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Experimental psychology and visual artwork

Notes from the laboratory

Abstract
This article explores ways in which modern experimental psychology can provide information about aspects of the processes involved in the creation of visual art. Many areas of research in the fields of neuroscience and cognitive neuropsychology yield information that can be used to develop techniques to benefit the production of art. Several phenomena are discussed to provide a comprehensive perspective on the psychological, behavioural and physiological processes that influence the creation of artwork.

Keywords*:* paradoxical facilitation, cognitive psychology, system 1, system 2, verbal overshadowing, perceptual constancy, categorical, coordinate, TMS

Introduction
Many psychologists have provided analyses of artists and their work, including choice of subject matter, states of mind, symbolic interpretation, etc. Artists have looked at the process as product, as it were. Process art is an artistic movement as well as a creative sentiment, where the end product of art is not the principal focus. The 'process' in process art refers to the process of the formation of art – the gathering, sorting, patterning and the initiation of actions and proceedings. There is a widespread curiosity about and a focus on the production of artwork, but very little information is available about its 'psychological mechanisms', as it were. The field of experimental psychology can provide a great deal of such information, however, given a certain degree of extrapolation from studies that for the most part are directed towards therapeutic intervention. As the term implies, experimental psychology refers to research applying experimental methods to psychological study and its underlying processes. It involves the study of sensation and perception, memory, cognition, learning, motivation, emotion, developmental processes, social psychology and the neural substrates of all these. There are psychological, behavioural and physiological dynamics that motivate and drive the creation of art and a great deal of research that can yield empirical information about them. This article proposes to forge some links between the fields of psychology and art so as to provide insight and hopefully facilitate strategies to benefit creativity rather than interpretations for understanding; this is about the processes within the artist and not the products of the creative process. My point of departure has been to provide empirical perspectives on some time-honoured practices in the field of visual art. The study of the human form, painting, sculpting or drawing from live models, has been done for generations in Western culture, from the metal ages, through classical antiquity and to our own age. Many art colleges teach live modelling today, although the practice has taken somewhat of a back seat to modern influences. Nevertheless, in view of its extremely long history in comparison with other forms of visual expression, I think it is of interest to study some of the psychological aspects and effects of working with human models.

Figure 1. Depicting the human figure has a very long history in Western society; from the metal ages to the present it has always had its place. Modern experimental psychology can yield information about the effects of this kind of work, perhaps contributing towards an understanding that may provide more strategies to benefit visual artistic work. The young man on the left is a charcoal drawing from my days in art college (Statens Håndverks -og Kunstindustriskole: SHKS). Stine Vogt, 1978. Charcoal on paper

System 1 and system 2

Before going into the more specific studies pertaining to art, some general conceptualisations will be presented. System 1 and system 2 describe a wide range of functions, covering many behaviours and situations, and awareness of them can ultimately be useful factors in the creative process. In his book summarising decades of research in cognitive psychology (not to be confused with what is called 'cognitive behaviour therapy'), the Israeli-American psychologist and Nobel laureate Daniel Kahneman outlines two modes of thought: *system1* and *system 2* (Kahneman, 2012). The cognitive processes we associate with thinking, for example memory, language, planning and knowledge on one side, and perception and emotion/motivation on the other, are active in radically different timelines. *System 1* is fast, instinctive, automatic and emotional, while *system 2* is slower, more deliberate and more logical. *System 1* processes are unconscious, effortless, automatic and emotionally based. They are associated with the limbic system of the central nervous system, a deeper and older part of the brain, hence usually referred to as lower-order functions. *System 1* functions without self-awareness or control; it is uncritical and intuitive and completely in the present – the here and now. Scientists disagree about what percentage of processing is done in *system 1*, but most agree that by far the greater part takes place there. *System 2* comprises deliberate, conscious, effortful and controlled mental processes; it involves self-awareness; it is logical and sceptical, and it plays a major part in seeking new or missing information and making decisions. Its processes are associated with the cerebral cortex, the outer layer of the brain, usually termed higher-order processes. We can say that we are physiologically divided into *system 1* and *system 2* and that the two systems are not entirely synchronised. One study by Winkielman, Berridge and Wilbarger (2005) nicely illustrates this division. The objective of the study was to explore three properties of basic, unconsciously triggered affective reactions: how they may influence subsequent behaviour, how they work without eliciting conscious feelings and how they interact with motivation. Participants were given a fictional objective for the study (that the experiment would assess how biological rhythms would affect reaction times and moods), after which the genuine study commenced. Photographs of happy or angry faces were presented subliminally, that is, too quickly for consciousness to register, in this case 16/1000 of a second, or 16 milliseconds. The time found for a visual stimulus to be consciously registered is in the area of 200 milliseconds (Rutiku, Aru, & Bachmann, 2016). The genuine objective was to assess the pictures' influence on the evaluation of a drink that was served after the presentation. After this sequence, participants were asked to assess the drink, the same drink for all. Upon questioning, the participants who had seen the happy faces subliminally reported a greater liking of the drink and were much more disposed to buy it than those who had seen the angry faces. Among other things, this is a clear demonstration of both how fast *system 1* is as well as showing that emotion, or motivation, is completely synchronised with perception. The eyes see and the emotions react – with lightning speed – leaving consciousness lumbering far behind. For a comprehensive discussion of automatic, unconscious processes and their associations in the central nervous system, see Vandervert (2016).

Paradoxical facilitation

Another general feature of our nervous system is something we are all subject to: that the higher-order functions of the cerebral cortex strongly tend to suppress the lower-order functions by virtue of their high demands on resources. This may at times be a formidable obstacle to creative work. The phenomenon called paradoxical facilitation illustrates how creative skill can emerge with the loss of higher-order functions. It appears that resources that would otherwise be engaged in these functions are set free and can sometimes contribute to creative work.

An emergence of new skills has been observed in patients with the onset of dementia, suggesting that loss of function in one brain area can release new functions elsewhere (Miller, Boone, Cummings, Read, & Mishkin, 2000). The objective of this study was to characterise 12 patients with frontotemporal dementia (FTD), a type of dementia involving neuronal loss in the frontal and temporal lobes of the brain, and who had acquired new musical or visual abilities despite progressive dementia. Common signs and symptoms of FTD include significant changes in social and personal behaviour – and in some cases the emergence of artistic ability. It was found that loss of functions in the frontal part of the temporal lobe may lead to the facilitation of musical or visual skills. These findings can help us to understand processing in healthy individuals. With the awareness of how some functions of the central nervous system can override others, as is shown in the studies of paradoxical facilitation, it is possible to plan and execute work so as to minimise such interference and thus allow the different processes to work together instead of against each other.

Transcranial magnetic stimulation (TMS)

We have seen how the loss of function in one part of the brain can facilitate functions elsewhere in the brain. Transcranial magnetic stimulation provides a way to study facilitation in healthy individuals (Osborne, 2003; Luber & Lisanby, 2014). TMS uses induced electromagnetic currents to modulate focal brain activity. With this method it is possible to either depress or stimulate the underlying cortical activity, depending on the desired therapeutic outcome. Professor Alan Snyder, director of the Centre for the Mind at the University of Sydney, has done extensive work on savant skills. Savant syndrome is a condition in which persons with significant mental disabilities demonstrate certain abilities far in excess of average. Such skills may include rapid calculation, map making, musical ability or artistic ability. Snyder argues that savant skills are latent in us all, hypothesising that savants have relatively unimpeded access to lower-level, less processed information due to the failure of the executive processes that package information into holistic concepts and meaningful labels (Snyder, 2009; Chi & Snyder, 2011). The following is an excerpt of a TMS session in Professor Alan Snyder's laboratory in Sidney, a transcript from a participant undergoing TMS by the suppression of higher-order processing:

> A series of electromagnetic pulses were being directed into my frontal lobes, but I felt nothing. Snyder instructed me to draw something. 'What would you like to draw?' he (Snyder) said. 'A cat? You like drawing cats? Cats it is'. I've seen a million cats in my life, so when I close my eyes I have no trouble picturing them. But what does a cat really look like, and how do you put it down on paper? I gave it a try but came up with some sort of stick figure, perhaps an insect. While I drew, Snyder continued his lecture. 'You could call this a creativity-amplifying machine. It's a way of altering our states of mind without taking drugs like mescaline. You can make people see the raw data of the world as it is. As it is actually represented in the unconscious mind of all of us'. Two minutes after I started the first drawing, I was instructed to try again. After another two minutes, I tried a third cat, and then in due course a fourth. Then the experiment was over, and the electrodes were removed. I looked down at my work. The first felines were boxy and stiffly unconvincing. But after I had been subjected to about ten minutes of transcranial magnetic stimulation, their tails had grown more vibrant, more nervous; their faces were personable and convincing. They were even beginning to wear clever expressions. I could hardly recognise them as my own drawings, though I had watched myself render each one, in all its loving detail. Somehow over the course of a very few minutes, and with no additional instruction, I had gone from an incompetent draftsman to a very impressive artist of the feline form. (Osborne, 22 June 2003)

Categorical and coordinate processing

When drawing or painting a three-dimensional scene, two processes often come into conflict. Kosslyn (1987) proposed two distinct processing modes, termed *categorical* and *coordinate spatial relations*, respectively. Categorical representations capture general properties of the visual percept without defining exact quantifiable properties. Conversely, coordinate representations capture precise spatial locations of objects and scenes, or their parts, in terms of measurable units (Jager & Postma, 2003). Roughly speaking, the categorical mode is comparable to *system 2* processing in that it makes use of concepts that are not based on perceptual input, for example ‘man’ or ‘vase’. A man can have any visual characteristics in any combination, skin colour, hair colour, age, stature, etc. The variations are endless, but we all know what ‘man’ is; it is a category dependent on cognition. Conversely, the *coordinate* mode applies to the perceptual information of *system1* about the man, what he looks like, rather than what category he belongs to: how tall, exactly what skin/hair/eye colour he has, how he is positioned – sitting, standing, walking away or towards and so on. We need coordinates to be able to judge distances, for example in reaching for something or in determining the colour of an object. There is little use of category if you want to pick up a cup of coffee; you need the wherewithal to assess where it is and how far you need to move to grasp it. Its primary function is physical orientation in order to get about in the world. In painting or drawing from models or scenes, the coordinate processing mode is extended beyond its survival value service in order to project three-dimensional scenes on two-dimensional paper or canvas. For this, you need to be able to assess proportions as they appear; you need to assess real perspective, foreshortening, exact colour modulations, etc. A categorical apprehension can get in the way of this veridical assessment for reasons I will return to in the section about perceptual constancy.

Verbal overshadowing

We have discussed how two relatively physiologically separate systems work. This entails, among other things, that our emotions and perceptions *(system 1)* are rendered partly or sometimes completely inaccessible to us because they are compromised by higher-order processes, what we normally refer to as thinking or cognition *(system 2)*. Language, very much a *system 2* function, can interfere quite forcefully with visual perception and visual memory and by extension visual artwork. *Verbal overshadowing* refers to the detrimental effect of verbal descriptions upon visual recognition. It has been shown that when people attempt to verbalise memories that are not language related, such as a colour or the characteristics of a face, the memory of them deteriorates. The effect was originally thought to comprise the formation of verbally encoded representations that would mask and interfere with access to the original, non-verbal memory (Schooler & Engstler-Schooler, 1990). It has since been found that it is not merely a matter of verbalisation obscuring an intact, original memory, however, but rather a general shift in processing that actually weakens the ability to use non-verbal operations. In other words, non-verbal abilities are themselves subject to deterioration (Schooler, 2002). This is obviously of great relevance to visual artists. In view of this relatively recent insight, it becomes pertinent to control and limit the influence of language/verbalisation when working visually. Techniques can and should be developed with this in mind so that visual work and the appreciation of the same is not talked to death, as it were. It may be said that the worst thing one can do to a painting is routinely done in art museums; a guide leads a group of viewers from picture to picture and talks about each one. There is usually no time to look quietly at the artwork before the next verbal barrage. It virtually guarantees that the viewers’ experience of the work is curtailed and reduced to a little fact-gathering at best.

Perceptual constancy

In the TMS session described above, the stimulation suppressed activity in the frontal lobes of the subject, creating a temporary depression of *system 2* executive functions. As mentioned, these include basic cognitive processes such as attention control, cognitive inhibition, working memory (or short-term memory), cognitive flexibility and language. It can be viewed as the mind’s administration and integration centre, without which we would not have survived as a species. When these are suppressed, visual resources are allowed greater scope, just as what appears to occur in the cases of FTD and paradoxical facilitation discussed above. We shall look at some of the mechanisms that facilitate the integration of visual input into the ‘executive branch’ in the frontal lobes and discuss how this highly efficient allocation of resources becomes a liability in the production of visual artwork, so much so that it becomes necessary to unlearn the normal way of seeing. Although we are unaware of it, vision is one of the most complex and layered functions of the nervous system. It comprises a host of sub-functions, beginning with the image on the retina of the eye and ending, more or less, in the frontal lobes, the executive part of the brain, via paths along the entire cortex. The image goes to the back of the brain to the occipital lobes and is assembled into a comprehensible percept in stages. During its long journey through the brain and back again, the image is simplified by a process called *perceptual constancy*. With this process, all extraneous information is stripped away to make a sort of icon that is easily combined with other cognitive functions, such as stored memory representations and language, which facilitates executive function – *system 2*. There are many constancies that enable us to make sense of the visual world. Size constancy, for example, equalises the real variation in size created by perspective (Fig. 2).

Shape constancy (Fig. 3) allows us to perceive an object from different locations and perspectives. With this function, we are able to see that the bicycle is the same whether viewed from the front, back or side. The utility of this is apparent; without it we would see a new object each time we moved. Similarly, colour constancy (Fig. 3) allows us to compound the huge variations of colour temperature and light values around an object so as to simplify identification. The end product of perceptual constancy is stripped of variation, providing a much more easily and clearly identifiable environment than would have been the case if the constancies were not there. In terms of species survival, this is of the utmost importance. If we did not perceive by way of constancy, an object would have to be re-analysed with every new angle, at every different perspective; a wolf viewed from the front would seem a different animal if viewed from the side. perceive by way of constancy, an object would have to be re-analysed with every new angle, at every different perspective; a wolf viewed from the front would seem a different animal if viewed from the side. Constancy unifies and simplifies, which has obvious survival value, but it also removes a great deal of visually compelling material, reducing the visual repertoire and with it the joy of experiencing the incredible richness of the

visual environment.

Figure 2. In this example, when we view a train along the platform, we know that the front of the train is the same size as the back end, even though the actual impression tells us that it gets a great deal smaller. The tiny man in the foreground is exactly the same size as the one further along the platform,

but looks much smaller, illustrating how we manipulate size according to what we know and not so much what we see.

Figure 3. It is not hard to see that this is the same bicycle in different orientations. Were it not for object constancy, we would not be able to assess this. If we were to draw the two, however, we would have to go against constancy in order to produce a visually correct image.

Figure 4. Colour constancy: The three pictures are obviously of different colours, but the normal visual system has no difficulty in seeing a white cat on a cluttered surface

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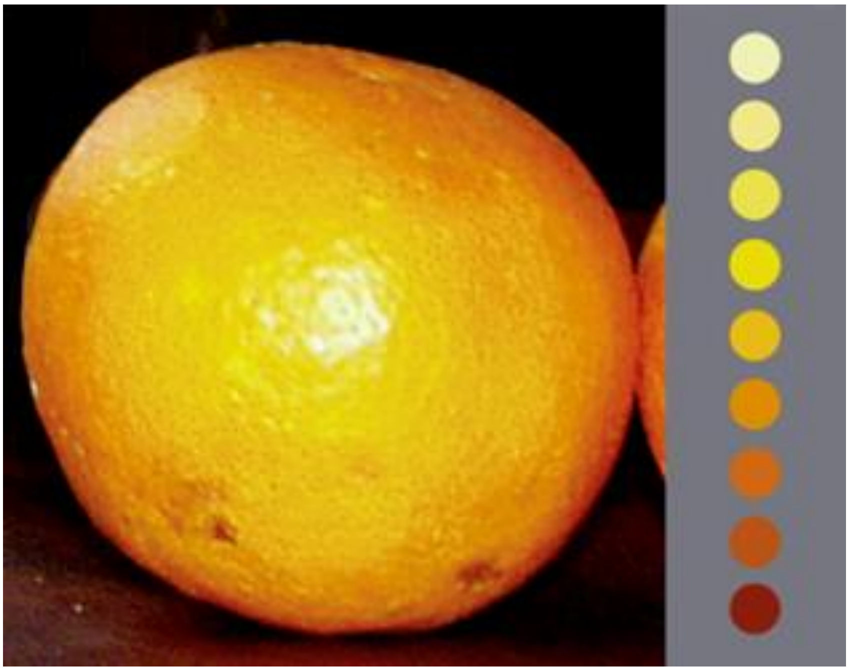

Figure 5. Colour constancy, the last to develop in humans, is the equalising of the different colours and values around a form. The picture of an orange is an example of this: most people perceive it as a relatively uniform orange colour with a little difference in light and dark areas. In reality, we see not only light and dark areas and one basic colour but a range of colours with different colour temperatures, from the cold, acid yellow in the lightest area to the warm reddish brown in the shade. The colour scale on the right side of the picture shows precise extractions of these colours to demonstrate the large variations in hue.

There are some simple ways to counter the effects of perceptual constancy. In order to correct for perceptual errors of foreshortening, Leonardo da Vinci set up a glass pane with a grid vertically in front of the model, thus making it possible to trace correct proportions on the glass. A simpler way of countering the reduction of perceived size differences, or size and shape constancy (for example, the difference between the front and the back of the train in Fig. 2) can be corrected by using a pencil or a similar object as a sort of ruler. Hold the pencil at an arm's length, as vertical as possible, and use the thumb to mark the perceived length or height of the model. The correct difference can then be transferred to paper or canvas (Fig. 6).

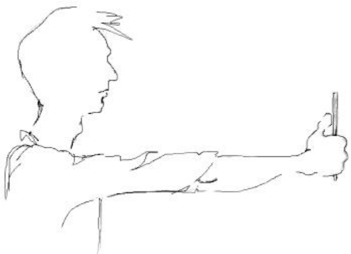

Figure 6. Using a pencil or similar object to obtain correct variation in size and shapes.

Colour constancy, the tendency to eliminate colour and light variations in objects, can be countered by viewing the different parts of the object (like the orange in Fig. 3) through a small hole. Make a hole about 5mm in diameter on a piece of paper and look at the object bit by bit. This allows an analysis of colours independently of each other and gives a veridical impression of the real and often quite dramatic colour variations that are actually there to be seen. Lacking bits of paper with holes, closing a fist to make a make a small opening through which to peek will do just as well.

Working from models

One area in the visual arts that has been extensively undertaken is that of drawing, sculpting and painting the human figure. This practice affords the perfect challenge to the activity of learning to see, or rather, *re-learning* to see. However, it has been taken somewhat for granted that this is so, without much empirical evidence other than the accumulated experience over time and hundreds of generations of gaining proficiency from this type of work. This lack of factual knowledge may not seem like a big problem, but the absence of concrete knowledge has in turn taken attention away from the learning process itself to the advantage of the product, leading to the conception that since nobody is interested in pictures of nudes in this day and age, there is no point in producing them. With this, a vast source of generalisable skills is lost. As mentioned, for the purpose of creating visual artwork, the constancies become something to unlearn in order to gain access to the visual richness that is actually out there, preventing access to the coordinate properties of the visual array. The study of the human form provides a unique way to this unlearning. While allowing a rich scope for individual interpretation, it nonetheless provides the stability for learning to portray the figure as it actually appears. A knee in perspective has to be correctly drawn in order to function pictorially. If it is not correctly done, it will seem wrong to the viewer. We all have bodies, and we all know how a body looks and works; therefore we have a common reference that gives the stability necessary for learning. In attempting to provide empirical evidence for the idea that work with live modelling alters visual perception, a study of eye movements in artists trained in live modelling was conducted with a control group of unskilled participants (Vogt & Magnussen, 2007). Long before, the Russian scientist Alfred Yarbus (1967) had found that eye movements of participants viewing pictures of people (the Unexpected Visitor by Ilja Repin, 1888, and others) showed a strong, uniform tendency to fixate on human features. We hypothesised that artists with training in live modelling would exhibit eye movements that would reflect increased interest in form, colour and composition as a function of experience in countering the effects of categorical cognition and perceptual constancy, and consequently that they would fixate less on human features. Figure 8 shows an example of the scanpaths we obtained. The scanpaths and their statistical analyses strongly supported our hypothesis; artists used significantly more varied scanning strategies, encompassing the entire surface of a set of pictures which included parts of or entire human forms, than did the untrained participants, indicating that the artists made extensive use of colour, form and compositional features while the untrained group focused almost exclusively on the human features. For different reasons, the eye movements of some visual artists *without* experience in live modelling were included in the study, and these invariably showed the same patterns as the untrained group (as this was coincidental, more work is needed to explore this, for example a replication of the study described here, with three groups instead of just two – untrained controls, artists without training in live modelling and artists with such training). Results suggest that training in live modelling takes us away from the simplifying and automatic search for identifiable features, the visual norm, to a varied search strategy that includes many more visual features. In a subsequent test of memory, artists with live modelling training had significantly higher scores on all parameters: conceptual, form/colour and composition. A study of hemispheric lateralisation (Vogt & Magnussen, 2005) showed that the processing of pictures of athletes (comparable to models in live modelling) took place significantly more in the left hemisphere compared to visually untrained participants. This accords with and supports other findings that the right cerebral hemisphere is optimised for processing unfamiliar input, while the left hemisphere is optimised for processing familiar input (Goldberg, 2009). As new things become familiar to us, the left hemisphere develops *routines* for processing them. Hence, artists with training in portraying the human form have developed schemes for apprehending its visual features. One may say that when the brain must deal with vastly greater visual input (greater apprehension of visual, coordinate components), its plasticity allows it to distribute imagery so that the left hemisphere does the routine work, leaving the right hemisphere free to accommodate new, richer imagery.

Figure 7. This is a painting of a model we had in art college (Statens Håndverks -og Kunstindustriskole) years ago. Working with human models affords a rich scope of personal expression while simultaneously demanding correct dimensions and colouristic interpretation. Stine Vogt, 1978. Oil on canvas.

Figure 8. The topmost picture shows the image as seen by all of the participants in the eye-movement study. The image in the centre shows an example of the scanpath of an unskilled participant, typically with a few eye movements over the scene and a strong focus on the man Photoshopped into the original picture of barrels filled with potatoes. This replicates the findings of Yarbus (1967), in which participants showed exactly the same visual behaviour. The image at the bottom shows a typical scanpath from a participant from the group of artists with live modelling experience. Eye movements are distributed over the entire scene, showing an interest in the entire image, not just the figure of the man; form, colour and composition have acquired salience as a function of training in pictorial, or coordinate, perception.

Conclusion

The studies presented here give indications of a vast reservoir of obscured resources that may be brought to the surface of the mind, as it were, and thus made more deliberately accessible in the creative processes. Knowledge about them is a solid step in this endeavour. It can prepare the ground for a more productive administration of the work process. We have seen that there are two separate physiological systems that can operate almost independently (Kahneman, 2012; Winkielman et al., 2005). *System 1* is rapid, largely unconscious, automatic, emotional and completely in the present. It is susceptible to being overridden by the more laborious, slow action of *system 2,* the activity that is generated in the outer layer of the brain and comprises our consciousness. I would argue that it is *system 1* that gives a work of art its impact. The merits of a work of art, in any medium, are of course a combination of skill and what I will call *presence*. As I see it, artwork needs something as elusive as vitality. In more scientific terms, it needs emotionality and acute perception (*system 1*) as well as skill and deliberation (*system 2*). The study by Winkielman et al. (2005) gives us a glimpse of a level of the psyche in which perception and emotion are completely in accord despite no contribution from consciousness. As shown in the studies of verbal overshadowing, language can and will obscure immediate perceptual impressions. In overthinking a visual work, the *presence* of a work of art can easily disappear. *System 1* insight is fast and tenuous. It extinguishes as quickly as it emerges. Who among artists has not had the experience of suddenly knowing in an instant exactly what is right for the work, only to lose the insight, the gut feeling, the instinct in subsequent overthinking. If one accepts that the *system 1* experience is fragile and brief, rather than desperately trying to retain the complete perceptual/emotional experience itself, it becomes possible to trust the *memory* of the insight. One can't feel it anymore, but one can remember its character. Then the work can be integrated with planned, laborious *system 2* activity. In other words, it is possible to use time deliberately. One technique for facilitating such *system 1* insight is to leave the work for a while and then go back to it to see what happens in the split second one sees the work again. *System 2* will have disengaged in the meantime, and an opening has been created for *system 1* for a brief moment. Instead of a clash of functions in which the most fragile loses out, the systems can be made to complement each other. Finally, the perceptual skills obtained in drawing or painting from models has a profound impact on visual perception. The effect is powerful and lasting; many of the participants in the eye-movement study described above (Vogt & Magnussen, 2007) had not worked with models for many years and were doing completely abstract work at the time of the experiment, but the effects of their live modelling training were still fresh. It seems that once one has learned to see *coordinately*, or pictorially, rather than functionally, the ability does not fade. As mentioned initially, the object of the training is not necessarily the creation of the pictures themselves but what the practice does to enhance visual perception. With knowledge it becomes possible to understand that what seems to be a rather ethereal 'gut feeling' or instinct is in fact a vast reservoir of perceptual and emotional abilities that can become clear with effort. In effect, in giving them time, scope and attention, these abilities can become permanently accessible to us.

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References

Chi, R.P., & Snyder, A. (2011). Facilitate insight by non-invasive brain stimulation. *Public Library of Science, 6*(2), e16655.

Goldberg, E. (2009). *The new executive brain: Frontal lobes in a complex world.* Oxford: Oxford University Press.

Jager, G., & Postma, A. (2003). On the hemispheric specialization for categorical and coordinate spatial relations: A review of the current evidence. *Neuropsychologia*, *41*(4), 504–515.

Kahneman, D. (2011). *Thinking, fast and slow.* New York: Farrar, Straus and Giroux.

Kosslyn, S. (1987). Seeing and imagining in the cerebral hemispheres: A computational approach. *Psychological Review*, *94*, 148–175.

Luber, B., &Lisanby, S.H. (2014). Enhancement of human cognitive performance using transcranial magnetic stimulation (TMS). *NeuroImage, 85*(3), 961–970.

Miller, B. L., Boone, K., Cummings J. L., Read, S. L., & Mishkin, F. (2000). Functional correlates of musical and visual ability in frontotemporal dementia. *The British Journal of Psychiatry 176*(5), 458–463.

Osborne, L. (2003, June 22nd). Savant for a day. *New York Times Magazine.*

Rutiku, R., Aru, J., & Bachmann, T. (2016). General markers of conscious visual perception and their timing. *Frontiers in Human Neuroscience*. Retrieved from www.frontiersin.org/articles/10.3389/fnhum.2016.00023/full

Schooler, J. W. (2002). Verbalization produces a transfer inappropriate processing shift. *Appl. Cognit. Psychol., 16***,** 989–997.

Schooler, J. W., & Enstler-Schooler, T. Y. (1990). Verbal overshadowing of visual memories: Some things are better left unsaid. *Cognitive Psychology, 17,* 36–71.

Snyder, A. (2009). Explaining and inducing savant skills: Privileged access to lower level, less-processed information. *Philosophical Transactions, the Royal Society Publishing, 364,* 1399–1405.

Vandervert, L., (2016). The prominent role of the cerebellum in the learning, origin and advancement of culture. *Cerebellum & Ataxias*, *3*, 10.

Vogt, S., & Magnussen, S. (2005). Hemispheric specialization and recognition memory for abstract and realistic pictures: A comparison of painters and laymen. *Brain and Cognition*, *58,* 324–333.

Vogt, S., & Magnussen, S. (2007). Expertise in pictorial perception: Eye-movement patterns and visual memory in artists and laymen. *Perception, 36*(1), 91–100.

Winkielman, P., Berridge, K. C., & Wilbarger, J. L. (2005). Unconscious affective reactions to masked happy versus angry faces influence consumption behavior and judgments of value. *Personality & Social Psychology Bulletin, 31*(1), 121–135.

Yarbus, Alfred L. (1967) *Eye movements and vision,* (Institute for Problems of Information TransmissionAcademy of Sciences of the USSR, Moscow), New York: Plenum Press.