & Palmer, 1990; Rao, Morrison, & Davis, 1977; Rao, Morrison, Davis, & Freeman, 1977; Roll & Persinger, 1998; Stanford, 1970). Memory seems to serve the function of organizing stimuli and responding to those considered important (Roll & Persinger, 1998), the importance being based primarily on relevance (Carpenter, 2005; Irwin, 1978b). The information is then processed to determine whether it emerges in consciousness (Irwin, 1978a) as a visual image (Broughton, 2006). It has been suggested that ESP and memory are parallel processes (Carpenter, 2005).

The aim of the proposed neurophysiological account of visual experience is to identify the locations where the perceived information is integrated and stored.

Visual Imagery and Retrieving Memories

Visual imagery occurs when perceptual information is retrieved from memory; this process is often referred to as “seeing with the mind’s eye” (Kosslyn, Ganis, & Thompson, 2001). The visual representation of a perceived object is considered to “depict” the object rather than describe it, leading to a picture-like reconstruction (Kosslyn, 2005). The physical qualities of the object (shape, color, and texture) are stored in long-term memory, the locus of which is believed to be the inferior temporal lobes (Thompson, Kosslyn, Sukul, & Alpert, 2001). The posterior parietal cortex is believed to be where spatial properties (the relative positions of objects in space) are processed (Kosslyn, 2005).

Neuroimaging studies of visual imagery indicate that activation occurs in the primary visual cortex (V1 or V2; Kosslyn et al., 1999; Kosslyn & Thompson, 2003; Thompson et al., 2001). This part of the brain receives input from the eyes via the lateral geniculate nucleus (LGN; Tong, 2003), suggesting that V1 processes perceptions and low-level images. The visual

image of an object's properties activates the visual cortex. On the other hand, the visual image of a spatial representation does not activate the primary visual cortex because it is stored in the posterior parietal cortex (Kosslyn & Thompson, 2003). Following the processing routes noted before, the visual information is carried to the posterior parietal cortex, where the spatial properties of the object are processed. This discovery of the role of activation in V1 has led to the conclusion that the primary visual cortex supports representation during visual imagery (Kosslyn, 2005; Kosslyn & Thompson, 2003), implying that we can create an image through volition or will, without perception.

Kreiman, Koch, and Fried (2000) found that approximately 90% of single neurons demonstrated the same selectivity during perception as in the generation of visual imagery. Similar results were obtained in an fMRI study, where over 90% of the locations across the brain were activated at the same time (Ganis, Thompson, & Kosslyn, 2004). Cortical stimulation of V1 in the blind leads to the experience of a spot of light (Brindley & Lewin, 1968; Dobbelle & Mladejovsky, 1974; Merabet, Rizzo, Amedi, Somers, & Pascual-Leone, 2005). Taken together, this evidence supports the existence of a real image appearing in one's mind (Kosslyn & Thompson, 2003).

A possible explanation of visual imagery is that the anticipation of seeing an object leads to the priming of the representation of the object's properties in the brain (Kosslyn, 2005). Visual imagery occurs when one expects to see an object, with the result that a depictive representation of the object is created in the primary visual cortex. First, the frontal lobe processes the stored structure in cortical areas devoted to memory. A signal is then sent to the inferior temporal lobes to activate representation of the object (Kosslyn, 2005). This activation propagates backward to form a depictive representation in the visual cortex.

The primary visual cortex may be activated by anticipating perception of an object. Thus, visualizing what one desires can easily create or distort a perception (Kosslyn & Thompson, 2003).

The Roles of V1 and the Higher Visual Areas

Which locations in the brain are best suited to receive perceived information and integrate stored information? The best candidate for receiving perceived information is V1 and the best candidate for integrating stored information is the higher visual areas, which include the posterior extrastriate areas V2, V3, V3A, V4, V5, as well as the parieto-occipital and posterior intraparietal visual areas.

Visual stimuli are absorbed by photoreceptors in the retina, and then the output neurons of the retina transmit the input to the primary cortex in two major ways. About 90% of the output from the retina flows to the LGN and then to V1, whereas the remaining 10% is projected to the

superior colliculus and then to the pulvinar, reciprocally connecting with the extrastriate areas surrounding the primary visual cortex (Tong, 2003).

The brain is a very highly connected network that is subject to feedforward and feedback connections, leading to a high degree of interaction (Crick & Koch, 2003). V1, in particular, has well-organized connections with multiple areas in the brain. It connects not only with the higher visual areas, but it also receives feedback exclusively from the motion-sensitive areas of the extrastriate cortex, the superior temporal sulcus, the superior temporal polysensory areas, the inferotemporal cortex, the parahippocampal gyrus, the lateral intraparietal area, the frontal eye fields, and the auditory cortex (Tong, 2003). In other words, there is a very complex neural network that reaches out to other cortical areas. The detailed functions of V2, V3, V3A, V4 and V5 are described in a review paper by Grill-Spector and Malach (2004).

Evidence shows that the primary cortex is the place that integrates stored information. Activation of V1 has been observed in the blind during Braille reading (Cohen et al., 1997; Sadato et al., 1996), suggesting its functional involvement in tactile processing (Cohen et al., 1997). In other studies (Amedi, Raz, Pianka, Malach, & Zohary, 2003; Raz, Amedi, & Zohary, 2005), the possibility of visual imagery was ruled out by employing congenitally blind participants, as well as using abstract verbal tasks and episodic retrieval instead of Braille. The results show that V1 was activated during these verbal tasks, and there was a positive relationship between the magnitude of V1 activation and performance in the verbal memory tasks.

There is considerable evidence that the primary visual cortex is involved in the processing of tactile, auditory, and linguistic information in the blind (Merabet et al., 2005). Visual imagery has been implicated in the normal tactile perception of certain object properties (Klatzky, Lederman, & Reed, 1987; Sathian & Zangaladze, 2002; Sathian, Zangaladze, Hoffman, & Grafton, 1997). In these studies, normally sighted participants were asked to evoke visual imagery while touching objects hidden from their view. Visual imagery was found to enhance successful identification of the objects' spatial properties, such as shape and size. These processes provide the opportunity for information stored in memory and perceived information to interact with each other.

Visual Images of Targets in ESP Tasks

As earlier noted, the most convincing ESP evidence comes from studies using the ganzfeld technique, remote viewing, and certain spontaneous cases. Visual imagery induced by the ganzfeld has been associated with decreased alpha, or alpha suppression (Wackermann, Putz, & Allefeld, 2008; Wackermann, Putz, Buchi, Strauch, & Lehmann, 2002). There is also evidence from these studies that the primary visual cortex was activated at the time of the imagery. Moreover, alpha rhythms in the occipital lobe were

elicited in a pair of proximal identical twins, and matching alpha rhythms were observed between distant identical twins (Duane & Behrendt, 1965). Other promising evidence comes from studies of presentiment (Radin, 1997, 1998), in which slow cortical potentials (SCPs) in the primary visual cortex are commonly used to predict future acquisition of information. SCPs were also shown to be significantly different in response to a light flash than in response to no flash (Radin & Lobach, 2007).

It is logical to infer that VI is activated while participants experience visual images of targets during an ESP task, followed by activation of the higher visual cortex. ESP experiences are well known to be linked to temporal lobe activation (Persinger, 1984, 1989; Persinger & Valliant, 1985). Palmer and Neppe (2004) reported a positive relation between EEG anomalies in the temporal lobes and ESP in female neuropsychiatry patients. When 5 Hz, 8 Hz, 10 Hz, or 15 Hz flashing lights were presented to one of a pair of unrelated people, correlated EEG patterns over the right parietal region were found in response to yoked circumcerebral magnetic fields (Persinger et al., 2010).

There is evidence that the right hemisphere of the brain might be particularly involved in psi (Broughton, 1976, 1978; Ehrenwald, 1984; Roll & Persinger, 1998). Such right hemisphere involvement has been observed in ESP tests with the psychic Sean Harribance (Roll & Persinger, 1998). Along with the idea that the brain is a very highly connected network, it is reasonable to assume that the right temporo-parietal junction might be involved with various kinds of ESP experiences.

At the beginning of an ESP task, participants try to imagine and anticipate seeing a target. This leads to the priming of the representation of the target's ostensible properties in the brain. The role of success-related expectations can be seen in research on the "sheep-goat" effect (Schmeidler, 1952; Thalbourne, 1981). Sheep (who believe in the possibility of ESP) were found to score better on ESP tasks than goats (who do not believe in the possibility of ESP) in a meta-analysis (Lawrence, 1998). Sheep expect that the emerging of visual images will lead them to make a correct response which, in turn, makes them more willing to wait passively for potentially psi-mediated images of the target to emerge in consciousness, thereby reducing the signal-to-noise ratio (Bem & Honorton, 1994). Similarly in spontaneous cases, people may consciously or unconsciously anticipate relevant imagery.

Next, the frontal lobe processes the stored structure in memory's cortical areas and sends a signal to the inferior temporal lobes to activate a representation of the target, creating a visual image. This image is formed when visual memories are activated, which activation serves as a precursor of the visual experience in an ESP task. Activation of VI is followed by activation of the higher visual areas.

In the meantime, this activation interacts with perceived information gathered from sensory input and/or associated thoughts in the

cortical areas, although it is still unclear what this sensory input consists of. The primary visual cortex perceives sensory input, after which the visual image propagates backward to construct the image of the ESP target. It can be plausibly hypothesized that this visual imagery is equivalent to the visual experience in successful ESP performance, providing a meaningful representation of subtle paranormal and normal information from perception and memory. Visual imagery serves a functional role in enhancing the likelihood of successfully identifying targets by integrating the information flow from both sensory input and memory.

Conclusions and Future Research

The generation of visual imagery is a good way to extract information from normal and/or paranormal sensory input and memory. The diverse and rich cortical response interconnections to and from the primary visual cortex make this area a plausible locus for representations derived from information stored in memory and representations that have been activated by a currently unknown, but subtle, process. This process serves to construct visual ESP experiences.

Neurological data on the role of the primary visual cortex and temporo-parietal cortex in ESP are needed to test this assumption. One such test involves the use of transcranial magnetic stimulus (TMS). Given that TMS provokes long-term inhibition or facilitation of cortical excitability (Pascual-Leone et al., 1998), it would be very interesting to test people whose primary visual cortices are temporarily impaired or excited. Such a study would support the functional involvement of the primary visual cortex. Because this area is functionally involved in the visual ESP experience, TMS should either impair or enhance the experience. For example, a repetitive 0.33 Hz TMS has been shown to create deficits in visual perception tasks (Kammer, Puls, Strasburger, Hill, & Wichmann, 2005), and repetitive 1 Hz TMS has been shown to impair performance in visual imagery tasks (Kosslyn et al., 1999). Repetitive 10 Hz TMS has been used to increase cortical excitability in the motor cortex (M1) but decrease cortical activity in the supplementary motor area (SMA) of the cortex (Pascual-Leone et al., 1997). In the same study, repetitive 1 Hz TMS increased cortical excitability in the SMA but decreased it in M1. Researchers can test the effect of TMS on ESP using any test paradigm aimed at evoking visual imagery, such as the ganzfeld, remote viewing, or dream research.

Nevertheless, many basic but important questions remain. What percentage of participants report visual experiences in ESP experiments? How often are such visual experiences associated with success on the ESP test? Some participants might express ESP in nonvisual ways, such as through feelings (Broughton, 2002; Stanford, 1990), intuition (Broughton, 2006; Broughton & Bourgeois, 2001), thoughts (Stanford, 1990), or presentiment (May, Paulinyi, & Vassy, 2005; McCraty, Atkinson, & Bradley,

2004a, 2004b; Radin, 1997, 1998, 2004; Radin & Lobach, 2006; Sartori, Massaccesi, Martinelli, & Trissoldi, 2004). As noted above, it is common in presentiment research to use the skin conductance response (SCR) to detect precognitive information. Other measures that have been used are heart rate (McCraty et al., 2004a, 2004b; Sartori et al., 2004) and event-related potentials (ERPs; McCraty et al., 2004a, 2004b). Many researchers have successfully replicated these results (Bierman & Radin, 1997; Bierman & Scholte, 2002; May et al., 2005; Radin, 2004). These studies provide a possible explanation for how the emotional system perceives paranormal information (Broughton, 2004, 2006). In an fMRI distant healing study (Achterberg et al., 2005), recipients of healing intention from distant healers were shown to have activation of the anterior and middle cingulate area, the precuneus, and the frontal area. Additional research is needed to determine if ESP functions intrinsically in a perceptual-emotional-cognitive manner that is nonvisual. However, the possibility that these nonvisual ESP pathways might support the creation of visual ESP experiences cannot be disregarded.

According to one neuroscientific review of sleep (Hobson, 2002), dreaming is an illogical, hallucinatory, and emotional state. It involves widespread and complex networks that have been found in the primary visual cortex, prefrontal cortex, amygdala, anterior cingulate, ventral striatum, posterior cortices, thalamus, hypothalamus, pons, and hippocampus. The most intense dreaming occurs during rapid eye movement (REM) sleep. During this stage, there is widespread activation of the brain, and imagery is generated internally, while external sensory input and motor output are effectively blocked (Hobson, 2004). This blocking of external sensory inputs suggests that REM might not be the best state for eliciting ESP and that other stages, particularly stage 1, might be more suitable. However, it must be noted that high-quality ESP during REM sleep was demonstrated in the famous Maimonides dream studies (Ullman, Krippner, & Vaughan, 1973).

In summary, I propose that visual ESP experiences result from the creation of imagery through the parallel interaction of normal/paranormal perceptions and information retrieved from memory. Further exploration of this topic would be of interest because it has the potential to advance our understanding of the ways in which humans take in and interpret information. This proposed process for the creation of genuine visual ESP experiences is intended to set the stage for uncovering important clues about the neural mechanisms that underlie the interaction of sensory information flows.

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Abstracts in Other Languages

Spanish

UN POSIBLE PROCESO EN LA EXPERIMENTACIÓN DE IMÁGENES VISUALES DURANTE UNA TAREA PES

RESUMEN. El experimentar una imagen visual de un objetivo se produce en los experimentos de ganzfeld y visión remota, así como en casos espontáneos. Sin embargo, poco se sabe sobre cómo generan los participantes estas imágenes. En el comienzo de una tarea PES, los participantes tratan de imaginar y anticipar ver al objetivo. Esto lleva a la estimulación de la representación de las propiedades aparentes del objetivo en el cerebro. La corteza visual primaria cumple la función de enlazar la información perceptual a través de las distintas áreas del cerebro

para construir una imagen del objetivo. A continuación, el lóbulo frontal procesa la estructura almacenados en las áreas corticales de la memoria y envía una señal a los lóbulos temporales inferiores para activar una representación del objetivo, creando una imagen visual. Esta imagen se forma cuando las memorias visuales se activan, como precursoras de la experiencia visual. La activación del área V1 es seguida por la activación de las zonas visuales superiores, que crean la experiencia visual PES. Proporciono conclusiones y sugerencias para futuras investigaciones.

French

PROPOSITION D'UN PROCESSUS POUR FAIRE L'EXPERIENCE D'IMAGES VISUELLES DE CIBLES DURANT UNE TACHE D'ESP

RESUME : Faire l'expérience d'une image visuelle d'une cible se produit dans les expérimentations de Ganzfeld et de Remote Viewing ainsi que dans les cas spontanés. Toutefois, on sait peu de choses sur la façon dont les participants génèrent ces images. Au début d'une tâche d'ESP, les participants essayent d'imaginer et d'anticiper la vision d'une cible. Cela mène à une amorce de représentation des propriétés ostensibles de la cible dans le cerveau. Le cortex visuel primaire a pour fonction de relier l'information perceptuelle à travers différentes zones du cerveau pour construire une image de la cible. Ensuite, le lobe frontal traite la structure stockée dans les aires corticales de la mémoire et envoie un signal au lobe temporal inférieur pour activer une représentation de la cible, créant une image visuelle. L'image est formée lorsque les souvenirs visuels sont activés, ce qui est un précurseur de l'expérience visuelle. L'activation de l'aire V1 est suivie par l'activation des aires visuelles supérieures, qui crée l'expérience visuelle d'ESP. Des conclusions et des suggestions pour la recherche future sont fournies.

German

VORSCHLAG, WIE SICH DIE AUFNAHME VISUELLER BILDER VON ZIELOBJEKTEN WÄHREND EINER ASW-AUFGABE ERFASSEN LÄSST

ZUSAMMENFASSUNG: Visuelle Bilder von einem Zielobjekt werden im Ganzfeld, bei Fernwahrnehmungsexperimenten wie auch bei Spontanberichten erfahren. Jedoch ist wenig darüber bekannt, wie bei Teilnehmern diese Bilder zustandekommen. Zu Beginn einer ASW-Aufgabe versuchen die Teilnehmer, sich das Sehen des Zielobjekts vorzustellen und zu antizipieren. Dies führt im Gehirn zum Aufruf der Repräsentation der scheinbaren Eigenschaften des Zielobjekts. Zu den Aufgaben des primären visuellen Cortex' gehört das Verknüpfen wahrnehmungsmäßig gewonnener Informationen über verschiedene Hirnareale hinweg, um das Bild des Zielobjektes zu konstruieren. Als nächstes

verarbeitet der Frontallappen die gespeicherte Struktur in den Kortikalgebieten des Gedächtnisses und sendet ein Signal zu den Schläfenlappen, um eine Repräsentation des Zielobjektes zu aktivieren, wobei ein visuelles Bild erzeugt wird. Dieses Bild kommt zustande, sobald visuelle Gedächtnisinhalte aktiviert werden, was zu einem Vorläufer der visuellen Erfahrung führt. Die Aktivierung von Areal V1 hat die Aktivierung der höheren visuellen Gebiete zur Folge, was zur visuellen ASW-Erfahrung führt. Schlussfolgerungen sowie Vorschläge für künftige Forschungen werden unterbreitet.