Mental Imagery and Creativity

Mental images, or envisioning things with your "mind's eye," are now studied via multiple levels of observation and involve computational neuroscience, robotics and many disciplines that complement philosophy and form integral parts of cognitive science. MENTAL IMAGERY AND CREATIVITY offers an historical analysis of the use of "mental images" in science. This book also gives many useful illustrations, depicting roles of imagery with 21st century technology, including the usage of imagery, fMRIs and internet connections, allowing people to control virtual avatars or robots at remote distances. Imagery formations and brain imaging techniques allow non-communicative patients, who appear to be in vegetative states, to communicate effectively, despite brain damage. Notwithstanding many 21st century developments of imagery combined with technology and science, many speculative accounts of imagery arose in the 20th century. Philosophic developments, regarding the relation between mental imagery and creativity, are provided in order to compare and contrast speculative and rational foundations. Creativity is defined in relation to problem-solving, inventiveness, art, discovery and cognitive formations of ranges of possibilities, arising before and after realizations (i.e., when one recognizes real and unreal events or solutions), involving images of events, solutions and alternatives.

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Mental Imagery and Creativity

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MENTAL IMAGERY AND CREATIVITY:

COGNITION, OBSERVATION AND REALIZATION

An Expanded Production of the

HONORS THESIS

Presented to the Honors Committee of

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In Partial Fulfillment of

The Requirements

For Graduation in the Honors Program

By

William A. Brant

San Marcos, Texas

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Preface

Inevitably, scholars have old writings that have been cast aside for some time and which they, perchance, come across, and, if judged favorably enough, they revise and develop them. This book is one such case. *Mental Imagery and Creativity* was written during the spring semester of 2003 at Southwest Texas State University in San Marcos as an honors thesis and partial requirement for both my bachelor of science degree in psychology and graduation *summa cum laude* "with honors."

During 2003 I was selected to be the graduation speaker for my own class in front of hundreds of graduates in the fields of liberal arts, fine arts and communication studies, and, coincidentally, I was privileged to present the change of the name of our university from Southwest Texas State University to the new name of our institution, "Texas State University." The name has, I think, undergone several positive transitions--so many changes that perhaps our most famous graduate, President Lyndon Johnson, would need serious contemplation in order to realize that the institution is the same with respect to place, origin and spirit as his own when he graduated from Southwest Texas State Teacher's College in 1930.

After rereading the heart of this book, i.e., my ten year old thesis, which I wrote under the guidance of Prof. Maria Czyzewska (Professor of Cognitive Psychology at Texas State University), I decided to revise portions of it in order to create a more practical and scholarly work that emphasizes applications of

mental imagery and creativity. Much of the revision was quite easy since the philosophical portions have endured, and the descriptions of experiments within cognitive psychology remain the same. So, I have added some important concepts, quotes and illustrations to the text.

Insofar as creativity is a concept that is most applicable to every academic field as well as its status as a conception that transcends each discipline, I write this book for the purpose of enlightenment upon the relation between *mental imagery* (i.e., which arises when we close our eyes and visualize objects, think of sounds, tastes etc.) and *creativity*, which is generally judged as something that is becoming of a person after some unique performance or impressive expression happens.

What I sincerely hope is that you, my reader, envision the concepts and examples within this book and come to creative realizations of your own that I help impress upon you.

William Allen Brant

April 2013

I. Introduction to Cognitive and Philosophic Approaches to Mental Imagery and Creativity

21st century cognitive neuroscience confronts theorists and practitioners with new techniques, technologies and methodologies that increase our understandings of mental imagery and creativity in various ways that are interconnected with multiple fields. These multiple fields of study include biology, sociology, cultural anthropology, computer science, robotics, art and philosophy. For instance, in order to understand the vital interconnections between mental imagery and the expression of creativity or creative thought, there is need for socio-cultural understandings that allow scientists as observers to account for subjects' creative designs and perhaps strikingly similar designs, which may be quite common, unoriginal and uncreative within particular social and cultural contexts that are relevant to subjects being observed by scientists investigating mental images and creativity.

Much theoretical debate, however, does not contribute as significantly as it should to the formations of testable scientific hypotheses concerning mental imagery and creativity. This book presumes that the reason for the reduced amount of contribution to research programs linking mental imagery to creativity is that theoretical approaches tend to focus upon limited and particular levels of analysis and observation, which theoretical dichotomies tend to presume.

Theorists have been perhaps overly concerned with relating the concept of mental imagery to other concepts, such as perceptual conscious experience,

"quasi-perceptual conscious experience" (Thomas, 2013), and concepts that presuppose dichotomies about the "internality" of mental imagery and the mental image's picture-like or representational qualities in addition to presuppositions about the inner causes of creativity.

The latter types of distinctions about the inner and outer aspects of both concepts lead to serious misconceptions in many cases. Sociological and cultural factors tend to be ignored and are necessary for what is both produced creatively and observed to be creative. The latter factors also transcend many of the dichotomies contributing to misconceptions within the theoretic literature about mental imagery and creativity.

In the following pages readers will be confronted with writings of both theory and practice that indicate coming and potential advances within scientific research programs as well as reasons to undermine the presupposed dichotomies, which insist that entire aspects of mental imagery and creativity are solely internal or purely external. *Mental Imagery and Creativity* attempts to reconcile problems interposed between scientific and philosophic progress. Concerning the interrelations of creativity and mental imagery, it is argued that explanations must be multi-disciplinary, which suffices to conclude that each of the involved academic disciplines possess virtues worthy and crucial for creative expression about the relations of mental imagery and creativity, and what is needed and offered is a wide array of levels of analysis and observation with concepts that bridge them together.

Historical analyses may provide us with good reasons to begin with the ancients, including Aristotle, but we will begin our investigation of mental imagery and creativity with a brief description of the ideas of those who first established the usage of these concepts in combination with each other within science during the 1870s and 1880s (i.e., starting with those who were knowledgeable of the scientific method and its applications).

A. 19th Century Pioneers of Mental Imagery and Creativity within Science

The use of the concept and term "mental imagery" is historical and dates back approximately one and a half centuries to a time period in England when John Tyndall (1820-1893), the renown physicist, was greatly contributing to the study of magnetism, thermal radiation and the atmosphere. Probably the first usage of the phrases "mental images" with the concept of "creativity" within a scientific context was during Tyndall's 1870 speech called "Scientific Use of the Imagination" in which he also incorporates the idea of creative powers.

Tyndall argues that many scientists form mental imagery as a crucial part of the processes concerning the discoveries, innovations and creativity in sciences. We shall later see that it was quite appropriate for a physicist to engage in discussions about creativity and imagery because physics, as a most developed science, also had to be concerned both practically and theoretically with observations that are directed toward specific objects and which result in mental imagery formations that contribute to several aspects concerning the

directions taken via scientific methodology. On September 16, 1870 John Tyndall addressed the British Association in Liverpool, England about his hiking trip in the mountains with which he brought a text on logic, Goethe's *Farbenlehre* (i.e., color theory, which is relevant to all visual mental images) and two volumes of poetry.

Tyndall titled his lecture "Scientific Use of the Imagination" and proceeded to give several examples of prominent scientists who have used their own imaginations and expressions of creativity in order to propel science progressively onward. For example, Tyndall considered Newton's investigations of gravitational forces in combination with Newton's imagination of the moon falling after some fruit fell from an apple tree under which he sat. Tyndall uses mental imagery and creatively and draws unique scientific conclusions via merely imaginatively following the scientific method. John Tyndall (1895, 103-4) provides imaginative examples, forming scientific hypotheses and conclusions about light, refraction and the color spectrum:

> **"**In explaining sensible phenomena, we habitually form mental images of the ultra-sensible. . . . Let us then carry our results from the world of theory into the world of sense, and see whether our deductions do not issue in the very phenomena of light which ordinary knowledge and skilled experiment reveal. If in all the multiplied varieties of these phenomena, including those of the most remote and entangled description, this fundamental conception always brings us face to face with the truth ; if no contradiction to our deductions from it be found in external nature, but on all sides agreement and verification ; if, moreover, as in the case of Conical Refraction and in other eases, it actually forces upon our attention phenomena which no eye had previously seen, and which no mind had previously imagined--such a conception, must, we think, be something more than a mere figment of the scientific fancy. In forming it, that composite and creative power, in which reason and imagination are united, has, we believe, led us into a world not less real than that of the senses, and of which the world of sense itself is the suggestion and , to a great extent, the outcome. . . . You may, moreover, urge that, although the phenomena occur *as if* the medium existed, the absolute demonstration of its existence is still wanting."

Tyndall had a long lasting impact on the scientific community, which was rapidly expanding and already elaborately interconnected throughout Western Europe and the USA. Some of Tyndall's ideas were reemphasized within the inaugural address of Jacobus van't Hoff (1852-1911) in 1878 at the University of Amsterdam titled "Imagination in Science" in which van't Hoff argued that the *imagination is crucial in virtue of at least five aspects of science*:

- ♠ The development of scientific hypotheses;
- ♠ Choosing the moment or object of observation;
- ♠ The discretionary aspect of altering the observed object;
- ♠ The discovery of aids or tools that facilitate or are required for observations (e.g., microscopes, new gadgets, or combinations of inventions etc.);
- ♠ The observation of dissimilarities and corresponding characteristics with other observations (Van't Hoff, 1878).

Francis Galton (1822-1911) is accredited with the very first survey methods concerning mental imagery, which aimed to pinpoint the varying amounts of vividness of mental imagery that are associated with its formations. Galton (1880, 301-2) states:

"The particular branch of the inquiry to which this memoir refers, is Mental Imagery; that is to say, I desire to define the different degrees of vividness with which different persons have the faculty of recalling familiar scenes under the form of mental pictures, and the peculiarities of the mental visions of different persons. The first questions that I put referred to the illumination, definition and colouring of the mental image, and they were framed as follows (I quote from my second and revised schedule of questions):-- 'Before addressing yourself to any of the Questions on the opposite

page, think of some definite object -- suppose it is your breakfast-table as you sat down to it this morning -- and consider carefully the picture that rises before your mind's eye.

1. Illumination. -- Is the image dim or fairly clear? Is its brightness comparable to that of the actual scene?

2. Definition. -- Are all the objects pretty well defined at the same time, or is the place of sharpest definition at any one moment more contracted than it is in a real scene?

3. Colouring. -- Are the colours of the china, of the toast, bread-crust, mustard, meat, parsley, or whatever may have been on the table, quite distinct and natural?'"

Galton was surprised to find that a relatively large number of intellectuals and scientists denied experiencing mental imagery at all, despite the fact that most people report that they often experience mental imagery to either greater or lesser degrees. While some have argued that there is a portion of the population (e.g., approximately 10% of the population) that either has very faint mental imagery or a lack of mental imagery, others, such as Faw (2009), have argued that even the small portion of the population that reports a lack of imagery actually experience mental imagery unconsciously. Otherwise, perhaps their imagery does not reach a threshold for their short-term memories to allow them to remember the imagery because they use language more often, for instance.

Similarly, people often forget about their own dreams, and there are many cases of dreams that have been recorded and forgotten thereafter, but they are retrievable. Day dreams are also very similar, and they more closely resemble or perhaps are even identical to sets of mental imagery, with which we are confronted during the waking state. According to Horikawa et al., (2013, 1),

"we present a neural decoding approach in which machine learning models predict the contents of visual imagery during the sleep onset period given measured

brain activity, by discovering links between human fMRI patterns and verbal reports with the assistance of lexical and image databases. Decoding models trained on stimulus-induced brain activity in visual cortical areas showed accurate classification, detection, and identification of contents. Our findings demonstrate that specific visual experience during sleep is represented by brain activity patterns shared by stimulus perception, providing a means to uncover subjective contents of dreaming using objective neural measurement."

It is important, however, for us to understand that there has been a set of trends that involved casting great doubt upon the existence of mental imagery and therefore its role in creativity. These trends became especially influential during the zenith of behaviorist psychology, and "mental imagery" as a phrase that had played a role in late 19th and early 20th century research underwent a period during which the scientific study of mental images was largely ignored and unattended to roughly from the 1920s until the 1950s.

Perhaps one reason for the lack of investigation during the early to mid-20th century (i.e., in addition to the rise of behaviorism) concerns the fact that academics, such as psychologists, rely heavily upon their verbal skills, which may lead many scholars to rely less upon conscious experiences of vivid mental imagery during the process of memorization of certain details.

Some accounts do suggest that instructions given, concerning imagery mnemonics for visual mental imagery and increasing memorization performance, are just as effective with the congenitally blind as they are with other subjects (Jonides, Kahn & Rozin, 1975). So, the crucial role of memory in relation to mental imagery and creativity requires experimental techniques and comparative analyses of these two groups, namely, the congenitally blind and subjects

forming mental imagery that the former group is unable to form or utilize concerning memory and creativity.

B. Mental Imagery and Creativity: Recent Examples and Concerns

Philosophic analyses often focus upon the extremities concerning concepts, i.e., the conceptual space or outlying regions at both ends of the scale or range of the concept. So, allow me to present a 21st century technique used with the accompaniment of fMRI technology for the purpose of illustrating some quite useful functions of mental imagery related to medical diagnoses and law, but which have implications for creative thought and expression.

In order to explain some of the combinations of mental imagery with other sciences, such as computer science and cognitive neuropsychology, consider some techniques that requires the usage of mental imagery with patients who have severe brain damage (i.e., such patients face diagnoses of being in "minimally conscious states" or "vegetative states"). One technique involves practitioners requesting for patients, who *prima facie* appear to be brain dead, to form specific types of mental imagery, which has been successfully utilized in order to serve as answers to yes-no questions and other polar questions.

Psychologists ask such polar questions as "Do you want to continue living?" (i.e., after asking control questions, e.g., Is your mother's maiden name "Smith"?) while teaching them to form specific mental imagery so that if the

answer is “yes,” the patient should imagine playing a sport (i.e., typically tennis[1]), and if the answer is “no,” then the patient should imagine being at home, and simultaneously an fMRI machine measures neural activity while practitioners pay close attention to the brain regions associated with playing the sport and thinking of home (See **Fig. 7** in Ch. **II.D.**). The technique has rendered different medical diagnoses and has allowed family members to converse with their loved ones who are no longer able to speak or write. In some cases individuals actually lose the ability to blink their eyes and swallow.

Extreme examples of mental imagery and creativity may very well concern the mental imagery of minimally conscious patients (Cruse & Owen, 2010; Stins, 2009; Owen et al., 2006). Although the patients are given many opportunities to express themselves via answering polar questions, and in such a condition as a minimally conscious state perhaps there are remnants of a creative mind, nevertheless we would not ascertain that the individual in that state is creative because creativity has a close connection with the person’s ability to perform and express acts creatively.

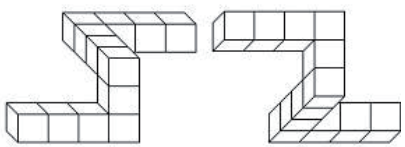
There have not been significant studies, concerning patients characterized as “minimally conscious,” performing the various psychophysical tasks and rigorous mental exercises that experimentation with mental imagery requires. Creativity has not yet been studied in relation to minimally conscious patients’ mental imagery, which may require scientists to incorporate types of polar

[1] Tennis is an important sport with respect to mental imagery because it involves the visualization of the use of a racket in order to hit the ball (i.e., tool usage) as well as hand-eye coordination. Other sports may involve formations of mental imagery concerning very different positions and skills and thus different brain regions of neural activity.

questions to allow for creative responses, if possible. However, scientists are motivated to increase the efficiency of technology in order to allow minimally conscious patients to communicate (Stins, 2009; Owen et al., 2007a; Owen et al., 2007b).

In order for a more comprehensive view upon the topic to arise, new techniques await development in order to test the limitations and vividness of minimally conscious subjects' mental imagery as opposed to typical tasks that involve the manipulation of objects in the mind's eye or prediction about whether the objects are identical in respect to their shapes.

Fig. 1 Mental Rotation of 3D object via Mental Imagery: Are the figures identical?



For instance, the identical geometrical figures in **figure 1**, which are reconfigured illustrations adapted from Shepard and Metzler's (1971) article titled "Mental rotation of three dimensional objects." For instance, **Fig. 1** should take the average person longer to assess whether the figures are identical than most other arrangements of the two figures of blocks, which is a task that requires mental imagery.

Johnson (1990) argued that the mental rotation of the objects by the participants in the experiments involves the following order of cognitive processes or stages: first comes the creation of the mental image of the object, then the mental rotation of the object until some sufficient comparison is possible to make, and then the comparison, and next comes the making of a choice about whether the objects are the same or different. Lastly, the report of that decision follows.

Shepard and Metzler (1971) found that the greater the rotation of the angles of the geometrical figures is, the longer the time period elapses before one can make an accurate judgment about whether the objects are the same or different; this is why it is claimed above that the arrangement of **Fig. 1** will take longer than most arrangements, but the answer is provided to you beforehand that the figures are the same.

Of course, the amount of time it requires for one to successfully ascertain whether the objects are the same or not can be significantly lowered if one attaches a sphere or cylinder to both of the objects, for instance. Various experiments during the 1970s attempted to discover the subjects' response times concerning the examination and mental manipulation and matching of figures, which were found to vary proportionately with certain spatial properties of the figures, such as their degrees of difference with respect to rotation and sizes (Kosslyn, 1980).

Since the 1980s there has been a lively debate concerning what the best interpretations and explanations of the experimental conclusions are about

imagination and mental imagery (Pitt, 2012). Much of the debate has been costly since it mistakes mental imagery as an *explanandum*, although mental imagery is an *explanans*, which presents problems between theorists who argue for broader concepts of mental imagery and those who argue for narrower ones.

Additionally, various studies compare and contrast the abilities of mental rotation between males and females, children and adults as well as comparative accounts of those who suffer from brain damage and who have reduced abilities to mentally rotate or not, including fMRI studies. Mental imagery studies involving memory and abnormal psychology directly involve issues concerning psychopathology as well as post-traumatic stress disorder (PTSD), the invasiveness of mental imagery (e.g., soldiers and police cannot rid certain, sometimes horrible, scenes they envision), and the lack of distinction that is made in certain cases between mental imagery (i.e., derived from memory) and sense perceptions concerning what is happening here and now (Ehlers & Clark, 2000).

However, what we do not have are scientific accounts of mental imagery studies concerning the contrast and comparison of creative geniuses, on one side, and people who lack creativity for reasons, such as brain damage or deficits in respect to living extended time periods in environments with very little diversity and stimulation. The invasiveness of some mental imagery, which is found with PTSD, is also described by some creative inventors, such as Nicola Tesla (See **Ch. II.D** for Tesla's description of his own imagery).

In respect to the former accounts there are many exemplary people who are legendary in respect to their incredibly vivid mental imagery, such as the Nicola Teslas, Einsteins, and the Stephen Hawkings of the world or artists and musicians, like Diego Rivera, Dali, Van Gogh, Mozart and Sam Cooke. The latter people may well be argued to have had more lively skills concerning the vividness of their imaginations and mental imagery and/or their abilities to combine mental images in various ways in order creatively express something.

In the latter sense we are confronted with another interesting analogy, which is opposite of the traditional empiricist analogy (i.e., that mental imagery forms as copies of previous sensory perceptions), insofar as the mental imagery becomes that from which the creative expressions are copied. That is, the person, say, the imaginative musician thinks about her performances beforehand in perhaps vivid ways, and the actual performance that later occurs may even be viewed as creative but less so than the musician had imagined. The artist may indeed be limited by the meticulous coordination between the imperfect skill of his hand and the production of a copy of what he had envisioned through mental imagery.

One common assumption within cognitive science and at large is that mental imagery is as *internal* for those who are minimally conscious as it is for the renowned creative minds (i.e., each of these individuals has a privileged access to the mental content, such as the vividness of their mental imagery). So, the most knowledgeable person about the imagery is the individual with whom it forms. Concerning our current status regarding scientific advances about

individualistic experiences and scientists' capabilities of recognizing the content of thought of the other person in very basic ways via fMRI machines, we have attained a position within our present information age that allows for us to observe what used to be regarded as totally private information, for instance (Brant, 2012).

Despite these assumptions, the dichotomy or dualistic speech about "mental stuff" and "physical stuff," which is generally and respectively presumed to be internal versus external, involves obvious misconceptions as well as hidden ones since. For example, nobody can non-arbitrarily point to or demarcate any line between mental and physical things. The reason for this can well be explained via describing mental phenomena as postulates of speculative theories, which supply these mental entities (i.e., as imagined objects or events) to scientists but require much further explanation.

Such a mental entity (e.g., a mental image, qualia etc.) typically serves as an *explanans*, although it may be mistaken as an *explanandum* (Ivanov, 2013). That is, mental imagery serves as a concept and phrase that does explain, but the phrase "mental imagery" still requires explanation itself. So, mental imagery is that which explains, but the imagery is not that which is being explained because what is being explained is unknown until it is uncovered as a complex and functional anatomical feature or behavioral tendency in complex relations to the environment.

This distinction between mental imagery as an *explanans* rather than an *explanandum* is important and will be addressed again. Physiological

psychology aims to explain mental phenomena in functional and anatomical terms. Physiological psychology focuses upon the complexity of active structures of the nervous system and organism that are necessary and sufficient for mental imagery and creativity, according to various views, such as physicalism. First-person accounts of mental imagery and creativity offer a different level of observation and allow different levels of analysis to arise. However, first-person accounts may lead to grave misconceptualizations, especially if they fail to be partially confirmed via scientific methodology.

Mental imagery greatly contributes to people's creative expressions in ways that are necessary in order for those expressions to be performed. By this, again, I mean that the sort of phenomenon that we are investigating is relationally crucial in respect to creating innovations, say, in a similar but more specific manner in comparison to the way in which the mind is crucial for creative expression, despite the fact that one element of the creative process sometimes involves the paint that is accidently knocked over and which strikes the canvas at unforeseen angles, i.e., the unanticipated and unintentional aspects that sometimes contribute to our judgments of the brilliance of the creative arts.

The unexpected events that are incorporated into the creative process, which are referred to as "coincidental" or "accidental," are sometimes quite important. However, they are inessential aspects concerning creativity, according to the latter view, and they shall not be discussed within the scope of this book. Certain characteristics, such as the vividness of imagery, may become less important when people become more reliant upon written or spoken

language (or their hands and movement patterns when they play instruments) in order to express their creativity. However, discarding mental imagery entirely is closely akin to ignoring a most crucial part of the faculty of the imagination, and the theme of the imagination has been one that has an ancient philosophical history predating Aristotle (Shields, 2011).

In philosophy we often attempt to illustrate these ranges between what is *imagined* to be polar opposites, to wit: We analyze the entities under investigation, such as mental imagery, within a range on several scales (e.g., from order to disorder), including individuals with grave deficiencies but who form mental imagery (e.g., minimally conscious patients) and those with remarkably elaborate vividness and accuracy levels concerning mental imagery (e.g., ingenious inventors, creative business owners, managers, and artists). The range of the philosophical analysis from order to disorder also includes the sane and the deranged, which may involve either the voluntary formations of mental imagery or the greatly invasive mental imagery that involuntarily arises.

Philosophers organize the research material and texts of psychology into formal and structured arguments and place much of the conceptual content into historical settings that relate to the development of the ideas within the history of thought.

Psychology, as an approximately 150 year old science, generally focuses upon populations of *people from Western countries that are industrialized, democratic,* involve much *formal and institutionalized education* and have

relatively higher amounts of *wealth* than most of the human population both at present and throughout human history[2] (Henrich et al., 2010).

Moreover, there is great focus upon undergraduate students as subjects within psychology experiments, especially psychology students who can easily be compensated for their time and efforts via extra credit for their courses. Students consequently learn about the experimental conditions and process, but they simultaneously exacerbate the problem, which is partially solved via multicultural experimentation.

Thus, we should consider that many of the psychological attributes and their generalizations that are made may only reflect a small portion of humankind. Additionally, several studies, such as Segall et al. (1966) and Henrich et al., (2010), provide reasons to consider great differences in respect to the general types of populations investigated by psychologists as well as the populations' differences in regard to performances on sensation and perception tests and with illusions, which suggest that there may be significant differences in groups' mental imagery formations that are investigated by science in relation to those billions of people who have never partaken in any experiment whatsoever.

[2] There are an estimated 108 billion humans who have been born throughout the history of our species, according to the Population Reference Bureau (2013, www.prb.org), and slightly over seven billion on the planet in 2013.

C. Aims of Investigation: Contributions to Philosophy and Cognitive Science

The aims and purpose of this book concern a partial reconciliation of some historical concepts in philosophy and psychology with the much more contemporary and practical concepts within cognitive psychology. Of course, cognitive psychology is an interdisciplinary study, which involves neuroscience, computer information systems and graphics and several other fields. However, in the 21st century there is often a reluctance in respect to cognitive psychologists working together with philosophers. So, this book is an attempt to serve here as a bridge between these disciplines without an expensive toll.

The problem with science and philosophy is at least twofold: on one hand, scientists, e.g., cognitive psychologists, are often far too focused upon the generation of empirical data, which gives them the problem of lacking the developed ideas (i.e., ideas developed by means of logic and rational argumentation) that guide groundbreaking experimentation via constructions of hypotheses that test theories. Scientists, hope they can find answers to the problem of creativity and mental imagery via accumulating enormous amounts of information and facts.

However, principles and theories that guide revolutionary experimentation require philosophic assessment, which evaluate the internal consistency of the working theoretical framework by means of deriving logical conclusions that either point out theories' absurdities or misconceptions or provide much greater support for their internal and external consistency. External consistency involves

consistency with the actual world (i.e., the possible and real world in which we live) as well as with other worldviews that arise from different theoretical stances.

Such worldviews are evaluated philosophically in virtue of their comprehensiveness, parsimony, absence of contradictions and practicality. So far there is neither a comprehensive theory of mental imagery nor creativity, and we must question the parsimony, consistency and practicality of the theories we utilize in order to form scientific hypotheses concerning mental images and creativity. Practicality in science is one means by which the external consistency of some theory is evaluated because if the theory is conceivably tested via experimentation (i.e., after there are indications that certain hypotheses will produce confirming or disconfirming evidence for the theory after the experimentation), the application and use can be in favor of the theory, which provides confirmative evidence that the theory is externally consistent.

On the other hand, even analytic philosophers place far too much importance on theorizing from the armchair, while they tend to greatly ignore empirical research about the mechanisms behind mental imagery, sensory experiences by means of various sensory modalities, creativity and other neurocognitive functions that require rigorous interpretations of data that has been scrupulously collected via scientific methods and honest practitioners (Metzinger, 2003).

My contributions to the latter interrelated problem (i.e., of the philosopher of mind who *ignores* the scientific discoveries and the cognitive scientist who *accumulates worthless data* without paying attention to theoretical underpinnings

that support useful hypotheses) within this short cognitive psychology book concern offering explanations for sensation, perception, mental imagery and creativity that provide useful analogies for understanding these vital concepts in addition to historical definitions that not only demonstrate the originators of the important developments of these conceptions but also provide simple and easy to understand terminology that can be useful for teaching methods and learning.

Lastly, the aim of this book is to present parallels in philosophy and science with the accompaniments of excerpts and conclusions from cognitive sciences that either challenge or compliment certain philosophic principles and assertions about the mind or brain and its functions.

In philosophy and psychology we all want to know how the mind works and what interesting, important and practical things we can create from such knowledge with the assistance of sciences! Generally, there are six assumptions that tend to prevail and provide the foundation of research programs concerning philosophy, cognition, neuroscience, psychology and the like, which include:

(1) We have minds, and we have bodies (i.e., solipsism is presumably false, for instance). **(2)** A single individual's minds and body function together in multifarious ways. **(3)** bodies of biological organisms are physical and publicly observable (i.e., our bodies consist of matter, and occupy space).

(4) Each of us have mental lives that *appear* to be private in various ways. **(5)** Each individual has a "privileged access" to information or content of one's own mind (e.g., if I experience pain, the best person from whom another may attain knowledge about my pain is me since I do have this privileged access

to such information). **(6)** human minds evolved with or as central nervous systems of our ancestors via particular biological processes (e.g., natural selection, kin selection and sexual selection) in combination with factors that differ in respect to rates of survival, death, reproduction, and variance (i.e., the slight variances of members of a species from the other members and variance in genotype, phenotype etc. concerning the parent or parents and offspring (Brant, 2012; Grimm, 2008).[3]

The weakest assumption above is perhaps (4) since it refers to an appearance, which neither involves the assumption that anything concerning what is mental is private nor that the mental stuff is public in virtue of attaining information about the individual. However, (6) is perhaps the most dubious assumption because it refers to the biological evolution of the mind, for instance, rather than the brain, which is anatomically and physiologically distinguishable, although the mind has historically been mistaken to exist within the heart, for

[3] **(6)** entails that with brain damage one may, in fact, lose many or all of the features of the mind that arose as results of evolution and individual development. Comparative vertebrate anatomy and the fossil record of the five types of vertebrates (e.g., fish, amphibians, reptiles, birds and mammals) teach us that the first types of vertebrates from which we evolved were agnathan fish, which were the ancient ancestors of second type of vertebrates, the amphibians (Benton, 1993). Some of the ancient amphibians are distinguished from reptiles insofar as amphibians lay eggs in water, beginning the life cycle mostly submerged, whereas reptiles lay eggs on land and evolved from some of the more ancient amphibians. Lastly, mammals and birds evolved from reptiles with a few exceptional species, such as platypuses, which are mammals that lays eggs, and dolphins and whales, which are mammals born within the water. Since biological organisms require sufficient amounts of oxygen in order to perform cognitive tasks, to have brain activity, and to think, in general, and since oxygen consumption levels are lower within the water via gills and skin than for air breathing organisms (Kumar & Hedges, 1998), especially concerning larger vertebrates, the evolution of the human mind and brain in addition to its development during a single lifespan are greatly due to the evolution of vertebrates following fish and amphibian developments.

instance. Many proponents have even argued that all matter has mental attributes (i.e., panpsychism).

What lies before you within the following pages is a harmonious union of philosophy and cognitive psychology, which have been, respectively, developed via rational argumentation and logic and the accumulation of data and their interpretations via inferential statistics as well as by means of the scientific method by various practitioners within the cognitive sciences.

The philosophic principles and assertions about creativity and mental imagery shall first be presented with minor accompaniments of relevant material within the field of cognitive science, and special attention is paid to David Hume's philosophic system in respect to mental imagery. Cognitive psychologists may ask: Why should David Hume's 18th century philosophy be given such great consideration concerning mental imagery and creativity?

What is being offered here concerns many overlooked aspects of Hume's theory of mental imagery (i.e., Hume's so-called "ideas") and creativity (i.e., special combinations of these ideas with one another via Hume's principles of transitions of thoughts). For instance, Hume offers what he argues to be three comprehensive ways through which an individual transitions from one type of mental image to another one (i.e., the principles of resemblance, contiguity in space or time and causation), which specifically occurs when the individual is not led to form a mental image on the basis of any experience involving some immediate sensory perception (i.e., as opposed to the remembrance of a sensory perception).

Perhaps many of Hume's interesting and insightful descriptions about how mental images function in relation to other formations of mental images is still beyond the scope of cognitive science. For instance, we cannot yet combine the 1950s technology of the isolation tank developed by John Lily for sensory deprivation (i.e., within which individuals float in a soundproof and pitch black chamber in salt water at body temperature) with the real-time functional Magnetic Resonance Image (fMRI) machine *noiselessly* scanning the individual's brain activity. Some of the latter ideas were used within the 1980 film Altered States.

The fMRI machine currently sounds like a loud and terrible siren, which many people even exclaim that they "hate," and they generally involve the human wearing clothing at room temperature or colder and being within a well lit room, which is in stark contrast to a sensory deprivation chamber. The experience of the fMRI is absolutely terrible, and many people find it comforting when another person tells the subject how long the subject has been in the fMRI and how much more time is left.

Thus, cognitive neuroscientists are confronted with many unwanted sensations and perceptions that interfere, like noise, with both the observation and analysis of the images of neural networks. Perhaps future inventions of fMRI machines with sensory deprivation functions will lead many experimenters to ignore vast amounts of the current cognitive neuropsychology research with our fMRIs. Of course, scientists who have access to fMRI technology require vast amounts of funding and, therefore, underemphasize many disadvantages regarding the technology they must use.

Various psychologists support Hume's philosophy and even use his examples in virtue of forming 21st century scientific hypotheses that test Hume's system of thought. For example, Jonathan Haidt (2001, 816; Haidt & Joseph, 2011) supports Hume's theory and describes Hume's stance as one that coincides harmoniously with contemporary moral psychology. John Biro (Smith, 1990) wrote an article titled "Hume and Cognitive Science," which treats a vast amount of Hume's whole philosophy as worthy of contemporary scientific consideration. Cognitive scientist and philosopher of mind, Jerry Fodor (2003, 8) argues that there has been a great change in the interpretation of Hume's writings concerning the empirical theory of ideas, which is justified via the capability to build scientific research and experimental programs upon or consistently from such theory:

> "Hume saw that accepting (what historians of philosophy call) the "Theory of Ideas" is central to constructing an empirically adequate account of cognition; indeed, that it is primarily the commitment to the Theory of Ideas that determines what form an empirically adequate cognitive psychology must take. For Hume, as for our contemporary cognitive science, the mind is preeminently the locus of mental representation and mental causation. In this respect, Hume's cognitive science is a footnote to Descartes's, and ours is a footnote to his. . . . Hume sees that the ultimate vindication of the Theory of Ideas must be to show that you can construct an independently warranted empirical psychology around it; that is Hume's argument for the Theory of Ideas. . . . {T}he 'Theory of Ideas' (TOI) is more or less interchangeable with the 'Representational Theory of Mind' (RTM); both designate a familiar galaxy of claims including that typical propositional attitudes are constituted by relations to mental representations; that mental processes consist of causal interactions among these interrelated states and entities, and so forth.

Philosophers do tend to describe phenomena quite differently and appeal to various reasons that often relate concepts rather than simply involve strict use of observations concerning scientific methodology. However, one operational

assumption that presides throughout this book is the similar assumption that philosophic theory concerning cognition, mental imagery and associated processes for the expression of creativity must be justifiable via the theory's ability to yield scientific research, hypotheses and experimentation that tests the theory in order for the theory to be grounded, practical and evaluated in accordance with external consistency. Fodor and I thus maintain that Hume's theory of ideas includes the latter attributes.

Haidt[4] and many other psychologists praise Hume's empiricism and his theory of the sense of morality as well as criticize Immanuel Kant's ethical theory. Some of these criticisms involve cognitive science because they are also relevant to theories of knowledge that produce definitions for such concepts as cognition, sensation, perception and mental imagery as well as ways in which we attain knowledge, which are relevant to all of these conceptions. In opposition to Haidt's (2001 & 2011) mischaracterization of Kant as a "rationalist," Immanuel Kant (1781 &1787) states within the very first lines of his introduction "On the Differences of Pure and Empirical Knowledge":

> "That all our knowledge begins with the experience there can be no doubt. Because where else should the capability of knowledge become awakened into exercise, if it would not happen via objects that stir our senses and effect, in part, the representations (or mental images) themselves, and bring parts of our active understanding into movement, comparing these, separating or connecting them, and processing the raw stuff of sense impressions toward a knowledge of objects, which is called experience? The following time, anyway, foregoes no knowledge within us before the experience, and with experience everything begins.

[4] Unfortunately, Haidt (2001) mischaracterizes Kant's philosophy as a form of rationalism (i.e., the thesis that some ideas are inherited rather than attained entirely via experience) rather than as a union between empiricism and rationalism, which is made explicit within Kant's first lines of his magnum opus, *Critique of Pure Reason* (1781 & 1787).

If, however, uniformly or straight away, all of our knowledge with experience arises, then knowledge for that reason definitely does not emanate or originate entirely from the experience. Because it could well be that our knowledge from experience itself is that which is compounded from knowledge that arises with experience and knowledge that does not, and which we receive through impressions as well as that which our own individual capability of knowledge (purely compelled via sensory impressions) yields from itself, and which has additional basic elements we cannot distinguish until much practice and attention of ours has been put forth toward making these dissociations. It also still requires a closer investigation rather than readily discarding the question at first appearance: Whether there is independent knowledge of the same kind as from the experience which itself comes from all of the impressions of the senses. One calls such knowledge a priori and distinguishes it from the empirical, which has its sources a posteriori, namely, in the experience."

John Tyndall (1896, 103-4) argued similarly within his lecture in 1870 that there is an inherent usefulness of the imagination in science, and the formation of an *explanans* of what is able to be experienced via sense perceptions involves something that goes beyond the immediate origins of experience, such as mental images:

Philosophers may be right in affirming that we cannot transcend experience : we can, at all events, carry it a long way from its origin. We can magnify, diminish, qualify, and combine experiences, so as to render them fit for purposes entirely new. In explaining sensible phenomena, we habitually form mental images of the ultra-sensible.

The "independent knowledge," to which Kant refers, concerns what we know and that may, in principle, transcend the boundaries of any possible and finite experience. For example, many adults and adolescents as well as some children would claim to know that "the shortest distance between *any* two points is a straight line." However, such knowledge cannot be attained directly from (or arise out of) any set of experiences in ways that depend entirely upon experience

of things within the environment for the assertion and realization of such knowledge claims.

Such knowledge cannot originate even in manners that depend on any immediate set of conscious experiences in order to be learnt as facts among many other facts like them, because no set of experiences is infinite, but such knowledge of straight lines, distance, and points is either about all sets of coupled points whatsoever or about an infinite number of them, which, in both instances, goes beyond any possible set of experiences. Kant, thus, questions whether this type of knowledge (i.e., concerning all or infinite numbers of coupled points joined by straight lines and involving the shortest distances between them) is independent knowledge in the same sort of way that we presumably have independent knowledge of, say, a cup lying on the table because the cup is on the table, which is independent from any experience and knowledge.

In the latter case the cup partially causes the experience and is requisite for such knowledge. So, the question arises whether the fact that "the shortest distances between all coupled points are always straight lines" is a fact that is independent of experience and knowledge in the same way as the cup on the table or whether such a fact is mind-, subject- or observer-dependent, for instance.

Additionally, Kant is accredited with the first modern view that is vastly different in virtue of the typical way of understanding objects. Kant argued that the objects of consciousness, about which we know, are involved in a sensory perception process through which objects (i.e., that exist independent from

perception and experience) must already conform to our ways of forming cognitions before we can know, understand and consciously experience anything as an object. Thus, observation, according to Kant, requires aspects of objects conformations to the receptivity of sense perception, and objects' conformations must be able to be cognitively filtered during the process of their utilization for the attainment of knowledge.

Previous scholars and even contemporary researchers have focused more upon higher order cognition, assuming that belief as an aspect of a cognitive recognition process of objects (e.g., the belief the cup is on the table) mostly involves the conformity of the belief with the objects, which is less fundamental, as opposed to Kant's idea that the objects always first conform to the ways of believing.

Translations and interpretations are often neither accurate nor charitable to what was meant. For instance, my translation of Kant above could have involved substituting the words "knowledge" (i.e., *Erkenntnis*) for "cognition" or the less likely alternative word, "perception," and the term "representations" (i.e., *Vorstellungen*) for "imaginations" or "mental imagery," and perhaps even substituting the word "experience" (i.e., *Erfahrung*) for "know-how" (www.dict.cc/?s=know+how).[5]

[5] Unfortunately, many translations of Kant in English are misleading. For instance, the word *Anschauung* means "view," and *Intuition* obviously means "intuition," and although Kant uses both of these German italicized words, the word *Anschauung* is translated by philosophers as "intuition." The meanings of phrases are problematic, and Kant was one of the innovators who began a new style of writing in German.

Neither Kant nor Hume's comprehensive philosophic systems concern the content of this book. Certain aspects of Hume's skepticism are briefly mentioned. What remains of Hume's works within the subsequent pages concerns a series of selected relevant arguments, principles, analogies and examples related to the results of inferential statistics, observations, experimentation and conclusions derived from contemporary cognitive science.

D. Scientific Use of Theoretical Postulates: From Atoms to Cells

IMAGERY AS A SCIENTIFIC POSTULATE AND OTHER POSTULATES IN THE HARD SCIENCES: Scientific methodology very often utilizes postulates in the form of theoretical entities. For instance, this is the case for physics (e.g., the Rutherford-Bohr model of the atom) and the physical entities that physicists postulate, observe, analyze and measure to certain extents, which are derived from the latter measures in accordance with specific levels of observation and analysis. Postulates and theoretical entities include what are considered to be physical objects or physical phenomena, like *atoms* and *photons* or *light*, which are absolutely necessary in order for anything to live. They are all necessary conditions for mental imagery formations.

What is obvious is the fact that without atoms, chemical elements and molecules (e.g., carbon, hydrogen, oxygen, and water) and without light there would be no cells. Without cells humans could not form mental imagery. What is less obvious is exactly how atoms, light and cells (e.g., as neural networks)

should be best defined and utilized conceptually in order to enlighten us about mental imagery and creativity. Mental imagery is observable from very different levels of observation than atoms, photons and cells because such observations must incorporate the latter entities, which form complex neurocognitive interrelations that enable mental imagery formations.

In microbiology the postulates are *cells*, which consist of abstract and quite general but necessary characteristics that are used to describe the widest array of life from bacteria and other unicellular microorganisms as well as the entire human being who consists of roughly 100 trillion cells (Alberts et al., 2002). As theoretical entities I do not mean that there is no such thing as a cell because, indeed, there are many life forms, including fungi, plants and animals, that have cells, but no organism possesses any cell that ONLY contains the characteristics of the general concept of the cell, i.e., no such cell exists which has NO other characteristics apart from what is contained within the general description of what a "cell" is. Thus, any cell is far more unique and complex than any description of a cell.

The reason why there is an absence of any specific characterization of cellular life via the abstract conception of a cell is simple, to wit: each cell of an organism contains much more than what is conceived as the general concept of the cell or cellular life, anatomically and physiologically speaking. The concept of the cell is utilized for teaching and learning a biological concept that is interrelated with many others. So, even unicellular organisms are far too diverse to enable comprehensive and consistently descriptive generalizations that would

account for these biological structures that are considered the most minuscule units of life that can also be classified as living beings.

The reason why any real cell's traits are much more complex than the universal description of a cell's traits is that the *cell* is a general biological concept that appears to imply that a cell is easily distinguishable from other cells as well as a cell's environment, for instance, via certain modes and levels of observation, such as vision via microscopes. However, cellular components of single-celled and multi-cellular organisms are far more complicated than the characteristics that all different types of cells have in common. Cells are dynamic, and each has a unique life span.

Additionally, distinguishable characteristics that are typically ascribed to cells are greatly relative to the specific level of observation (i.e., appearing one way via only one level of observation and another way via other levels). Characterizations of cells require specific ranges of microscopic levels of observation in order for agreements to be made about them amongst multiple observers. Despite what cell we see with the lens of the microscope and the inferences we make about the cell's independent structure with borders or a cell wall, the microscope itself "lightens up" the cell and, therefore, penetrates through, reflects away from and absorbs within the cell with photons of various frequencies. Photons from microscopes are less invasive than sunlight. So, they typically present no important changes for standard observation.

Cells constantly and continuously absorb, emit, reproduce and are penetrated by all sorts of physical entities (e.g., molecules, photons etc.), which

entails that they cannot be easily distinguished from the environment within which they function. Living cells emit biophotons (Rahnama et al., 2011). So, distinguishable characteristics depend upon the level of observation and analysis from which the distinctions are drawn. The levels of observation vary greatly and are describable in several manners, including via technological descriptions involving the ranges of microscopes' magnification levels with which cells appear.

We may apply the concept of an "abstract idea" to the concept of the cell in order to understand its relevance as a necessary condition concerning the imagination, mental image formations, and creativity. George Berkeley (1710) explains that there is no such thing as a general triangle or abstract concept of a triangle because triangles can range from a wide array of possible lengths, can have symmetry or asymmetry, can consist of multiple colors, etc. Cells also range greatly in their sizes, colorations, symmetries etc.

So, there is no triangle that can both exist and be characterized by all of these diverse characteristics that triangles, i.e., as possibilities have, but which no single triangle really or even potentially possesses; this is what is meant by "abstraction," which also applies to concepts, such as atom, photon, mental image and cell. Our descriptions of cells are crucial to mental imagery insofar as mental imagery forms via neurocognitive processes, involves various sizes, types of activity, and chemical elements, nerve cells and neural networks (i.e., as necessary conditions for mental imagery). Cells, photons etc. are abstractly characterized within this book so that levels of investigation can be pursued that

better accompany explanations for the interconnections of mental imagery and creativity.

The process of abstraction involves the production of such concepts as triangles, atoms, photons, cells and mental imagery, which form by means of the reduction of informational content concerning some observable phenomenon in order to retain information relevant to a certain model or purpose. For example, the abstraction of a pig skin American football to the more general and abstract concept of ball allows one to reduce the information that is case specific to that particular ball. However, misconceptions may arise as a result of one considering that all balls are spherical when, in fact, such a ball is certainly not spherical but appears ovular and three-dimensional with two tapered ends.

E. Scientific Use of Theoretical Postulates: Mental Imagery

Mental imagery is another type of postulate in the form of a theoretical entity, which is utilized in cognitive science, psychology, robotics, computer science, philosophy etc. A theoretical entity is a symbol and aspect of a spatial and temporal or mathematical model, which corresponds to some particular data set attained from observations. In certain sciences, such as microphysics the theoretical entity does match or closely resemble the actual entity itself. However, the image is crucial for understanding the physical meaning of the entity.

In the same manner that it would be difficult to grasp what mental imagery is by describing just the neurological activity of certain networks of cells within brains, we are challenged by the task of understanding the concept of the "cell" in biology by means of describing bundles of atoms or chemical elements (e.g., carbon, hydrogen and oxygen, which combine to form water molecules and account for most of what a cell is), i.e., because different levels of analysis and observation are required for the descriptions of cells than for descriptions of molecules or atoms and likewise for mental images.

Mental imagery is recognizable to each of us who is able to non-verbally imagine sights, sounds, tastes etc., which could include you closing your eyes and visualizing the bright yellow and circular shape of the sun situated above a snowy, triangular mountain top, and such visualization might be described as happening within the spatial limits of this set of images of your imagination in a similar manner to the spatiality of your visual field. You may consider the visualizations you have had during novels you read.

Can you close your eyes and envision the scenery of the sun and mountain with your mind's eye? Cognitive neuropsychology provides ways to objectively measure the characteristics of mental imagery referred to as "degrees of vividness" by using fMRI machines, which measure (de)oxygenated blood flow, and psychophysical tasks, which come in various forms (Cui et al., 2007), such as those in **Fig. 1** (Shepard & Metzler, 1971).

Experimentation with individuals forming visual mental imagery within fMRI machines have illustrated, for instance, that the lateral occipital complex is

activated when the subjects either imagine or see letters “X” and “O” (Stokes et al., 2009). The middle temporal area of the visual cortex is involved with visual mental imagery of stimuli that move (Goebel et al., 1998), and visual mental imagery of houses and facial expressions involve activations within the ventral temporal cortex (O‘Craven & Kanwisher, 2000).

What still has to be accounted for concerns the difference between brain activity and images since they are not both presented together as a single plan and at one position. What then arises are descriptions, which are correlations between the body, including the brain, and worldly phenomena (i.e., the environment, which includes everything that is relevant for such descriptions) (Gherdjikov, 2008).

There are many differences, of course, between seeing and visually imagining, which are also measurable with fMRI analyses and psychological techniques. For instance, during visual perception the response time periods of neurons are significantly shorter than during visual imagery formation, which can differ anywhere from approximately 0.1s to about 0.8 seconds (Kreiman et al., 2000), and areas, such as the auditory cortex tend to show great reductions in neural activity during the act of visual mental imagery, whereas the auditory cortex remains active during tasks that require seeing (Amedi et al., 2005).

Theoretically speaking, what we want to avoid are certain ways of understanding mental imagery that involve *absurdities*, such as the idea that mental images are pictorial representations in the mind or brain, especially if that requires one to view these *postulated pictures of the mind as being viewed from*

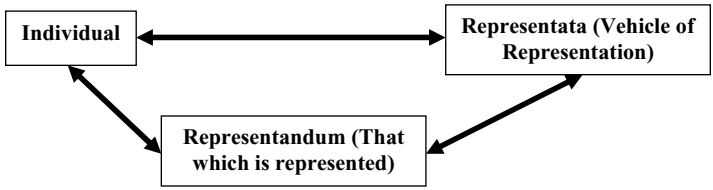
within, only being viewable in the mind, or requiring a viewer from within. Another set of theoretical absurdities involves the insistence that the *self*, or selfhood, is a substance that persists through time and which views these mental pictures that are totally private.

Many problems arise concerning the latter sorts of speculative hypotheses (or theoretical analogies) since, for example, other types of mental imagery from other sensory modalities (e.g., tactile or olfactory mental imagery of itches, touches and smells) are not well represented within pictorial frameworks of imaginative and individualistic information organization and their interpretations. There are, of course, cases with technology that involve sensory substitution devices, such as glasses that have video input capabilities along with audio output, which allow for blind people to perceive visual images via musical sounds (Levy-Tzedek et al., 2012).

A complicated set of conceptions arise when one attempts to utilize "mental representation" as a instrument of the nervous system. For instance, the mental representation is often conceived as including the vehicle which represents (i.e., the representata, including neurocognitions), that which is being represented (i.e., representandum, which are physical entities), the individual as well as the interrelations between the latter triad shown in **figure 2**.

The mental representata perform some of the most complex cognitive processes of the brain that incorporate information that is relevant to enhancing survival chances efficiently (Metzinger, 2003, 43).

Fig. 2 Theoretic Relations of Mental Representation



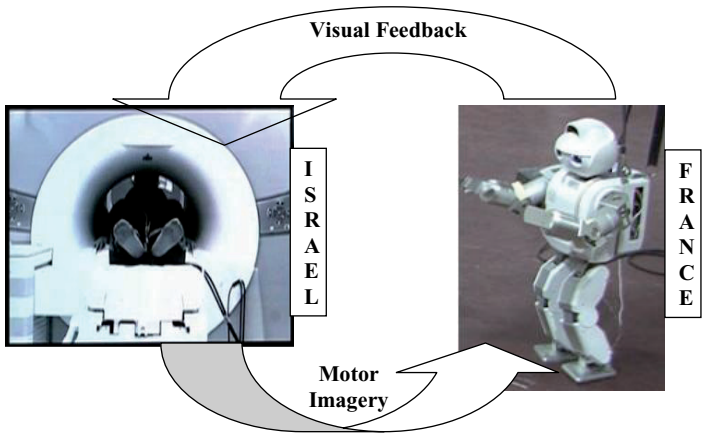
Mental representations are generally considered to be different from representations that can occur within the environment, such as a log that may stand-in and replace a beaver's dam or something that fills in for something else, such as the auditory information that fills in for the excitement of the visual cortex via light when blind people use sensory substitution devices (Levy-Tzedek et al., 2012).

Of course, it is always virtuous to ground our theories (or construct them) from some practical application when possible. Some of the most innovative research concerning mental imagery involves one imagining that she is moving her own arms and walking while she lies within a real-time fMRI machine. The digital images produced by the fMRI, which result from formations of visual and motor imagery, are sent as signals from an fMRI laboratory in Rehovot, Israel to Béziers, France where the signals become the digital input for a bipedal robot that moves the same directions that the subjects imagine moving.

The goals of the experiment were accomplished when subjects controlled the robot's directions of movements by means of what many refer to as "thought control," in addition to visual feedback and digital signals sent over the internet.

Figure 3 illustrates this experimentation conducted at the Joint Robotics Laboratory.

Fig. 3 Thought Control, Mental Imagery and Guiding Robots via the Internet



Of course, the latter experiment requires the usage of computer programs coding neural activity as well as the conversion of such information to motor commands, which is similar but not identical to the commands sent from the brain to the legs of the patient. Control via purely mental events or thought control, however, does not occur. Cohen et al., (2012, 314) describe their pilot study in **Fig. 3** as follows:

"We present a robotic embodiment experiment based on real-time functional Magnetic Resonance Imaging (rtfMRI). To our knowledge, this is the first time fMRI is used as an input device to identify a subject's intentions and convert them into actions performed by a humanoid robot. The process, based on motor imagery, has allowed subjects located in Israel to control a HOAP3 humanoid robot in France, experiencing the whole experiment through the eyes of the robot."

Thomas Metzinger (2003 & 2013) utilizes two concepts in order to explain the events occurring within Fig. 3, concerning the control of the robot and robotic "embodiment," which include the concepts of the "Phenomenal Self Model" (PSM) and the "Phenomenal Model of the Intentionality Relation" (PMIR). PSM and PMIR are theoretical entities that are utilized for the decisive conceptual interconnection of the first- and third-person approaches to consciousness, mind, mental events etc. Metzinger (2003, 299) writes:

> **"**The content of the PSM is the content of the conscious self: your current bodily sensations, your present emotional situation, plus all the contents of your phenomenally experienced cognitive processing. They are constituents of your PSM. . . All those properties of yourself, to which you can now direct your attention, form the content of your current PSM. Your self-directed thoughts operate on the current contents of your PSM: they *cannot* operate on anything else. . . . If you want to initiate a goal-directed action aimed at some aspect of yourself—for example, brushing your hair or shaving yourself—you need a conscious self-model to deliberately initiate these actions.
>
> Of course, there is unconscious behavior like scratching or automatic self-protective behavior—for instance, when a ball suddenly comes flying toward you at high speed. We can also imagine a sleepwalker scratching himself or even avoiding a ball, or an epileptic patient with an absence automatism brushing his hair or shaving. All these are not self-directed actions, they are self-directed behaviors; a conscious process of goal selection does not precede them."

Typically mental images are not conceived as involving agency, but they are indeed conceived as belonging to the individual and as representational activity. According to Metzinger (2003, 406), concerning conscious experience, the cognitive agency happens when processes of selecting contents of cognition for additional processing becomes represented, in which case it is integrated within the PSM.

The complicated set of events occurring during the experiment portrayed in **Fig. 3** involve mental imagery that is motor imagery combined with visual mental imagery when the subject within the fMRI imagines himself walking, and embodiment of the subject with the robot he controls happens as a result of veridical feedback, involving aspects of the control, agency, and PSM.

Combined visual and motor controlled actions, which are guided via spatial orientation, are described by Milner and Harvey (Vecchi & Bottini, 2006) first in virtue of the primary function of visual systems and in relation to their reasons for being naturally selected through evolutionary processes, namely, because the primary aspect of visual systems functioned in ways that provide animals with distanced sensory control over their own movements. Secondarily, the aspect of vision that is referred to as "sight" evolved much later (Milner & Goodale, 1995).

When mammals, such as humans, walk, there is a coordination and synchronized set of responses that are both visual and motor; these "visuomotor responses" account and compensate for locations and physical properties (e.g., terrain) of the targeted areas to step in addition to the organisms' positioned limbs and body. Embodiment within remote controlled robots is allowing for these evolved processes to utilize this coordination for various alternative goals.

F. Roles of Creativity and Mental Imagery: Dichotomies

At this juncture perhaps it is most appropriate to suspend our conceptual investigation and considerations of the mental image as a scientifically observable phenomenon (e.g., like the atom or cell) and which involves piecing together so many various disciplines' manners of observing and measuring activities that are closely related to each other in respect to the concept of mental imagery. Perhaps to the same degree we find mental imagery to be challenging to study as a result of its relation to abstract, personal, and first-person accounts, we are struck by the abstractness, cultural, social and third-person accounts of creativity.

Creativity in the latter sense involves what is generally considered to be an outward expression or performance of something artful, inventive and innovative in some way, although neurocognitive processes are also assumed to be requisite for the imagination that determines these creative outbursts. According to Nicola Tesla (1919, 5):

"The moment one constructs a device to carry into practice a crude idea, he finds himself unavoidably engrossed with the details of the apparatus. As he goes on improving and reconstructing, his force of concentration diminishes and he loses sight of the great underlying principle. Results may be obtained, but always at the sacrifice of quality. My method is different. I do not rush into actual work. When I get an idea, I start at once building it up in my imagination. I change the construction, make improvements and operate the device in my mind. It is absolutely immaterial to me whether I run my turbine in thought or test it in my shop. I even note if it is out of balance. There is no difference whatever; the results are the same. In this way I am able to rapidly develop and perfect a conception without touching anything. When I have gone so far as to embody in the invention every possible improvement I can think of and see no fault anywhere, I put into concrete form this final product of my brain. Invariably my device works as I conceived that it should, and the experiment comes out exactly as I planned it. In twenty years there has not been a single exception. Why should it be otherwise?

Engineering, electrical and mechanical, is positive in results. There is scarcely a subject that cannot be examined beforehand, from the available theoretical and practical data. The carrying out into practice of a crude idea as is being generally done, is, I hold, nothing but a waste of energy, money, and time."

Nikola Tesla was perhaps the most ingenious and influential inventor, scientist and engineer of our last millennium because, for instance, he revolutionized both mechanic motors and AC electric generators as well as anticipated world-wide wireless communication a century before its development. Within the latter quotation and within **chapter II.C** Tesla's own personal account of his condition is given in order to provide a detailed first-person account of an extraordinary man's ability to form incredibly vivid mental imagery and who is world-renowned for his incredible creative expressions, patents and inventiveness.

Interestingly, some of the cognitive science literature on the topic of mental imagery concludes that there is a relatively minor relation between the vividness of mental imagery and creativity. For this reason a portion of this book attempts to reconcile aspects and experiments concerning mental imagery and creativity as well as provide a detailed account of David Hume's philosophy, which contributes at least in part via its relatively simple terminology and wide-ranging explanatory power that is quite easy to understand, i.e., if it does not mirror what contemporary cognitive psychology expresses about mental imagery and creativity.

Within William James introduction a definition of psychology as a science and its relation to the other sciences and philosophy is given. James (1892, 1-2) ascertains that:

"**The definition of Psychology may be best given in** the words of Professor Ladd, as the *description and explanation of states of consciousness as such*. By states of consciousness are meant such things as sensations, desires, emotions, cognitions, reasonings, decisions, volitions, and the like. Their 'explanation' must of course include the study of their causes, conditions, and immediate consequences, so far as these can be ascertained.

Psychology is to be treated as a natural science . . . This requires a word of commentary. Most thinkers have a faith that at bottom there is but one Science of all things, and that until all is known, no one thing can be completely known. Such a science, if realized, would be Philosophy. Meanwhile it is far from being realized; and instead of it, we have a lot of beginnings of knowledge made in different places, and kept separate from each other merely for practical convenience' sake, until with later growth they may run into one body of Truth. These provisional beginnings of learning we call 'the Sciences' in the plural. In order not to be unwieldy, every such science has to stick to its own arbitrarily-selected problems, and to ignore all others. Every science thus accepts certain data unquestioningly, leaving it to the other parts of Philosophy to scrutinize their significance and truth. All the natural sciences, for example, in spite of the fact that farther reflection leads to Idealism, assume that a world of matter exists altogether independently of the perceiving mind. Mechanical Science assumes this matter to have 'mass' and to exert 'force,' defining these terms merely phenomenally, and not troubling itself about certain unintelligibilities which they present on nearer reflection. Motion similarly is assumed by mechanical science to exist independently of the mind, in spite of the difficulties involved in the assumption. So Physics assumes atoms, action at a distance, etc., uncritically; Chemistry uncritically adopts all the data of Physics; and Physiology adopts those of Chemistry. Psychology as a natural science deals with things in the same partial and provisional way. In addition to the 'material world' with all its determinations, which the other sciences of nature assume, she assumes additional data peculiarly her own, and leaves it to more developed parts of Philosophy to test their ulterior significance and truth. These data are --

1. *Thoughts and feelings*, or whatever other names transitory states of consciousness may be known by.

2. *Knowledge*, by these states of consciousness, of other facts. These things may be material objects and events, or other states of mind. The material objects may be either near or distant in time and space, and the states of mind may be those of other people, or of the thinker himself at some other time.

How one thing *can* know another is the problem of what is called the Theory of Knowledge. How such a thing as a 'state of mind' can be at all is the problem of what has been called Rational, as distinguished from Empirical, Psychology. The full truth about states of mind cannot be known until both Theory of Knowledge and Rational Psychology have said their say. Meanwhile an immense amount of provisional truth about them can be got together, which will work in with the larger truth and be interpreted by it when the proper time arrives. Such a provisional body of propositions

about states of mind, and about the cognitions which they enjoy, is what I mean by Psychology considered as a natural science. On any ulterior theory of matter, mind, and knowledge, the facts and laws of Psychology thus understood will have their value."

James places the role of philosophy as one that involves a comprehensive picture or a "science of all things," which plays the role of evaluating and scrutinizing some the involvements of sciences' acceptances of data that are arbitrary and are accepted without question. Obviously, some of the data provides practical purposes when it is unwaveringly presumed to be true.

James (1892, 3) later asserts that "{m}ental facts cannot be properly studied apart from the physical environment of which they take cognizance." It is at this juncture concerning the proposed dichotomy and, according to some views, a fundamental epistemic distinction between two types of study material, including, on one side, mental events, mental objects, and on the other side, physical substances, physical events etc.

The epistemic dichotomy is also found within our natural tendencies to describe certain first-person and third-person accounts in ordinary language, but often the epistemic dichotomy leads some to seriously consider whether there are two types of fundamentally different stuff with which we are concerned, namely, mental stuff and physical things. Within this book I treat the latter dichotomy concerning real distinction between the mental and the physical as a false dichotomy and misconception that is detrimental to cognitive science.

Particular first-person accounts have been well argued since Wittgenstein to be "immune to error," which include statements, such as "I see a cloud and believe it will snow today" and "my knee hurts," whereas other first-person

statements lack the same sort of immunity, such as “my hand is raised high” and “I grew three inches in girth last year” (Pryor, 1999; Prosser & Recanati, 2012).

Such a dichotomy as the mental-physical one has led many scientists to search for a real distinction and demarcation line and objective boundary between the mental and the physical; the dichotomy often is presumed without doubt or suspicion. However, the dichotomy may in some cases even be useful within the psychological sciences and explaining “what things occur with whom” (i.e., involving the PSM (Metzinger, 2003)) because the mental-physical dichotomy concerns the contradistinctions between subjects, say, within experiments and objects that they will or do experience. Nevertheless, when it comes to some subjects and objects or physical entities there can be absolutely no real or actual distinction that can be made in a non-arbitrary way, and I suggest this is the case for all subjects and objects.

For example, the subjects in an experiment who are accompanied by lights are only determined to be entirely or distinctly different things than the lights are from certain view points and levels of analysis (e.g., it seems that way to the naked human eyes and according to our conscious experiences). However, in fact, light consists of photons, and photons penetrate through our entire visual systems as well as the dorsal and ventral parts of our skulls, photons are absorbed by our brains, causing chemical reactions and color experiences, photons reflect and scatter away from our organisms, and biophotons[6] are even emitted by each of the cells in our bodies.

[6] See Rahnama et al., 2011.

Some prominent physicists have especially characterized the dichotomy described here, including John Tyndall who asserts during “The Belfast Address” on August 19, 1874 that:

> When ‘ nascent senses ’ are spoken of, when ‘ the differentiation of a tissue at first vaguely sensitive all over ’ is spoken of, and when these possessions and processes are associated with ‘ the modification of an organism by its environment,’ the same parallelism, without contact, or even approach to contact, is implied. Man the object is separated by an impassable gulf from man the subject. There is no motor energy in the human intellect to carry it, without logical rupture, from the one to the other” (Tyndall, 1895, 195).

Distinguishing light from the human organism must involve some arbitrary distinctions that are made, which is comparable to the distinction between air, oxygenated blood and our lungs as we exhale, or a woman who is swimming in a lake, gulping mouthfuls of water, and urinating in contrast to (or in a dichotomous opposition to) the water itself (i.e., while we keep in mind that the human organism, organs, muscles, tissues and cells are mostly comprised of H_2O, the chemical formula for water).

Since the so-called subjects are made up of the very objects about which many thinkers attempt to distinguish them from (i.e., whether light, water, air or various other chemical elements), such an endeavor is destined to fail, if it attempts to continually proceed via presupposing that the distinctions are non-arbitrary and real distinctions.

What is requisite for a consistent psychological science concerns reformulations and different conceptual constructions within theoretical frameworks that draw their practicality from their capabilities to contribute to

yielding testable scientific hypotheses. John Richardson (1980, 25) proposes in his book *Mental Imagery and Memory* that Ludwig Wittgenstein (i.e., within his *Blue Book*) was correct when he asserted that “in psychology there are experimental methods and conceptual confusion.”

There should be no doubt that the concept of creativity, which is understood culturally and psychologically, for instance, is one such concept that is confused, and the union between creativity, which is significant to us when it is expressed, and mental imagery, which is significant to us when we imagine our inner worlds that we realize sometimes have nothing to do with the environment within which we live, is even more perplexed.

Creativity can surely be mistaken for some passing social fad as well as the related mass cultural productions, which can substitute successful advertisement campaigns ideas about products for the quality of those products, such as pop art and much music sold via support of mass media systems. How creative can a piece of music be, for instance, which is popular at present but will lose its appeal in five years, when the desire to hear it thereafter all but entirely fades away?

Conceptualizing the theoretical and psychological formations that are called “mental imagery” by contemporary cognitive psychologists, and which were called “ideas” by late 19th and early 20th century psychologists (e.g., Wilhelm Wundt and William James) as well as the late 17th century and 18th century philosophers (e.g., Locke, Berkeley and Hume), requires a vast degree

of interpretation and an approach that inquires about the boundaries concerning the maximum and minimum limitations or ranges of mental imagery.

What is the difference between imagery in a dream and during the waking state? Is daydreaming something that involves some of the same content concerning mental imagery that hallucinations do as well? How dim or faint can mental imagery be before it has negative affects upon creativity? How vivid or intense is mental imagery that has negative affects upon creativity? What is the current theoretical understanding of mental imagery and its vividness formed within patients who are in minimally conscious states? How do creative geniuses, such as Nikola Tesla, compare to in respect to their abilities to form vivid and accurate mental imagery?

Creativity is an amazing mystery that has managed to baffle psychologists and philosophers for centuries. Mental images are those very same things about which Nikola Tesla writes in his autobiography, and which undoubtedly contributed to his efficiency in respect to his very creative and inventive mind. David Hume's philosophical contributions to our understanding of creativity and the manners in which they relate to mental images will be considered as well. Hume's views will be compared to views in modern cognitive science for both a critique of Hume's philosophy and his assumptions along with the assumptions made by cognitive scientists.

Imagery generally pertains to mental events that are visualizations of sights, sounds, smells, tastes and sensory feelings.[7] A vast amount of human

[7] Emotional feelings, on the other hand, may involve mental imagery as a vital role since we do form mental images of emotional facial expressions of anger, sadness, surprise,

thought can be categorized as mental imagery, which is very useful for individuals to make deductive inferences. For example, if a person is asked if an apple is larger than a grape, then the individual may form mental images of both of these objects, compare them and provide inferences based upon the analyzed visualizations. Such mental imagery generally arises in such cases, even if one is asked not to visualize the apple or grape.

Our minds also utilize imagery throughout the creative process. The phenomenon we call 'imagery' we be considered at length in the creative process in order to facilitate an understanding of the mental events that take place when a creative genius derives something innovative.

The field of psychology as a science has only existed for a relatively short period of time in comparison to the other sciences because its origins trace back to around the time period of Wilhelm Wundt at the University of Leipzig in 1879. For example, in 1881 the first journal for psychological research was published and called *Philosophische Studien* (i.e., *Philosophical Studies*, despite its content as a psychological science).

In the early 20th century John Watson, the founder of behaviorism, asserted that only publicly, as opposed to privately, observable phenomena are relevant to science. However, mental imagery is obviously not publicly observable and requires combinations of first- and third-person data in order for it to undergo intense scientific investigation. During the mid-twentieth century behaviorism, the scientific study of human behavior was the dominant approach

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disgust and happiness, for instance. The study of microexpressions psychology may combine with mental imagery studies in order to shed light upon their interconnections and the role of imagery concerning emotions.

in psychology, and mental imagery was not given much attention to until the latter half of the 20th century.

Under the influences of John Locke (1632-1704) and George Berkeley (1685-1753), David Hume (1711-1776), a Scottish empiricist, attempted to describe the functions and nature of the mind. The two perceptions of the mind include impressions and ideas. The latter category of perceptions is comparable to the manner by which cognitive scientists define "mental imagery." The combinatorial process through which Hume describes the nature of creativity with different forms of imagery bonded together is paramount to both an understanding of the mind, and more specifically the creative process. Hume's view of the creative process with a special emphasis upon mental imagery (i.e., Hume's 'ideas') will be compared in the following chapter to views in modern cognitive science within this thesis.

There have been very few experiments concerning mental imagery as it pertains to creativity. The purpose of the present investigation is to analyze experiments regarding both imagery and creativity in an attempt to illustrate the creative process as a whole with a special emphasis on mental imagery.

II. Mental Imagery and Creativity in Philosophy

A. Humean Perceptions of the Mind: Ideas and Impressions

"We may divide all the perceptions of the mind into two classes or species, which are distinguished by their different degrees of force and vivacity. The less forcible and lively are commonly denominated *Thoughts* or *Ideas*. The other species [is called] . . . *Impressions* [*or Sensations*] (p. 455)."

David Hume (1748) *An Enquiry Concerning Human Understanding*

David Hume divides our sensations and recollections of these sensations into two categories, which are: (1) *thoughts or ideas*, and (2) *impressions or sensations*. To Hume, nothing is present to the mind except for impressions and ideas. Thus, the mind is composed of only impressions or sensations and thoughts or ideas, which are all referred to as "perceptions."

Impressions are defined as all the passions, emotions and sensations that first appear in the mind with the most force and violence. Hume labeled the first species of perceptions "impressions," which means "when we hear, or see, or feel, or love, or hate, or desire, or will" (Hume, 1952, 455). Impressions are the perceptions that enter one's consciousness and mind in the liveliest, most violent and forcible fashion, especially in comparison to the less lively ideas, which may be described similarly.

For example, eating an apple may involve seeing the redness, roundness and size of the apple, smelling it, and tasting its juice and the crispness of its skin. If we divide the entire experience, or set of experiences, into their smallest

parts, such as the mere experience of redness, then we are confronted with a simple idea. A complex idea is two or more simple ideas in combination with one another.

When an individual tastes a watermelon, hears a song, feels the wind on his or her face, smells the smoke of a fire or witnesses a sunset, the person possesses impressions or sensations of these events concerning one of two types of perceptions that make up a large part of the content of the person's mind. Or when a woman loves a man, a person fears a rabid dog or an individual hates a family member, these psychical events of the individual are also called impressions.

We may divide these impressions into three groups: **(1)** We undergo impressions that are our sense perceptions, such as visual, auditory, olfaction, gustatory and tactile sensations. The traditional notion of the latter five sense perceptions might, however, be best expanded so that we include the sense of balance in addition to other senses, for example. **(2)** We have impressions referred to as emotions, like sadness, fear and surprise. Interestingly, the latter type of impressions seem to first utilize the sense perceptions in order for emotions to present themselves and their vicissitudes. So, for instance, love, fear and hate cannot take place without the use of sense perceptions and combinations of impressions.[8] **(3)** lastly, we undergo impressions that we often

[8] Emotions have been shown to intensify in cases where more mental imagery formations take place (Holmes & Mathews, 2005 & 2010). Imagery has been shown to evoke emotion in more intense manners than verbal representations, and imagery plays an important role in both psychological disorders and treatment (Holmes & Mathews, 2010).

consciously experience and that directly concern the will, volition, choice or voluntary aspect of behavior.

Importantly, the remembrance of **(1)**, **(2)** and **(3)** illustrates the elaborate varieties of ideas (or mental imagery) preceded by their corresponding impressions. "Ideas . . .are the less lively perceptions, of which we are conscious, when we reflect on any of those sensations," according to Hume (1952, 455). Hume referred to the second species of perceptions as thoughts or ideas. Ideas are the faintest images of the mind that are brought about by thinking, reasoning and reflection or when we think about seeing, hearing, smelling, loving, hating, willing or fearing. Ideas are the perceptions that enter the conscious mind in a manner that tends to be the dullest and least lively fashion.

Additionally, the entrance of the ideas within the conscious experience occurs only after we have already undergone impressions, and these ideas tend to be fainter and duller perceptions of the mind than their comparatively similar and counterpart perceptions, which are the impressions. For example, if you now look at the black pixels or ink of the following word "black," the intensity of the blackness you now consciously experience is still more vivid than the intensity of blackness of the word "**black**" if you are merely imagining the latter intensity in bold, and this is the case even if what you imagine is a darker, more intense black that is in typed in bold letters, except in rare occurrences, such as disorders (e.g., post-traumatic stress disorder or schizophrenia where imagery

can be invasive and extremely vivid). Likewise, for any types of sounds the recall or recollection of the call is most typically not nearly as vivid as the call itself.

When a person looks at a red apple, closes her eyes the following day and visualizes the redness within her mind, when an individual thinks about what it is like to smell a flower or when a woman hears a high pitch note of a mocking bird and reflects on this experience afterwards, the presence of these perceptions are designated 'thoughts' or 'ideas,' according to David Hume.

However, we may also consider these ideas of redness, the scent of some flower and the notes of the whistle to be images in some senses that are representations. That is, they may repetitively present themselves, i.e., represent themselves to whomever forms such mental imagery. Although problematic, a tripartite theoretical framework arises, which can be presented as follows: subject-object-image.

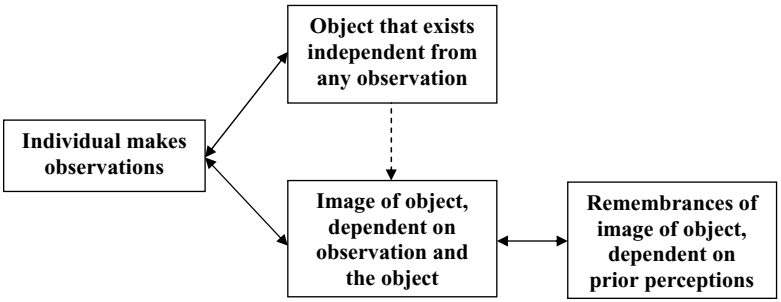
However, the image within the latter model can both be conceived within the Humean model as either the impression or the Humean idea, which resembles what cognitive scientists may call "mental imagery." Additionally, for Hume the cause of the impression is unknown insofar as the impression can be considered to be the object, or else the object (e.g., that exists independent from the perception) causes the impression, which is consistent with the notion that the image is a type or concerns all types of perceptions (i.e., impressions and ideas) of the subject, for instance.

Subject-object-image[9] forms the basis of understanding of representational realism, which is a theoretical position that asserts that objects exist independent from subjects, images and any perception of them, i.e., representational realism is a stance that is typically presumed by cognitive scientists. One theoretic problem of representationalism concerns making contradistinctions between the "image of the object" and the "remembrance of the image of the object" or the "representation of the object" and "memory of the representation of the object," which is illustrated in **Fig. 4**.

Hume's theoretic stance leans towards a form of representationalism because the impressions are given greater relevance with respect to the objects that may necessarily lead to them under the appropriate conditions. In Hume's *Treatise* (Book I, Part I, Sect. I) the following example is given: "To give a child an idea of scarlet or orange, of sweet or bitter, I present the objects, or in other words, convey to him these impressions; but proceed not so absurdly, as to endeavour to produce the impressions by exciting the ideas." For Hume there is a greater connection concerning the presentation of objects and their roles as excitations for the sensory impressions than for certain cases of ideas as excitations of the impressions.

[9] The subject-object-image relation is problematic insofar as there is no way of distinguishing between the subject and object in many cases. For instance, this is the case with light and color, which actually absorbs into the human visual system (i.e., causing chemical reactions that are necessary for color conscious experiences), reflects and scatters away from the visual system and penetrates the visual system. So, it is problematic to maintain at what point the light is the object or image or even the subject since the brain itself as well as all living cells of plants and animals emit ultraweak biophotons, and light is made up of photons (Rahnama et al., 2011).

Fig. 4 Complex Interrelations of Individual-Object-Image and Memory



It is questionable to what extent the image or impression of the object is dependent upon the object itself and just how accurately certain levels of observation can portray the object as an image correlated with certain characteristics of the object. Likewise, it is debatable just how much the remembrances of the image of the object depend upon the object that exists independently and to what extent the remembrances of images affect the subjects observations and images of objects. For instance, "memory color" is a phenomenon that leads perceivers to consciously experience different colors on the basis of different shapes of objects, for instance (Delk & Fillenbaum, 1965).

What immediately strikes me about Hume's philosophy is the ability of assessing "Humean ideas as impressions" themselves from which ideas about the ideas may arise. That is, many ideas may be considered to be impressions from which recollections of them follow, which are less vivid than the preceding perception. So, metarepresentation is easily incorporated within Hume's

philosophy, and an idea, such as remembering the shade of red of an apple, can become the remembrance of the memory of that shade, which entails that certain ideas have the capabilities of being impressions themselves.

Hume understood Thomas Hobbes and John Locke's representationalist stances, but he maintained a philosophy that remained neutral with respect to representationalism or indirect realism. According to David Hume, there are two types of impressions, which include: **(I)** simple impressions; and **(II)** complex impressions. For example, the sensation of redness of an apple is a simple impression, but the sensation of the entire apple's smell, color and shape is a complex impression. The simple ideas and impressions are distinguished by the vividness of their vicissitudes upon the mind.

Simple impressions are what our simple ideas correspond to, which means that we form exact mental representations and copies of simple impressions that we call 'simple ideas.' Hume (1992 p. 3) states that "the rule here holds without any exception . . . that every simple idea has a simple impression, which resembles it; and every simple impression a correspondent idea." All of our simple ideas are derived from our simple impressions. Thus, simple impressions are necessary conditions for simple ideas.[10]

In order to utilize and form new complex ideas the faculty of the imagination is necessary, according to Hume. The faculty of the imagination

[10] It was noted by Hume that every single simple impression is followed invariably by a simple idea, and when one event follows another event on every occasion, according to experience, the first event tends to be labeled the 'cause' and the second event is referred to as the 'effect.' Thus, there are interpretations that conclude that there is a causal relation that is observed in respect to simple impressions being the causes of simple ideas, which are the effects.

takes the simple ideas, separates them and unites them together in various ways. For instance, if we close our eyes for a moment and imagine the color 'red' (i.e., a simple idea), and we take into consideration the 'redness' of an apple while we are looking at one, then the idea of red, formed within the faculty of the imagination, and the impression observed through our eyes differ only in intensity and vividness rather than nature, according to Hume, which is why the impressions and ideas are both considered to be perceptions.[11] If we take a look at a blind person and a deaf person, these two people completely lack sensations and impressions of sight and sound.

However, not only are the sensations of vision and hearing completely absent from the deaf and blind individuals, but their ideas concerning these perceptions are at best rudimentary if not entirely nonexistent, i.e., if they have never had any preceding visual or auditory impression (i.e., congenital blindness and deafness). Perhaps the most obvious instances of deficits include those who are congenitally blind and who therefore can form no ideas about the colors. Even the language that is used with respect to colors is misguiding since reds and oranges may be described to blind people as warm whereas blues and violets are cold, despite the fact that blue flames burn at hotter temperatures than red, orange and yellow flames.

For the latter sorts of reasons a person who has never seen something cannot form visualized mental images. A person who has never heard a note is unable to think about the sounds of music. Moreover, the knowledge that these

[11] Hume did concede that this natural fact about the human psyche is not provable; however, it has not been disproved. In order for this notion to be refuted one needs only to produce a simple idea that does not have a corresponding simple impression.

individuals possess concerning sight and sound are typically those concepts attained through others, which may take place via language.

William James upholds the empiricism of Locke, Berkeley and Hume in various respects within his psychology textbook. James (1892, 302) wrote:

"IMAGINATION: What it is.--*Sensations, once experienced, modify the nervous organisms, so that copies of them arise again in the mind after the original outward stimulus is gone*. No mental copy, however, can arise in the mind, of any kind of sensation which has never been directly excited from without.

The blind may dream of sights, the deaf of sounds, for years after they have lost their vision or hearing; but the man *born* deaf can never be made to imagine what sound is like, nor can the man *born* blind ever have a mental vision. In Locke's words, already quoted, ' the mind can frame unto itself no one new simple idea.' The originals of them all must have been given from without. Fantasy, or Imagination, are the names given to the faculty of reproducing copies of originals once felt. The imagination is called ' reproductive ' when the copies are literal; ' productive ' when elements from different originals are recombined so as to make new wholes.

When represented with surroundings concrete enough to constitute a *date*, these pictures, when they revive, form r*ecollections* . . . When the mental pictures are of data freely combined, and reproducing no past combination exactly, we have acts of imagination properly so called."

After briefly explaining the different degrees by which people experience visual mental imagery, James (1892, 305-6) observes:

"A person whose visual imagination is strong finds it hard to understand how those who are without the faculty can think at all. *Some people undoubtedly have no visual images at all worthy of the name*, and instead of *seeing* their breakfast-table, they tell you that they *remember* it or *know* what was on it. The ' mind-stuff ' of which this ' knowing ' is made seems to be verbal images exclusively." But if the words ' coffee,' ' bacon, ' muffins,' and ' eggs ' lead a man to speak to his cook, to pay his bills, and to take measures for the morrows meal exactly as visual and gustatory memories would, why are they not, for all practical intents and purposes, as good a kind of material in which to think? In fact, we may suspect them to be for most purposes better than terms with a richer imaginative coloring. The scheme of relationship and the conclusion being the essential things in thinking, that kind of mind-stuff which is handiest will be the best for the purpose. Now words, uttered or unexpressed, are the handiest mental elements we have. Not only are they very rapidly revivable, but they are revivable as actual sensations more easily than any other items of our experience. Did they not possess

some such advantage as this, it would hardly be the case that the older men are and the more effective as thinkers, the more, as a rule, they have lost their visualizing power, as Mr. Galton found to be the case with members of the Royal Society."

Interestingly, there are many accounts of even blind people who claim that they can form mental imagery, and the congenitally blind can even draw images in order to represent visual mental images they claim to form. There are cases of colorblindness where individuals may undergo experiences of colors during dreams that they are unable to experience during the waking state, except for perhaps experiences of afterimages or "chimerical colors" that they may experience during the waking state. Arditi et al. (1988, 11) conclude that:

"{C}ongenitally blind people have imagery that is indeed different from that of sighted people. Some aspects of visual imagery are visual, and are not present in blind people's images, whereas sighted people's images have the visual property that angular size diminishes with viewing distance, blind people's images do not."

It is also noteworthy that blind people are able to draw pictures via utilizing graphical perspective in art, which is primarily considered to be a visual concept. However, the information concerning the amount of spatiality represented in the congenitally blinds' mental imagery was demonstrated by Arditi et al. (1988) to be substantially different than the amount of spatiality with regard to sighted folks.

Perspective and the latter accounts involve complex impressions and complex ideas, concerning Hume's definitions of the latter perceptions. Complex impressions are bundles of simple impressions, like complex ideas are compilations of simple thoughts. Simple thoughts and impressions have only a

few distinctions between one another since simple sensations or impressions are more vivacious than simple thoughts, and simple thoughts are derived from memory and are, arguably, combined in various ways via the faculty of the imagination, according to Hume.

Complex impressions and complex ideas include differences other than vividness and the addition of memory. Typically there is a resemblance between complex impressions and ideas. It is not necessarily true that complex ideas are ever just fainter copies of the complex sensations they represent since the complex ideas may not very closely resemble the preceding complex impressions, i.e., even if we concede that we are not referring to the differences in their vividness as perceptions. The comparison between complex impressions and complex ideas does concern the questionable accuracy of memory as well as the capability for the imagination to form accurately representative ideas of the environment in addition to creative ideas and their combinations.

For instance, when a woman eats caviar, she experiences an assortment of sensations, such as tastes, smells and sights. She looks at the caviar and tastes and smells it. All of the characteristics, which contemporary philosophers refer to as *qualia*,[12] which comprise the qualitative conscious experience of the caviar and the individual's relations toward it, are united as simple impressions that combine in a variety of ways in order to compose complex impressions.

[12] 'Qualia' pertains to the introspective nature and phenomenal aspects of mental experience. Arguably, when a person is drinking a cup of coffee, for instance, there is something that this experience is like and this 'likeness quality' is what is referred to as qualia, but any verbal description that a person could give could not provide a satisfactory description of coffee that would be equivalent to the actual experience (Chalmers, 1996).

According to Hume (1992, 3), “I observe, that many of our complex ideas never had impressions, that correspond to them, and that many of our complex impressions never are exactly copied in ideas.”

The latter may be argued to be the case as a result of the inaccuracies or deficiencies of the complex ideas in virtue of being representations of the complex impressions, for instance. One may imagine the Amazon River with waterfalls of wine and beautiful Amazonian women bathing in nearby lagoons, but these complex ideas were not derived from the actual observance of this location and event. The latter concerns the imagination in respect to complex ideas, but there are many examples of complex ideas that may more greatly rely upon the memory than the imagination.

For instance, a person who has seen the city of London could not possibly, i.e., considering the limitations of the human mind or human memory, form an idea of the entire city that perfectly represents each construction, tourist, native and the Thames River. Therefore, it appears obvious that many of humankind’s complex ideas are not derived from complex impressions and various complex impressions are never mimicked in ideas. There is a compensation with respect to the accuracy of memory and the lack of imagination or vice versa, namely, the inaccuracy of memory and the presence of the creative imagination.

David Hume provides us with the example of the complex idea of God, which is a combination of the ideas of power, goodness and knowledge as well as infinity. However, since nobody can experience an infinite amount of any of

these qualities, infinite goodness, wisdom and power, which are applied in order to create the idea of God, could not been derived from any preceding impressions. Thus, the characteristics that are combined and multiplied by infinity reside entirely within the faculty of the imagination for Hume, which is an example of what Hume would consider to be a most extravagant set of mental imagery, if he had utilized such a phrase from contemporary cognitive psychology.

Here, it is relevant to mention another division of the perceptions of the psyche, according to Hume:

- **Simple ideas (e.g., thinking of red)**
- **Complex ideas (e.g., thinking of a red apple)**
- **Simple impressions (e.g., seeing red)**
- **Complex impressions (e.g., seeing a red apple)**

There is no contradistinction or any separation that can be made with regard to the simple perceptions, i.e., the simple ideas and simple impressions. That is, a simple idea and a simple impression cannot be subdivided into parts by the one who consciously experiences and remembers them, for example, because as soon as an idea or impression has parts it suffices to be complex.

The category of mental images, referred to as simple ideas, is only allowed to comprise our thoughts after our sense perceptions have afforded them to our minds, according to Hume. Thus, all ideas have preceding impressions. The latter is Hume's conclusion, which is derived after he analyzes the remarkable resemblance between the impressions and ideas with the exception

of their degrees of vividness when we form them, and the resemblance is striking insofar as the ideas appear to be reflections of the impressions, which entails that each perception of the mind is double in some sense, appearing each as an idea and impression.

Interestingly, because Hume realized that not all ideas resemble impressions, he presents the distinction of the perceptions, dividing them into complex and simple perceptions (i.e., similar to qualia and quale, respectively), in order to account for observations that various complex ideas do not have impressions (e.g., thinking about a winged flying horse without ever seeing one) and in order to incorporate the observations that many complex impressions that we have are never formed as accurate copies when we recollect them and form ideas. For example, walking through and experiencing an entire city involves complex impressions to arise, but thinking about the city later involves complex ideas that are not truly accurate copies of the incredibly complex impressions.

Within Book I, Part I and Section I of Hume's *Treatise of Human Nature* Hume analyzes the origins of our ideas, and after subdividing the mind into simple and complex perceptions that each have corresponding double perceptions that are, namely, impressions and ideas, a consideration of the status of their existences as causes and effects is made. Hume presumes that all simple impressions are represented and attended to by simple ideas that correspond to them. Moreover, since there is an incredibly strong connection between each perception in respect to its double, Hume maintains that either the existence of the impressions have remarkable influence upon the ideas, or the

ideas have remarkable influence upon the impressions. Both types of influences, namely, the influence of memory upon conscious experience concerning sensory perceptions and the influence of sensory perceptions upon the memory and imagination, i.e., the ideas, are involved with every sensory modality (e.g., color memory is one example of memory's influence upon the conscious experience of color sensations).

Hume maintains that if there is indeed a constant conjunction, then the relation between the perceptions is not due to chance or ontic coincidence[13] because a constant and continuous relation demonstrates what is best considered to be a form of dependency of, namely, either the impressions upon the ideas or the ideas upon impressions. Thus, cognitive research programs may consider that they are given the task of illustrating the conditions under which the constant and continuous relations of the influence of the memory (i.e., Humean ideas) lead to ranges of changes concerning the sensory perceptions. For instance, with both the memory of colors and certain objects' shapes there are instances where the shape of something, such as a gray cloth, can be changed in order to provide the appearance that the cloth has tinges of green, such as when the cloth is shaped like a leaf (Epstein, 1967).

The very first appearance of simple impressions always takes precedence over and precedes the corresponding ideas. So, for Hume the foundational or primary aspect of the mind is the set of impressions, and there are basically three types of impressions that lead to the three following types of ideas:

[13] An ontic coincidence is an uncaused event or completely unnecessary being that is not brought about by causes (Hartmann, 1938).

- **The remembrance of the experience that one has when one remembers perceiving something with the sense perceptions (e.g., memory of seeing and/or hearing somebody);**
- **The remembrance of the experience of emotional feelings, such as the memory of sadness experienced after the death of a family member or friend;**
- **The memory of the experience of choice-making (e.g., you remember the experience of the decision of reading this book).**

In addition to the three types of impressions it has been explained why any impression may be divided into the categories of simple and complex. Generally, when we experience objects or events there is a "unity of consciousness" that coincides with the object, the conscious experience of the object and the thoughts about the objects and events (i.e., from a representationalist and Humean vantage point).

Moreover, such conscious experiences accompanied with unity also allow us to attribute several characteristics to the conscious experience in general as opposed to, for instance, the independent objects at which the conscious experience is directed.

Our faculties of the imagination allow us to combine simple ideas with one another, according to Hume, which may well lead one to inquire how exactly the faculty of the imagination functions, especially with relation to memory. Within the previous example the experience of redness must first be remembered in order to become an idea or thought. The simple idea of redness can then be

combined via means of addition, subtraction, division, multiplication etc. to any other simple or complex ideas, such as a vineyard in Oppenheim, Germany on the Rhein, which would allow us to imagine red vineyards, despite the memory of them as being green vineyards.

Our imaginations can form the complex idea of red vineyards within a small city via our faculties of the imagination, but it is necessary that we already first had the experience of redness before we could ever conjure up the totally imaginative image of the red vineyard, for instance. Moreover, it is important to note that it is not always possible for our memories to be so incredibly accurate and that the latter inaccuracies may involve significant aspects of our creative imaginations.

Fig. 5 A Humean Impression of red and Idea of Redness

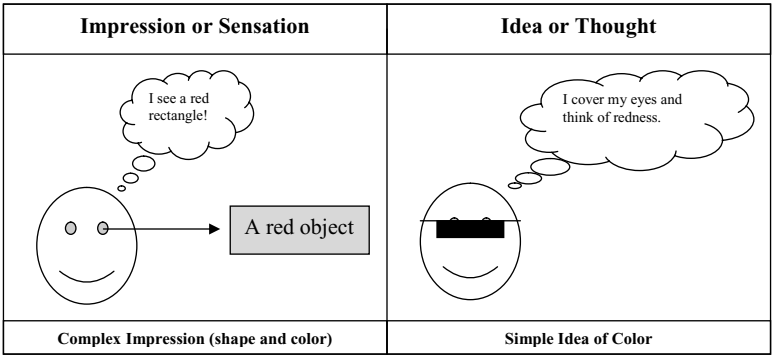


Figure 5 illustrates the two differences between a complex impression (i.e., the visual perception of an object that is red with corners) and the simple

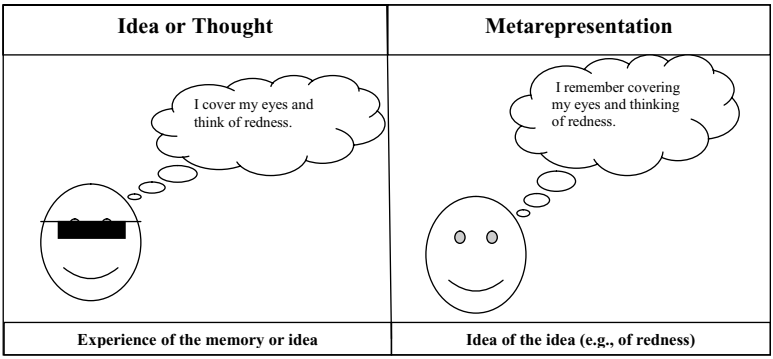
idea of “redness.” For Hume, the memory of an impression or “anticipation” of it by means of the imagination is called a “thought” or “idea.”

Hume conceded that it is possible (e.g., via hallucination) to have an idea that is even more vivid and intense than an impression. However, Hume’s fundamental principle within the first few chapters of his *Enquiry* maintains that the experience of actually sensing and eating an apple, for instance, is much livelier, vivacious and more forceful than merely thinking about sensing and eating an apple. According to Hume’s principle, our consciousness experiences involve both “ideas” and “impressions,” but impressions are almost always much more vivid.

Figure 6 considers the ease at which Hume may incorporate metarepresentations within his theory via assessing “Humean ideas as impressions,” which allow ideas about ideas to arise. So, multiple ideas may be considered to be impressions (i.e., perhaps something like impressions that are excited via the cognitive system itself), and recollections of these ideas as impressions form and are less vivid than the preceding perception.

So, metarepresentation is easily incorporated within Hume’s philosophy, and an idea, such as remembering the shade of red of an apple, can become the remembrance of the memory of that shade, which entails that certain ideas have the capabilities of being impressions themselves. Consider **Fig. 6** to be a couple events that follows the events within **Fig. 5**.

Fig. 6 Concept of Metarepresentation Consistent with Hume



Although our thoughts or ideas may at first appear to be limitless because we can think of strange monsters in distant lands covered by snake-like mountains swimming through violet waterfalls, there are “very narrow limits” concerning these creative powers of our minds, and, according to Hume in his *Enquiry Concerning Human Understanding*, this “amounts to no more than the faculty of compounding, transposing, augmenting, or diminishing the materials afforded to us by the senses and experience” (Sect. 2).

Hume writes that when one thinks about a golden mountain, one merely joins two non-contradictory ideas that one has already been “acquainted with” via former experiences, namely, (1) gold; and (2) mountain. This means that certain ideas, such as roundness and being triangular, are not able to be conjoined in certain respects. For instance, there is no such thing and no such complex idea or complex impression that is a round triangle or a round pentagon.

Hume supports his arguments that ideas are feebler and are merely copies of impressions by analyzing the most complex, sublime and compounded idea (i.e., the idea of God) and demonstrating that this idea of an infinitely knowledgeable and infinitely good Being "arises from reflecting on the operations of our own mind, and augmenting, without limit, those qualities of goodness and wisdom" (ibid. Sect. 2).

In conclusion, what the cognitive psychologist confronts herself with concerning Hume's theory is one that considers the affects of sensory perceptions and other perception on memory, the imagination as a whole and mental imagery, and Humean theory allows for a representationalist model but does not presume it, remaining skeptical about representationalism without supporting its opposition. Moreover, the Humean cognitive psychologist considers the influence of memory, imagination and mental imagery upon the sensory and emotional impressions as well as those concerned with the conscious experience of decision-making.

Hume allows for higher order meta-cognitions and mental imagery that incorporates other mental imagery within it. The aspect of the theory to keep in mind concern the distinction between aspects of memory, imagination and impressions that are simple, i.e., they cannot be divided, versus the complexity of other memories, imaginations and impressions.

Lastly, the cognitive process of the short-term and long-term memory that plays a role (i.e., after certain striking sensory impression experiences are undergone) during the cognitive process of combining, augmenting, and

reordering etc. these memories, which can be more or less accurate in relation to their preceding impressions, is crucial for the creative process, which may substitute less accurate memories for the production of more imaginatively creative expressions. So, the combined and separate roles of accurate memory and the imagination, especially its element that concern inaccurate memories, during the creative process are important considerations that come to mind with study of Hume's philosophy.

B. The Analogical Aspects of Perception: Pressing Tablets, Tracing Papers

Simple thoughts are irreducible and indivisible ideas that are found to correspond and represent some impression that people have previously experienced in some sense. Therefore, every simple idea is a copy or image of an impression, according to the latter conception. We may, therefore, compare the copy of an impression and an idea to a copy of a piece of paper out of a Xerox machine. However, one drawback of such an analogy is that such an image does not generally correspond to impressions that are not visual representations. For instance, smells and sounds (i.e., the impression) and memories of smells and sounds (i.e., the ideas) do not fit neatly within this analogy.

A slightly better way of explaining the difference between the impression and idea is considering that that the mind is in some ways analogous to a blank clay tablet, an instrument for pressing and tracing, and sheets of paper. In this

analogy the impressions are the first indentations that are pressed into the tablet via a pressing instrument or stamp, and, importantly, these indentions must be made first in order for the thin tracing paper to be placed over the indentations (i.e., the tablet's indentations are analogous to impressions) and for the tracing instrument to lightly (i.e., less vividly) produce another image, which is a traced copy (i.e., the thought or idea in addition to the preceding impression).

At this point, the faculty of the imagination, i.e., in combination with memory or a faculty of recollection, is able to take the images of the tracing papers (i.e., the ideas) and to combine them in various ways with one another, including cutting, pasting, multiplying, dividing and simply adding them to one another. So, the analogy proceeds as follows: Something excites the instrument to press against the clay in order for it to press an image on the clay tablet, which becomes an indentation (i.e., impression), and then the tracing paper is placed over the impression, and an image is faintly copied via a tracing pencil.

The latter process repeats itself with a different excitation that brings about a different impression and a different image that is copied from the clay tablet, but the latter process occurs after the tablet has smoothed out perhaps most of the elements of the previous impression. Lastly, the copied images from the traces are gathered or recollected and combined in various ways.

The various ways that the copied images are combined that are both new and unique are also creative in virtue of being atypical, for instance. The traces are not always perfect because there are greater details within the impressions of the clay tablet than the tracing instrument can copy. Sometimes the traces are

less accurate, which may involve the production of highly unique traces, especially when they are combined with other copied traces, that may be interpreted as being creative.

Perhaps some of the copies are sometimes even partially left upon the clay tablet, which hinders the tracing instrument from making totally accurate copies of a new impression because either the impression is affected by the tracing paper left upon it, or the tracing paper, which already has traces from previous impressions, is unable to form clearly accurate copies since the copies must incorporate the previously traced marks. The latter aspect of the analogy takes into consideration the Humean concept that the ideas may influence the impressions, or mental imagery may influence coming sensory perceptions, for instance.

Likewise, the mind proceeds as follows: Something excites the sensory organs, which allow the mind to form impressions that are able to be remembered and copied in the form of fainter ideas or thoughts. The latter process is repeated several times with different excitations, different sensory organs and different impressions upon the sensory organs, which result from the different excitations, and then these ideas are recollected or remembered together in multifarious ways. When the recollected ideas are combined in both new and unique ways, the mind has developed something creative in virtue of its status of being atypical, for instance. The latter concerns perhaps the most obvious ways of forming creative ideas as opposed to the perhaps coincidentally

creative ideas that form partially as a result of false or inaccurate memories that are incorporated and still able to be useful concerning creative expressions.

In both cases of the mind and tablet-instrument-paper analogy the performance of creative acts concerns impression, fainter copies of impressions and then creative expression, which may best be described as that which one performs in unique ways and causes further impressions to arise, say, in oneself or others. Perhaps both the Xerox and tablet analogies capture something that is true in virtue of the minds of the blind, deaf etc. because the latter individuals must form many of their ideas concerning the impressions from other people's expressions and descriptions of their impressions as well as their ideas, and the copy of the latter ideas (i.e., as opposed to copies and recollections of impressions) lack a certain amount of luster and vividness that copies of copies and traces of traces possess. The principle here holds that copies of copies tend to be less accurate and fainter but may still be capable of involving creative expression.

C. Shortcoming of the Image and Tablet Analogy: Example of Uncreatively Imagining People and Racism

Obviously, the aforementioned analogies have their drawbacks, but they at least have their place in teaching and stimulating exploration on the themes. The complexity of the problem related to explaining associated physiology and anatomy involved in or comprising the formation of mental imagery and expressions of creativity is challenging, and such analogies are doomed to fall

short. Indeed, they are also insufficient to explain Hume's comprehensive conception of "ideas" because what has so far been mentioned has not included Hume's conception of "abstract ideas" or "distinctions of reason," which Jerry Fodor asserts are "incompatible" with an image theory of concepts (Fodor, 2003, 10).

Abstract ideas, such as the idea of a triangle, according to Berkeley and Hume, are problematic insofar as human cognition can, at best, only form a mental image of a particular triangle, say, one that is colored or uncolored, that takes up a certain amount of one's visual field and has certain angles that are strictly established within the imagination or as the content of consciousness, but they are inessential in respect to the abstract idea of the triangle since the general or abstract idea of the triangle includes any color and no color, any size, any set of inside angles that equal 180°, etc.

That is, a triangle need not be red or blue, or have a 90° angle within it because these are inessential (i.e., accidental or coincidental (Hartmann, 1938)) characteristics that are merely small portions of what is included within the abstract idea of the triangle. So, the abstract idea of the triangle as well as many other concepts we have (e.g., species, animals, plants, people, galaxies, planets, rocks, flowers etc.) are unable to be formed as mental imagery because we can only form thoughts of particulars rather than the whole set of particulars that make up any concept.

Mental imagery as a theoretical postulate may be considered quite different from other postulates, such as cells, which are characterized via

illustrations, but only as particulars. No abstract idea can be illustrated, however, and the abstract idea of mental imagery is no exception, but the same is the case for the abstract idea of the biological cell due to its range of varying and incompatible characteristics. The main difference appears to be that the particular cell can be illustrated in a way where observers can agree upon the characteristics portrayed, whereas we are, at best, merely approaching the ability to portray mental imagery via observation, measurements and mutual agreements, which will involve neural correlates, first-person accounts and other sets of information (Horikawa et al., 2013).

There may very well be some interesting implications concerning abstract ideas for cognitive science, mental imagery formation and creativity. For instance, perhaps the lack of creativity concerning the formations of mental imagery may involve cognitions that are racist. I am now considering a mental image, which involves an abstract idea, that a close friend of mine, Prof. Paul Hart (Texas State University), asked hundreds of students to imagine. Most of the students were asked during an introductory level course to US history from the reconstruction period of the Civil War until present.

Hart, in essence, asked hundreds of students to form mental images of a single person from Iraq, and he proposed that they form this imagery shortly after September 11, 2001 and around the time period of the US invasion of Iraq in 2003. The result of Hart's thought experiment involved well over 95% of the tested student population attesting to imagining a man with dark colored skin as well as a vast majority of students forming images of their man "with a

mustache," according to the votes of the students, which were collected by Hart via the traditional polar questioning and answering with the "hand-raising technique." For instance, Hart asked, How many of you imagined a child?, and a relatively miniscule portion raised their hands.

Of course, the abstract idea of an Iraqi involves women and children too! Iraqi women and children make up a majority of the Iraqi population. Women and children were only imagined within less than 5% of the image formations, roughly speaking, according to Hart's quick classroom style methodology.

In terms of the lack of creativity concerning mental imagery and its association with racism my suggestion is that a greater variety of mental images being formed would involve a type of social creativity. So, populations or social groups that are able to have such a diverse set of mental imagery that represents each portion of the demographics (i.e., perhaps it is even more inventively creative if the imagery concerns a fairly accurate proportion of each of the types of individuals represented within the population at large) express more creativity. For how could we even conceive of those groups of students in Hart's history courses, who were purportedly confronted via the mass media system's broadcast of anti-Iraqi propaganda, as being creative concerning their mental imagery?

The formation of mental imagery in such cases appears to be involved in racism, which is a typical tendency to homogenously form uncreative mental images about other races, societies, cultures, nations etc. in relation to social groups with which one tends to identify. Of course, there are creative formations

of mental images that involve such racism, which may be formed via those who create such propaganda (i.e., an overload of broadcasts with Iraqi men in comparison to a relatively small number of women and children before the 2003 US invasion of Iraq). Additionally, if the latter case is true, then it may suffice for individuals to form mental imagery of common images in order to determine the extent of the affects of mass media propaganda.

Additionally, creatively is involved in the inventiveness of weaponry that is associated with destruction and destroying what was created and creative; the lack of creativity is found in the unquestioning individuals who unimaginatively think of the same type of person, for instance, which creates social contradictions at certain points when the individuals realize just how similarly they think in accordance with their own social groups that formed misrepresentations of much of the world and others.

A general principle of abstract ideas, people and creativity may thus be expressed as follows: The abstract idea of people includes all sorts of people of different colors, genders, ages, opinions, cultures etc., but an individual only forms a particular mental image of a group of people at a specific time. Moreover, sometimes individuals tend to form mental imagery with very similar content (e.g., mental imagery of a bunch of white people or of just black men), which involves the lack of expression of creativity with respect to the concept of people. Expressing uncreative ideas must also be in relation to those same individuals' formations of mental imagery in the past or the typical formations of imagery of their own social groups with whom they identify and think alike.

So, basically racism involves being uncreative with respect to sets of mental imagery that one forms over time or within one's own group. Typically the mental imagery concerns the absence of formations of negative and discriminatory characteristics of one's own social groups (i.e., the in-group) as well as formations of negative and discriminatory characteristics and less diversity within one's out-group (Cikara et al., 2011).

D. Transitions from Ideas to Different Ideas: Vivacity and Imagery

The faculty of the imagination is guided by certain universal principles, and the faculty of the imagination is responsible for the various different separations of simple ideas as well as the unification of these ideas in various ways, according to Hume. David Hume mainly analyzes three universal principles of transition from one idea to the next, which we shall confront later within this section, and these transition principles are: resemblance, contiguity in space and/or time and causation.

The principles are applied by Hume to complex ideas that arise from other complex ideas within the subject rather than complex ideas that develop after one has undergone impressions or has heard the testimony or first-person account of another individual and thus transits from one idea to the next. Concerning our previous analogy of the clay tablet, impressions, tracing instrument and copies on tracing paper, the transition principles are similar to organizations of the tracing papers that typically disallow one page to be

randomly followed by another page when they arise within the memory and faculty of the imagination because they are ordered according to their similarities (i.e., resemblance), close proximities (i.e., contiguity in respect to space or time) and cause and effect so that the traces arise within memory and imagination in accordance with the latter ways of cognitive filing them.

In fact, Hume illustrates that when we have one complex idea in mind, another follows because it resembles the former in various or certain respects, or the first idea involves a spatial and/or temporal relation that is close to the second idea (i.e., contiguity), or the first idea is thought of as the cause, and the second is thought of as the effect or vice versa. That is, the first idea that comes to mind may be the effect, and the cause may thus arise thereafter. However, what Hume does not analyze at length is the transition of one simple idea to the next simple idea, despite the fact that one may think of a certain shade of blue and then think of the next contiguous shade of blue that is in close proximity to it in virtue of color space, lightness, darkness, hue et cetera.

One example of a simple idea is one's reflection on the colors 'red' or 'white' or perhaps the small part of a slope that is perceived visually. If we imagine an apple and divide the colors, shapes or angles, smell, taste and texture into irreducible and indivisible parts, we have the divided the idea of the apple into a bundle of simple ideas. Furthermore, we find that it is not within our power to imagine a simple idea that does not correspond with some impression that we have previously experienced. This is why it is impossible for a

congenitally blind man to form the idea of the color ‘blue’ and a congenitally deaf woman to possess the thought of the sounds a guitarist creates.

Thus, it is impossible to think of something in certain ways when we have not in some way sensed it already. For these reasons we allow children to experience the colors and sounds when we introduce the sensations to them rather than attempt to have them conjure up the idea of them in their heads, which often does not appear to be feasible.

However, it is worthwhile to consider the fact that although it is impossible (i.e., for one who is completely deficient of a type of sensory impression) to form an idea of something in the same manner as one who has already experienced it, an individual who never has the conscious experience may still be able to creatively form imaginative ideas about the thing, even though there is perceptual knowledge that she lacks about it.

Thus, it is important to note that the vividness of the perception and perhaps even the accuracy of the perception in certain respects are less important in respect to the expression of creativity than the combination of other factors. Extreme examples of this might well be considered in order to shed some light on what is meant here. One example may include certain aspects of Beethoven’s compositions of music during the time period when he became deaf in the early 19th century.

Another example of the varying degrees of vividness of imagery may include individuals who are at first presumed to be in “persistent vegetative states” are considered to be brain dead for several weeks. However, there are

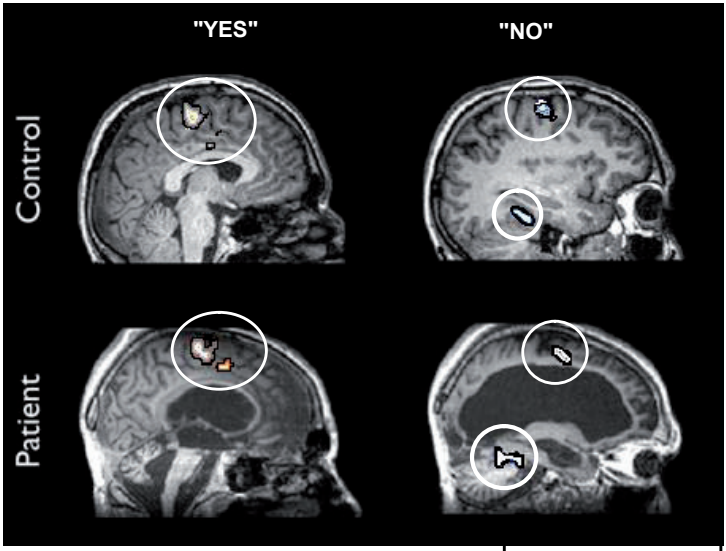
many accounts of such subjects being given cues to imagine themselves performing certain actions (e.g., the patient imagining herself playing tennis) in which case the same sort of neural activity and perhaps mental imagery may form within the person's brain and mind that also very similarly forms within a healthy control subject.

However, despite the fact that such individuals can imagine certain scenarios, which allow brain activity in different regions to be measured, and such measurements of the activity allow scientists to give patients the opportunity to answer YES when they imagine playing a sport and NO when they imagine their home, there has been absolutely no description of the expression of creativity of these people. The reasons for the lack of the performance of creative endeavors is quite obvious, although the people are arguably able to form mental images with some degrees of vividness.

In the New England Journal of Medicine Monti et al., (2010) published an article titled "Willful Modulation of Brain Activity in Disorders of Consciousness," which describes the latter experimental conditions and has contributed quite practically to the diagnoses of 54 patients who are thought to either have the conditions of minimally conscious states or vegetative states.

Figure 7 illustrates the brain regions that activate and that are measured when the imagination of playing a sport utilized for the purpose of answering YES to a question and imagination of being at home is utilized for the purpose of answering YES to a query (Monti et al., 2010).

Fig. 7 fMRI scans of Mental Images Formed via Patients in Vegetative States: "Yes" for playing a sport and "No" for Home



Monti et al., 2010

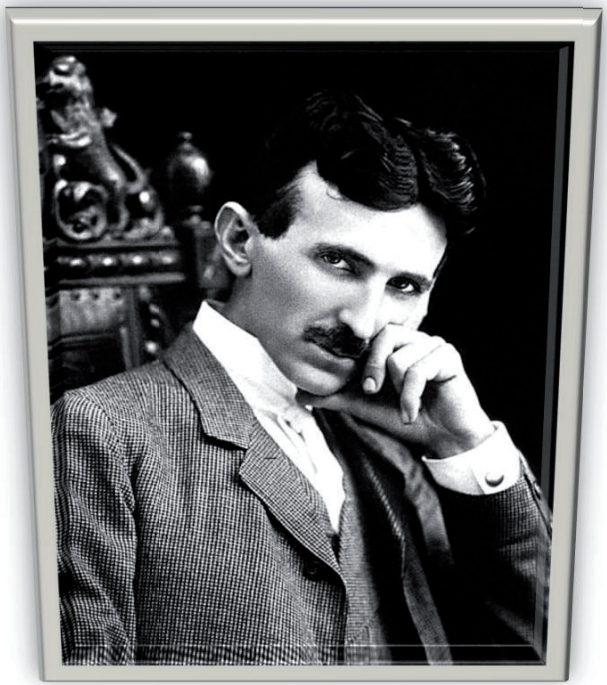
When we judge an individual as being a creative mind or creative soul, typically what we mean is that we have witnessed the person express something creatively or that the person expressed something that moved us or made an impression upon us, perhaps in some positive way. On the other hand, the impression is a first-person experience rather than a third-person experience, such as the creative performance or expression. Although creativity undoubtedly requires some sufficient amounts of inner and vivid first-person conscious experiences and the internal workings of the mind allowing ideas to be tailored uniquely and finely, the expression of creativity is quite different than any portion of the creative process, including the formation of more vivid mental imagery.

Campos and Gonzalez (1993, 923) write “{w}e evaluated the extent to which vividness of imagery is correlated with creativity in a sample of 1,361 university students from different disciplines and assessed which sensory modalities of vividness of imagery best predicted creativity. Vividness of imagery was generally poorly correlated with creativity and, for all subjects combined, explained only 2% of total variance in creativity.”

We may ask how accurate such types of experimentation describe the relation between mental imagery and creativity. Nikola Tesla, for instance, has been accredited with the ability to form incredibly vivid mental images, which were so elaborate that he even claimed that he would be able to tell whether prototypes of machines should be developed based upon whether they would function properly first from within his vivid and accurate visual mental images. That is, Tesla was able to visualize vast amounts of working parts of mechanical machines in order to predict with remarkable accuracy what their functions would produce once they were constructed.

Within Tesla’s short autobiography there are several reasons that are given for his so-called late entrance onto the world stage in respect to his fascinatingly creative and inventive mind that has, arguably, changed the modern world more than any other engineer and scientist. I mean here that his invention of alternating current induction motor, which is found in most motorized household appliances, and the alternating current generators, which revolutionized the basis for power within all industrialized nations infrastructures. Additionally, he anticipated and predicted many amazing feats to which he also

contributed within his writings, including the fax machines, radar and remote controlled objects, and world-wide wireless communication.



Nikola Tesla in 1896 at the age of 40

Tesla (1919; 1995, 4-5) writes:

"In my boyhood I suffered from a peculiar affliction due to the appearance of images, often accompanied by strong flashes of light, which marred the sight of real objects and interfered with my thoughts and action. They were pictures of things and scenes which I had really seen, never of those imagined. When a word was spoken to me, the image of the object it designated would present itself vividly to my vision and sometimes I was quite unable to distinguish whether what I saw was tangible or not. This caused me great discomfort and anxiety.

None of the students of psychology or physiology, whom I have consulted, could ever explain satisfactorily these phenomenon. They seem to have been unique, although

I was probably predisposed as I know that my brother experienced a similar trouble. The theory I have formulated is that the images were the result of a reflex action from the brain on the retina under great excitation. They certainly were not hallucinations such as are produced in diseased and anguished minds, for in other respects I was normal and composed.

To give an idea of my distress, suppose that I had witnessed a funeral or some such nerve-wracking spectacle. Then, inevitably, in the stillness of night, a vivid picture of the scene would thrust itself before my eyes and persist despite all my efforts to banish it. If my explanation is correct, it should be possible to project on a screen the image of any object one conceives and make it visible."

My early affliction had however, another compensation. The incessant mental exertion developed my powers of observation and enabled me to discover a truth of great importance. I had noted that the appearance of images was always preceded by actual vision of scenes under peculiar and generally very exceptional conditions, and I was impelled on each occasion to locate the original impulse. After a while this effort grew to be almost automatic and I gained great facility in connecting cause and effect. Soon I became aware, to my surprise, that every thought I conceived was suggested by an external impression. Not only this but all my actions were prompted in a similar way. In the course of time it became perfectly evident to me that I was merely an automation endowed with power OF MOVEMENT RESPONDING TO THE STIMULI OF THE SENSE ORGANS AND THINKING AND ACTING ACCORDINGLY. The practical result of this was the art of teleautomatics which has been so far carried out only in an imperfect manner. Its latent possibilities will, however be eventually shown. I have been years planning self-controlled automata and believe that mechanisms can be produced which will act as if possessed of reason, to a limited degree, and will create a revolution in many commercial and industrial departments.

I was about twelve years of age when I first succeeded in banishing an image from my vision by willful effort, but I never had any control over the flashes of light to which I have referred. They were, perhaps, my strangest and [most] inexplicable experience. They usually occurred when I found myself in a dangerous or distressing situations or when I was greatly exhilarated. In some instances I have seen all the air around me filled with tongues of living flame. Their intensity, instead of diminishing, increased with time and seemingly attained a maximum when I was about twenty-five years old."

Other experiments have illustrated other interesting facts about the vividness of mental imagery and its association with hallucinations that occur more frequently amongst schizophrenics than control subjects. For instance, Oertel et al. (2009, 1) claim:

"We investigated phenomenological and cognitive trait markers of schizophrenia, including cognitive correlates of hallucinations and vividness of mental imagery, and the influence of individual psychopathology. Overall, scores on the mental imagery

questionnaire (QMI [Sheehan, P.W., 1967. Reliability of a short test of imagery. Perceptual and Motor Skills 25, 744.]) suggested higher mental imagery vividness in first-degree relatives, high-schizotypy controls and patients, than in low-schizotypy controls. . . .These results suggest that vividness of mental imagery may be a trait marker across the schizophrenia spectrum."

Complex thoughts are simple ideas that we integrate, subtract from and/or add to other ones. Complex ideas are divisible and separable, like the idea of the apple from the previous example. Previously it was mentioned that all ideas are first derived from our sensory perceptions, and the mind can imagine golden mountains with purple caps, for instance, and horses with horns and wings, which we have never seen. However, these complex ideas are reducible to a number of simple ideas, previously derived from sensations, according to Hume.[14]

If we take the idea of 'whiteness' and combine it with the idea of the 'sun' we can conceive of a white sun. This is a complex idea because it is taking more than one idea, simple and complex, and integrating these thoughts so that they compose one entity, namely the 'white sun,' and a complex thought.[15]

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[14] Interestingly, for Hume one type of knowledge concerns that which cannot be thought to be otherwise. Thus, the relations of ideas are considered knowledge, and these ideas are things that can only be thought of as they are rather than in other ways. For instance, a 'triangle' is defined as a three-sided geometrical figure comprised of three inside angles that equal 180°. Any definition of the term 'triangle' that contradicts the previous definition is impossible and inconceivable because 'the three of sides of the triangle' and 'the 180°,' which denote the figure, must be thought of in order to describe the triangle. Our knowledge consists of the relations of ideas, which involves what is necessarily implied by our ideas. So, we can know that if a geometrical figure has a 64° angle, then it may very well be a triangle, and, for instance, if I assert that 'where there is no suffering there is no immorality,' then this statement is certain if the term 'immorality' simply means or entails suffering.

[15] It is paramount to note that individuals understand complex ideas in entirely different ways because people many times attribute, subtract or divide different simple and complex ideas to particular complex ideas. For instance, a religious person may have a

There is one fundamental distinguishing characteristic that exists between impressions and ideas; this characteristic is vividness. Thus, impressions are different from thoughts because they are more vivid, intense or lively than the latter. According to Hume, "the difference betwixt these consists of the degrees of force and liveliness with which they strike upon the mind, and make their way into our thought or consciousness" (Hume, 1992 p. 1).

For Hume, the terms 'liveliness, 'violence' and 'vividness' are interchangeable words that refer to the degrees of intensity that our impressions possess in comparison to their corresponding ideas, which are more dull unless one's mind is ill or extraordinary. Impressions enter the mind with the most force and violence, and are the first perceptions to appear. However, ideas conscious to our minds only after impressions have first presented themselves to our psyches, and complex ideas are less vivid and lively than sensations. This is the primary difference between thinking and feeling, to Hume. It is asserted by Hume (*Treatise* Book I, Part I, Sect. I) that:

> "The common degrees of these are easily distinguished; tho' it is not impossible but in particular instances that they may very nearly approach to each other. Thus, in sleep, in fever, in madness, or in any very violent emotions of soul, our ideas may approach to our impressions."

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completely different understanding of the word 'justice' than an atheist. For the theist 'justice' might entail that one deserves a punishment that is equal to the wrong deed that person brings about. However, the atheist might view justice as a term that implies one should be forgiven for his or her wrongdoings because the act that this person brought about has already happened and there is nothing that any one can do to prevent the consequences of that action. This is a case of attributing different ideas to the concept of 'justice'.

So, on occasion our sensations are so dull and faint that sometimes we cannot distinguish them from our ideas, according to Hume. But the vast majority of the time thinking and feeling are very different.[16] One fundamental question Hume did not answer is: what is the difference, besides the sequence difference, between an idea and an impression when the idea is at least as vivid as the impression in the event of an illness? Hume's philosophy would allow him to respond either by illustrating that the idea belongs to the memory or the faculty of the imagination, but it is questionable what role the idea plays during the impression.

One interesting and seemingly paradoxical similarity between sensations and ideas, or feeling (both emotionally and tactilely) and thinking, is that ideas are sometimes impressions. On the other hand, thinking is an impression as soon as one contemplates the act of thinking (See **Fig. 6**). For instance, a person might think about 'thinking,' and in this case 'thinking' is an impression while the meta-thought, the thought about the thought, is an idea. Put simply, when a person 'reflects' on his previous thought the 'reflection' is considered an idea. However, sensations such as vision, hearing, tasting, touching, loving and

[16] It may be argued that no one can draw a nonambiguous line between a sensation and an idea, but this in no way entails that a line cannot be drawn. A nonambiguous line cannot be drawn between people who are tall and short, but obviously we can determine whether or not a person is tall or another individual is short, for instance. So, objectivity, as opposed to subjectivity, has nothing to do with whether or not a nonambiguous line can be drawn.

fearing are never considered ideas. They simply are impressions, and they are in no way mere reflections of sensations.[17]

However, there are some impressions that are ideas. For instance, if a person is thinking about thinking about fear, the thought about fear is an idea because it is a reflection of the sensation of fear. However, the thought about fear is also considered an impression when the thought itself is reflected. Put simply, when a person reflects on his previous 'thought' the first thought out of the two is considered an impression. So, when a person is recollecting his 'thought about ethics' the recollection, which always takes place after the original thoughts, is fainter and less lively than the impression referred to as his 'thought about ethics.'

There may exist, however, one exception to the rule that simple impressions must always precede simple ideas. Any sort of simple impression that exists on a spectrum, like the color spectrum, or experiences that can be more or less intense, such as tastes like saltiness, are impressions that we may form simple ideas of without the preceding impressions, according to Hume. So, a person may taste food that is very salty and food that is less salty, and he or she can still possess an idea of 'saltiness' that is a different shade or intensity than all of his or her previous experiences.[18]

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[17] We may further categorize the impressions of the mind into (1) impressions that are not ideas, such as the sensations of fear and seeing orange, and (2) those that are ideas, which include all ideas that we can remember experiencing.

[18] This may however not even be an exception to the rule that simple impressions are always antecedent to simple ideas because one must acknowledge that simple impressions do, in fact, lie on a spectrum in order for one to have an idea of a color that he has never seen. Thus, the idea of a spectrum, which must be preceded by an impression of a spectrum, is a necessary condition for an unseen color to become an

Hume argues that the human mind is bound and limited by certain principles, and these principles of connection of the transition from one thought to another are: (1) *resemblance*; (2) *contiguity* in location and time; and (3) *cause and effect*. These three principles of connection illustrate how all of the human mind's thoughts or ideas are connected, and, in doing so, they depict the restrictive nature of the psyche and limitations in creativity, discovery and inventiveness. The connection here is simply the transition between one thought to another however obscure and disconnected these ideas may appear concerning one another.

Fig. 8 Images, Resemblance and Objects

Rene Margritte (1928/9)

idea, and the thought of a spectrum must precede the idea of the unexamined color. Therefore, Hume's law of antecedent sensations appears to have no exceptions.

The transitional principle of resemblance is best exemplified through art. For instance, when mankind observes a drawing or photograph we think of the actual art piece as the original object that it is depicting. In a painting in **Fig. 8** titled *La trahison def images* by Rene Margritte (1928/9), depicting a pipe, the idea that the actual work of art is not a pipe is written underneath the image, asserting that "this is not a pipe" in French cursive. The artist wanted to convey the idea that the object is not a pipe but a painting.

Margritte's painting portrays Hume's idea of resemblance as a transitional principle perfectly because it shows how the human mind can confuse the depiction of an object with the actual object that is being depicted. Our minds seem to make this connection instantaneously, and Hume labels this concept of transition 'resemblance,' which is the idea that individuals connect thoughts by proceeding from one thought to another in such a fashion that the second idea resembles the first. For instance, a child may imagine a goat after he or she observes a dog because in many ways the dog resembles goats, which are also vertebrates, mammals, furry etc.

The second transitional principle, according to Hume, is referred to as *contiguity*. When a person is thinking about one particular room in a house, for example, his thoughts may lead him to contemplate the status of the other rooms; and Hume refers to this connective principle as *contiguity of location*. Whenever one has thoughts about the Great Depression in the United States during the 1930s, for instance, this may lead a person to brood over the Presidency of Herbert C. Hoover (1929-1933) because he was a figure during

this era. One may even possess thoughts over the return of the U.S. troops from Nicaragua during the administration of Franklin Roosevelt. Hume refers to this sort of succession of thinking as *contiguity of time* concerning these latter two examples during the US Presidents' administrations. Here, the idea of contiguity is that whenever humans have a thought and another idea follows that concerns a close location or contiguous time, the procession of thought is said to have a contiguous connection.

The last principle of transition that connects the mind's ideas to one another is *cause and effect.*[19] For example, you may observe that when I release a billiard ball from my hand, it falls to the ground, and this occurs upon every single occasion. So, if you stand outside a pool hall and peer through the window as well as see me release the cue ball from my hand, then, even without seeing it hit the floor or hearing it, you may imagine that it loudly strikes the floor.

The connection that the mind employs in regard to cause and effect events is vast. A homicide detective, for example, instantly maintains that a murder has taken place in a room that possesses a dead body with wounds, a bloody knife and finger prints on the knife handle that do not match the dead body's prints. For the astute detective, a vast amount of possible causes are readily available to him or her once his or her mind has connected the scene,

[19] To Hume, cause and effect events *are* to be confused with correlated events because events that we label 'causes' and 'effects' are merely invariable correlations. In regard to cause and effect events mankind merely notes that one event follows another event invariably; thus, we establish the first event as the 'cause' and the second as the 'effect,' although we have no concept of the secret connection or powers employed amongst the two events, according to Hume. In fact, all cause and effect events could be the contrary because we can imagine them as such.

which is established as the ‘effect’ or ‘aftermath,’ with the notion of the ‘cause’ preceding the ‘effect.’

It would be outrageous for the human psyche to assume that the room with the dead body was not brought about by a cause. The connective occurrences of events are drawn together via the ability of the mind to model the world more or less accurately, which instantly transposes our thoughts toward possible causes. And the observation of the room brings to our psyches the obvious reflection of the anguish that the dead person “must” have undergone. Thus, our minds have the ability to look at an event or setting and instantly derive an explanation or explanations for the event or setting, which take the form of a cause or effect. Hence, Hume titled this transitional nature of our minds as the ‘cause and effect principle.’

Any set of thoughts whatsoever is limited by the three transition principles, so creativity exists within the boundaries of resemblance, contiguity and cause and effect, unless one is inspired by sensory perception or what other people claim happened (i.e., what Hume calls “testimony”). So, in order for one to come up with a creative thought he or she needs only to take an idea, and transpose his or her thoughts via the three transition principles: **(1)** resemblance; **(2)** contiguity in location and time; and **(3)** cause and effect. These three manners by which we connect ideas become more flexible with learning and experiencing in general because experiencing allows individuals to gain access to the ideas that are necessary for creative phenomena.

Experiencing allows each category to have more options through which an individual gains greater potential access to **(1)** more entities or appearances that resemble or seem to resemble one another, **(2)** more things that are or appear contiguous, and **(3)** more possible causes and effects or appearances of them. Creativity is a matter of being able to connect ideas to one another in new and innovative ways. These connections of ideas are facilitated through the attainment of ideas via recalling interesting sensory experiences and then adding, subtracting and combining ideas with more ideas via Hume's three principles.

The creative process for David Hume occurs in the three following steps: **(A)** the person utilizes his or her sense perceptions, which allows for sights, sounds, feelings, smells, tastes and emotions, such as love, fury, frustration and fear, to enter the mind; **(B)** the person reflects upon these impressions, both simple and complex, and thus simple and complex ideas are the results, which are conscious to the person; and **(C)** the individual combines, subtracts, improves, augments, and/or adds these ideas to one another.

(C) is accomplished via the three transition principles of the mind, which give rise to complex ideas that are sometimes innovative and pragmatic while others are old and useless, for instance. Therefore, sensations, ideas and the transition principles are all necessary conditions for the ability of the human psyche to create. This type of creation involves thought rather than accidental discoveries found through manipulating external objects.

What, according to David Hume, would actually increase the chances of an individual forming a combinatorial and creative idea? Experiencing as much as possible and having more different experiences than others may allow for more ideas to arise than others would possess. However, without time to reflect upon these experiences the individual may not be able to utilize the ideas in order to be creative.

Studying, for instance, would allow one to attain more ideas via combining remembrances of past sensations and augmenting them in order for them to resemble what is being studied. Greater amounts of ideas that an individual possesses bring about a greater potential for that individual to have readily available ideas for the imagination and memory. The functions of these ideas concern transiting one's thoughts via the three transition principles and/or adding, subtracting, dividing and/or categorizing the ideas into a creative thought.

In essence, there are aspects of creativity that involve the combinations of mental imagery and individuals' general tendencies to think of mental images that resemble others or to think of what involves close spatial or temporal proximity in relation to what the images serve to represent. The latter transition principle, which we may consider to be a hypothesis about mental imagery, also concerns cause and effect because causation involves events that are close with respect to time and space.

The vividness of mental imagery may involve other factors that are important with respect to creativity, such as individuals' attention spans that may

involve greater focus upon more vivid images and allow more utilizations of them for creative purposes.

III. Mental Imagery and Creativity for Cognitive Science

A. Brief Historical Sketch of "Mental Imagery" during the 20th century

Margaret Floy Washburn (1871-1931) was the first woman to earn a PhD in psychology from an American institution, which was from Cornell University where she studied under Edward B. Titchener, an Englishman who studied psychology under the guidance of Wilhelm Wundt. Perhaps Washburn (1916, xi) said it best, concerning her zeitgeist, when she wrote in her book *Movement and Mental Imagery* that:

> "From the point of view of scientific investigation no two subjects could present a stronger contrast than the two named in the title of this book. Movement is the ultimate fact of physical science. The measurement of the direction and velocity of movements is the most satisfactory achievement of science, and the scientist is contented with his explanation of any natural phenomenon when he has reduced it to movements and expressed their relations in a mathematical formula. On the other hand, nothing could be less attractive to the scientific investigator with such an aim than the domain of mental imagery, the world of imaginary objects. Mental images are not only removed from general observation and open to direct study only by the individual who experiences them, but even he has no satisfactory way of measuring them and reducing them to mathematics."

Washburn's analysis of mental imagery, the lack of techniques and technologies to study of mental imagery as well as the growing number of speculative hypotheses given by psychologists after using introspective analytic techniques, including Washburn's mentor, appeared to provide an ideal environment for behaviorists within psychology departments because

behaviorism involved the demonstration of results, which seemed to rely less upon theory and more upon practice.[20]

Edward Bradford Titchener (1867-1927) was one of Wilhelm Wundt's most accomplished and influential students. Titchener had a major impact on American psychology. He relocated to the USA in order to hold a position as a professor of psychology at Cornell University and to work on extensive translations of Wundt's works.

Titchener (1904) calls for a systematic study of imagery and argues that mental imagery is organic and that human minds are generally and falsely assumed to be capable of forming "images of all sensation," although Titchener concedes that this may be an exaggeration because he was unfamiliar with the less recent literature preceding the late 19th and early 20th century. Titchener

[20] Behaviorism appeared to many to be a full-proof type of investigation of psychological phenomena because behaviorism seemed to merely focus upon behavior and the measurements of movements. However, beyond the measuring of behaviorists there were many theoretical constructions, many of which were not falsifiable. Behaviorists presumed many principles and a theory of behavior that was, of course, totally immeasurable and which guided behaviorists so that it was unable to be tested by them. For instance, behaviorists maintained that an individual's behaviors could be predicted and would be determined by that individual's particular reinforcement and punishment history, despite the fact that no individual's entire reinforcement and punishment history was reliably observed and analyzed from birth until death. The reinforcement history concerns the past presentations of stimuli (or taking away stimuli), which is coupled with certain types of behaviors and which make it more likely for those behaviors to reoccur, which are called "positive (or negative) reinforcements." A punishment concerns the presentation of a stimulus (or taking away a stimulus) that is coupled with a particular behavior, which makes it more improbable for that behavior to be performed by the individual, and which is called "positive (or negative) punishment." Of course, an individual's entire reinforcement and punishment history are not observed and are perhaps, in principle, unobservable since one cannot know, for instance, whether a particular stimulus is pleasurable, painful, disgusting, sexually arousing etc., especially for individuals who might be masochists and sadists, and observing the individual constantly also presents an additional stimulus, which complicates the observations and measurements.

(1904, 35) quotes Lay's 1898, which asserts that "we have mental imagery from all the senses; that is, some of us are conscious of it."

We may observe at this point that Titchener has presented some of the confusion already existing within the mental imagery debate. One reason for the confusion wrought by Titchener concerns the capability of formations of imagery that contradict Hume's assertion that many sensations (i.e., sensory experiences) are too complex to be copied as ideas (i.e., mental imagery). Titchener did not specify exactly what he had aimed to criticize, i.e., whether he was arguing that some sensory experiences are too complex to be formed as mental images or whether certain types of sensory experiences simply cannot become mental imagery formations.

Lay's quote seems to refer to the modes of sensations though (i.e., as they are associated with visual, auditory, tactile mental imagery etc.) rather than the range of each and every type of sense perception (e.g., from the simple sensation of redness to the complex sensation of hundreds of different colors experienced simultaneously, which may be too complex for mental imagery formations). Although Lay's quotation does not assume that either all or the most complex sensations can be formed as imagery, Titchener appears to make the same mistake by mischaracterizing Stetson's 1896 and Galton's 1880 and 1883 positions the same way.

Titchener was, apparently, able to form quite vivid mental images, and he also thought that he could, despite the teachings of Wundt, rely upon systematic methods of introspection in order to form scientific conclusions via examining his

own thoughts. This resulted in Titchener's creation of an introspection training program as well as a resultant mixture of subjective opinions, agreements between psychologists regarding these opinions, and objective facts about mental imagery coming together in one deadening concoction (Schwitzgebel, 2004).

This concoction, which deadened the focus upon mental imagery during the decades following Titchener, must have played some role concerning the selection process of projects that took precedence, thereby reducing the amount of production of articles and research on mental imagery roughly from the 1920s until the 1950s.

Perhaps this mix of introspection, disconcerting agreements amongst those with similar opinions, and theoretic study of images provided good reasons for behaviorists to call for an end to the study of mental processes and a shift to a focus upon behavior because scholars were taking advantage of their freedom to speculate within the scientific journals. So, conceivably the behaviorist responses to introspective psychological investigation largely created a rational response to the study of mental imagery.

In chapters **I.D** and **II.C** George Berkeley's argument was put forth, which stated that no idea (i.e., mental image) of an abstract triangle is possible to be formed because the abstract idea of a triangle involves various different combinations of angles (i.e., just as long as the internal ones only equal 180°), various sizes, colors etc. Against Berkeley's notion that it is impossible to form the idea of an abstract and general triangle Titchener (1909) writes:

"I can quite well get … the triangle that is no triangle at all and all triangles at one and the same time. It is a flashy thing, come and gone from moment to moment: it hints two or three red angles, with the red lines deepening into black, seen on a dark green ground. It is not there long enough to say whether the angles join to form the complete figure, or even whether all three of the necessary angles are given. Nevertheless, it means triangle; it is Locke's general idea of a triangle" (Thomas, 2013).

The publication of speculative accounts within the psychology literature during the early 20th century led to greater disconnections between philosophy, which demanded rational argumentation and logical analyses (i.e., unlike Titchener' account of triangles), and psychology, which was on its way, especially with Pavlov and Watson, toward a series of investigations that focused mostly upon behavior and typically left mental processes and unobservable aspects of the mind out of the accounts.

Lay (1904) and Titchener (1904) both argue that it is very doubtful that certain types of organic sensations can be experienced as mental imagery, and both use the example of hunger during the absence of the sensation of hunger. This might lead one to an interesting hypothesis concerning eating disorders (e.g., are people with eating disorders related to obesity able to satiate themselves and then form mental imagery of the sensations of hunger or to form more pleasurable images concerning food after they have filled their bellies?).[21]

[21] Tiggemann and Kemps (2005) argue that mental imagery is a major component in the experiences of food craving that occurs retrospectively as well as the food induction at present insofar as the intensity of craving is related to the vividness of the mental images of the food. With 130 subjects (i.e., undergraduate students) they found that the specific modalities that were most involved with mental imagery were the visual modality (39.7%), the gustatory modality (30.6%) and smell (15.8%) with very little correlation concerning the tactile and auditory modalities. Tiggemann and Kemps (2005) conclude that experimental techniques in cognitive psychology may very well reduce the vividness of imagery involved with vision, taste and smell in order to reduce the amount of food

The idea of the imagery of hunger became a concern within subsequent articles, although eating disorders were not the focus of Lay and Titchener's works. The distinctions were conjectures made between what they refer to as the "organic sensation" of hunger and what they both consider but strongly doubt to be a type of mental image. Such speculation was easy to contrast with Ivan Pavlov's Nobel Prize winning work on digestion during the same time period.

Much of the debate about imagery during the 20th century did not contribute to any discoveries or interesting formations of scientific hypotheses. Hugh Chisholm (1911) edited the *Encyclopedia Britannica, which* published its 11th edition with a psychological definition of "image," which is defined as follows:

"Psychology recognizes two uses of the term. The simplest is for the impression made by an observed object on the retina, the eye; in this connexion the term "after-image" (better "after-sensation") is used for an image which remains when the eye is withdrawn from a brilliantly lighted object; it is called positive when the colour remains the same, negative when the complementary colours are seen. The strict psychological use of the term "image" is by analogy from the physiological for a purely mental idea which is taken as being observed by the eye of the mind. These images are created or produced not by an external stimulus, such as is necessary for a visual image (even the after-image is due to the continued excitement of the same organ), but by a mental act of reproduction. The simplest ideational image, which has been described as the primary memory-image, is "the peculiarly vivid and definite ideal representation of an object which we can maintain or recall by a suitable effort of attention immediately after perceiving it" (Stout). For this no external stimulus is required, and as compared with the after-image it represents the objects in perspective just as they might be seen in perception. This is characteristic of all mental images. The essential requisite for this primary image is that the attention should have been fixed upon the impressions.

The relation between sense-impressions and mental images is a highly complicated one. Difference in intensity is not a wholly satisfactory ground of distinction; abnormal physical conditions apart, an image may have an intensity far greater than that of a sense-given impression. On the other hand, Hume is certainly right in holding that the distinctive character of a percept as compared with an image is in all ordinary cases

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cravings. Subsequent studies may suggest that older theories misjudged the roles of combinations of mental imagery concerning certain sensations.

the force and liveliness with which it strikes the mind the distinction, therefore, being one of quality, not of degree. A distinction of some importance is found in the "superior steadiness" (Ward) of impressions; while looking at any set of surroundings, images of many different scenes may pass through the mind, each one of which is immediately distinguished from the impression of the actual scene before the eyes. This arises partly, no doubt, from the fact that the perception has clear localization, which the image has not. In many cases indeed an image even of a most familiar scene is exceedingly vague and inaccurate."

The latter definition of "imagery" includes a combination of concepts that involve confusions, such as a controversial interpretation of Hume's works and the incorporation of the platonic "ideal" in respect to the image as a representation of an object that one perceives. The characterization of Hume's concept of image is skewed since Hume's "ideas" served to explain the concept of the mental imagery, which Hume considered to be perceptions of the mind. Hume utilized the term "recollection" as well in order to describe both the cognitive process of memory as well as the faculty of the imagination's role concerning the repeated collections of images derived originally from sensory experiences.

The term "representation" was used by Hume in the context of the "sensation as an image" in addition to "the idea as an image," representing some object that is perhaps presumed to exist independent from perception. Additionally, Hume considered the "image" to be philosophically problematic, and he explicated some of the involved misconceptions.[22]

[22] Hume argues within his *Enquiry* (Sect. XII, part I) that we bear misconceptions when we place trust within our senses and observations without the strict use of reason: "{i}t seems also evident, that, when men follow this blind and powerful instinct of nature, they always suppose the very images, presented by the senses, to be the external objects, and never entertain any suspicion, that the one are nothing but representations of the other. This very table, which we see white, and which we feel hard, is believed to exist,

The greatest misconception concerning the Britannica definition of "image" is that it fails to distinguish between two important concepts of imagery (i.e., especially amongst direct realists, idealists, and representational realists), which may require the distinction to be made between the *sensory experience of an object as an image* and the *aspects of memory of the sensory experience of that object as an image*. For instance, the quote by Hume within the previous footnote incorporates the concept of the *sensory impression as the image* (i.e., the sensory experience of the table as an image), but the Britannica definition falsely presumes a different meaning (i.e., an image that is not the sensory experience) that is attributed to Hume's usage of "image" (See **Ch. II.A** & **Fig. 5**).

Another one of the earliest people to combine mental imagery and creativity was Warren Hilton within his book *The Power of Mental Imagery*. Warren Hilton (1914, 10) writes that:

"*Mental images are representations of past mental experiences of any and every kind*. They include past sensations of sound, taste, smell, feeling, pain, motion and the other senses, as well as sensations of sight. One may have a mental image of the voice

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independent of our perception, and to be something external to our mind, which perceives it. Our presence bestows not being on it: our absence does not annihilate it. It preserves its existence uniform and entire, independent of the situation of intelligent beings, who perceive or contemplate it.

But this universal and primary opinion of all men is soon destroyed by the slightest philosophy, which teaches us, that nothing can ever be present to the mind but an image or perception, and that the senses are only the inlets, through which these images are conveyed, without being able to produce any immediate intercourse between the mind and the object. The table, which we see, seems to diminish, as we remove farther from it: but the real table, which exists independent of us, suffers no alteration: it was, therefore, nothing but its image, which was present to the mind. These are the obvious dictates of reason; and no man, who reflects, ever doubted, that the existences, which we consider, when we say, this house and that tree, are nothing but perceptions in the mind, and fleeting copies or representations of other existences, which remain uniform and independent."

of a friend, of the perfume of a flower, just as he may have mental images of their appearance to the eye."

Warren Hilton (1914, 4-6), the founder of The Society for Applied Psychology, describes the importance of mental imagery in relation to memory and recognition (e.g., recognizing faces) in the following passage:

"{T}he memory process involves four elements, Retention, Recall, Recognition and Imagination; and the scope and operation of two of these elements, Retention and Recall, were explained to you. There remain Recognition and Imagination, which we shall make the subject of this book. We shall treat of them, however, not only as parts of the memory process, but also as distinct operations, with an individual significance and value. Both Recognition and Imagination have to do with mental images.

Recognition relates exclusively to those mental images that are the replica of former experiences. It is the faculty of the mind by which we recognize remembered experiences as a part of our own past. If it were not for this sense of familiarity and of ownership and of the past tense of recalled mental images, there would be no way for us to distinguish the sense-perceptions of the past from those of the present.

Recognition is therefore an element of vital necessity to every act of memory. Imagination, Past, Present and Future Imagination relates either to the past, the present or the future. On the one hand, it is the outright re-imagery in the mind's eye of past experiences. On the other hand, it is the creation of new and original mental images or visions by the recombination of old experiential elements."

Hilton (1914, 51-2) later asserts the importance of the role of imagery in relation to creativity as well as illustrates the misconceptions of about types of creativity, such creative minds of engineers, musical creativity etc.

"THERE is another type of imagination from the purely reproductive memory imagination of which we have been speaking in this book. There is also Creative Imagination.

Creative Imagination is more than mere memory. It takes the elements of the past as reproduced by memory and rearranges them. It forms new combinations out of the material of the past. It forms new combinations of ideas, emotions and their accompanying impulses to muscular activity, the elements of mental "complexes." It recombines these elements into new and original mental pictures, the creations of the inventive mind. Business and Financial Imagination

No particular profession or pursuit has a monopoly of creative imagination. It is not the exclusive property of the poet, the artist, the inventor, the philosopher. We tell you this because you have heard all your life of the poetic imagination, the artistic imagination, and so on, but it is rare indeed that you have heard mention of the business imagination."

One year before John Watson's so-called "behaviorist manifesto," which was a book called *Behavior: A Textbook of Comparative Psychology* (1914), Watson lectured and called for ending the use of introspection and introspective training within the discipline of psychology. Watson (1913a, 163-4) states:

"Psychology . . . has failed signally, I believe, during the fifty-odd years of its existence as an experimental discipline to make its place in the world as an undisputed natural science. Psychology, as it is generally thought of, has something esoteric in its methods. If you fail to reproduce my findings, it is not due to some fault in your apparatus or in the control of your stimulus, but it is due to the fact that your introspection is untrained...I firmly believe that two hundred years from now, unless the introspective method is discarded, psychology will still be divided on the question of whether auditory sensations have the quality of 'extension,'...whether there is a difference in 'texture' between image and sensation and upon many hundreds of others of like character."

Behaviorism began to form a stronghold in psychology and to dominate the research in virtue of the sheer amount of behaviorist experimentation being conducted about one decade after the death of Ivan Sechenov (1829-1905) and after Ivan Pavlov's (1849-1936) Nobel Prize speech in 1904 on the surprise topic of classical conditioning (i.e., instead of his award-winning work on digestion). John Watson's (1878-1958) experimental findings, concerning operant conditioning, paved the way for far less introspective accounts within psychological research and experimentation.

The result of so much behavioral research was a reduction of focus upon mental imagery in the field of psychology roughly from the 1920s until the beginning of the 1950s, which was just before cognitive psychology became realizable as an interdisciplinary study. Cognitive sciences began to make their marks during a MIT at a conference on September 11, 1956 with computer scientists, psychologists, and Noam Chomsky, the youthful theoretical linguist (Miller, 2003).[23]

By the late 1970s the Alfred P. Sloan Foundation (i.e., named after the CEO of General Motors) donated to the cognitive sciences, which solidified its name that had previously been "information processing psychology" at Carnegie Mellon University, for instance. Mental imagery reemerged as a concept from the very beginnings of cognitive science, albeit as an *explanans* rather than as an *explanandum*, which began yet again to serve as a guiding theoretical postulate (See Ch. **I.D**), aiding in the production of testable scientific hypotheses.

[23] There are some exceptions concerning the study of mental imagery within the 1920s through the 1950s (e.g., Pear, 1924 & 1927; Washburn, 1925; Aveling, 1927; Griffits 1927; Jacobson, 1932; Goldthwait, 1933; Sartre, 1936 & 1940; Shorter, 1952 (Shorter, for instance, argues that visual mental imagery is more like a set of descriptions than seeing.); Sperry, 1952; Flew, 1953; Schlaegel, 1953; Bexton et al., 1954; Brain, 1954; Danto, 1958; Barber, 1959)

B. Reintroduction of Mental Imagery to Psychological Experimentation

Mental imagery reentered the theoretic and practical concerns of psychologists with the newly emerging cognitive scientists[24] after a few decades of silence. For instance, George Miller (1956, 95) asserts that:

> "Our language is tremendously useful for repackaging material into a few chunks rich in information. I suspect that imagery is a form of recoding, too, but images seem much harder to get at operationally and to study experimentally than the more symbolic kinds of recoding. It seems probable that even memorization can be studied in these terms. The process of memorizing may be simply the formation of chunks, or groups of items that go together, until there are few enough chunks so that we can recall all the items."

One of the first cognitive psychology textbooks[25] was written by Ulric Neisser (1966, 4) in which he states:

> "{T}he term "cognition" refers to all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used. It is concerned with these processes even when they operate in the absence of relevant stimulation, as in images and hallucinations. . . . Given such a sweeping definition, it is apparent that cognition is involved in everything a human being might possibly do; that every psychological phenomenon is a cognitive phenomenon. But although cognitive psychology is concerned with all human activity rather than some fraction of it, the concern is from a particular point of view. Other viewpoints are equally legitimate and necessary. Dynamic psychology, which begins with motives rather than with sensory input, is a case in point. Instead of asking how a man's actions and experiences result from what he saw, remembered, or believed, the dynamic psychologist asks how they follow from the subject's goals, needs, or instincts."

[24] Noam Chomsky, however, does assert that the first cognitive science revolution occurred during the 17th century in Europe, which Chomsky states within a lecture at Carleton University in Ottawa on April 8, 2011.
[25] Thomas Moore published a textbook titled *Cognitive Psychology* in 1939.

The term “mental imagery” in cognitive psychology has been argued to mean any entities, settings, and events or objects about which a being generates a mental representation, which are not directly perceived via sense perceptions (Sternberg, 1999 p. 514). MacInnis and Price (1987, 473-4) maintain that mental imagery is “(1) a process (not a structure) by which (2) sensory information is represented in working memory.

Imagery processing, and information processing in general, fall on an elaboration continuum that ranges from processes limited to the simple retrieval or evocation of a cognitive concept to processes involving multiple concepts and constructions (e.g., problem solving, creative thinking, and day dreaming).” Mental imagery, according to Horowitz (1970, 3), is “{a}ny thought representation that has a sensory quality we call an ‘image’.”

However, imagery may also be defined as any mental recollection of the sights, sounds, tastes, smells and touches that one makes. Images *may* involve recollections of emotional feelings and remembrances of conscious experiences of choices (e.g., memories of emotional facial expressions as mental images). There is also question about the relation, function or necessary role that mental imagery plays with memory and recalling specific objects within the environment. According to O’Keefe and Nadel (1978, 389-90):

> “*The function and nature of imagery*. The demonstration that concrete words are recalled better than abstract words (cf. Paivio 1971) gave credence to the possibility that the chance to encode memory in imaginal form would improve long-term memory. The independence of some form of imaginal coding from verbal coding had already been established (e.g. Brooks 1968) and the study of imagery was on its way. Subsequent work has verified the facilitatory effects of forming images between paired associates (Bugelski, Kidd, and Segmen 1968), the importance of an interaction, preferably spatial,

within the image (e.g. Bower 1970), and the low interference seen between items remembered through the use of imagery coding.

The importance of spatial context in these effects is brought out clearly in the study of 'the method of loci', an imaginal technique known to the ancient Greeks and Romans and described by Yates (1966) in her book The Art of Memory as well as by Luria (1969). In this technique the subject memorizes the layout of some building, or the arrangement of shops on a street, or any geographical entity which is composed of a number of discrete loci. When desiring to remember a set of items the subject literally 'walks' through these loci and commits an item to each one by forming an image between the item and any distinguishing feature of that locus. Retrieval of items is achieved by 'walking' through the loci, allowing the latter to activate the desired items. The efficacy of this technique has been well established (Ross and Lawrence 1968, Crovitz 1969, 1971, Briggs, Hawkins and Crovitz 1970, Lea 1975), as is the minimal interference seen with its use."

Abstract words (e.g., *love*, *hate*, *freedom*, *good, democracy* etc.) involve concepts that cannot be comprehensively formed via any particular mental image. Generally, abstract words cannot be as easily remembered as concrete words. **Concrete terms** (e.g., *spoon*, *chair*, *guitar*, *green* and *running* etc.) involve those objects and events that we can sense and imagine, and the concrete terms' concepts are easier to memorize, especially via methods of memorization (e.g., the loci method).

The **method of loci** may involve an individual imagining her home, involving five different rooms with ten objects per room (e.g., the kitchen table, counter, cabinet, oven etc.). The task of memorizing, say, 50 items in a certain order would involve associating, with the assistance of mental imagery, each of those 50 items, which are considered to be placed within each room on top of, underneath, within or by any of the familiar objects inside her home.

Once the associations are made (e.g., if one of the 50 items is a $10 bill, then she may imaginatively associate the $10 with the dresser of drawers in her bedroom and further associate the "drawer" with "withdrawing money" while

forming a mental image of placing the $10 bill in the tenth drawer). The latter associations would involve the formations of multiple mental images, involving ideas that concern concrete words as well as several chances to remember the item (e.g., $10) via its imaginative location in her home, within her bedroom, inside the dresser, and in the tenth drawer.

There are aspects of memorization and processes involved with techniques, such as the loci method, that involve creativity. The associations that are made as well as the mental imagery that is formed during the loci method can be interpreted as incredibly creative. Parasuraman and Rizzo (2007, 139) argue that superior instances of memorization do not involve individuals with differences in brain structures or even advanced intellectual abilities but rather better memorization involves the incorporation of spatial learning strategies, such as the loci method.

The more elaborate and creative each association of an item is allows for a greater likelihood that the item will be remembered via such spatial memorization strategies. The less diversity and lesser amounts of associations with imagery involved within memorization appears to yield less creative, less imaginative, lesser amounts of imagery as well as reduced chances of recalling the items associated with familiarities. So, with respect to memory, memorization strategizing, and mental imagery there is an interesting connectivity with the creativity of associations that the memorizer makes.

Mental imagery includes many of the thoughts about objects that do not exist, like the imaginative image of oneself with eleven fingers. Thus, the phrase

‘mental imagery’ is very similar to the way that Hume uses the term ‘idea.’ In fact, the only major difference here is that Hume’s ‘ideas’ also refer to the reflections of our emotions, like love, fury and fear as well as remembrances of decision-making, whereas mental images are typically not conceived as involving the latter types of recollections (i.e., perhaps because the latter emotions and choices concern abstract concepts and terms that could involve several different types of formations of mental imagery).

Emotions, such as abstract ideas like anger or happiness, are less obvious when they are remembered and can at best be partially formed as mental imagery (i.e., there is no single set of images that encapsulate any particular emotion). However, facial expressions of others and ourselves are definitely imaginable, and facial expressions are interlinked with emotions and emotional expressions. Moreover, facial expressions of surprise, disgust, contempt, anger, sadness and happiness have been illustrated since the 1970s to be universal emotional expressions across cultures and are intricately involved with emotions, the remembrances of emotions etc. (Ekman & Friesen, 1971; Ekman, 1993).

An obvious mental image is a person visualizing an apple while his or her eyes are closed, for example. The specific terms, which are concrete, are typically the types of mental images and objects that are easy to remember because general terms can involve various different possibilities. For example, the word “fruit” can involve a wide range of different sizes, shapes and colors of a single object concerning the formation of a mental image of a piece of fruit.

Although apples may range from red to green to even the blackness of a rotten apple, the range of possible developments and mental images are not as great as those for a fruit. The words “fruit,” “food” and “music” are general terms rather than specific terms (e.g., *rice, eating* or *banana*). All of the latter terms as well as abstract terms, such as competitiveness and creativity, may very well coincide with formations of mental images that include imaginations of instances of *food* and *competition* (i.e., abstract terms), despite the inability to represent the abstraction and generality with any single image (i.e., *competition* cannot be encapsulated by any singular image that is definitive for that concept, which may include dominance and subordination or something like a split decision or tie with no clear winner at all).

Creativity, in the forms of creative thought and creative expression, involves combinations of abstract, general, and specific terms and ideas. Creative thought sometimes involves mental imagery formations that coincide with these abstract, general and specific terms. There is greater freedom of the ranges of relevant mental imagery that can consistently coincide with the abstract and general ideas. Moreover, there are probably no sets of mental imagery formations performed by any individual that would allow for any particular abstract or general term to be comprehensively represented.

Plucker et al., (2004) and Plucker and Beghetto (2004, 156) maintain that “{c}reativity is the interplay between ability and process by which an individual or group produces an outcome or product that is both novel and useful as defined within some social context.” Plucker and Beghetto (2004) show that the history

of the study of creativity within the fields of psychology and education has involved much support for creativity as a domain-specific as well as a domain-general phenomenon, and they conclude that creativity involves both specificity and generality levels that are dependent upon the ages of the individuals involved as well as the social contexts.

There are various psychologists who have attested to the fact that mental imagery leads important roles within the cognitive process of creativity before something is creatively expressed (Ernest, 1977; Sheehan et al., 1978; Forisha, 1978; Shaw & DeMers, 1986 & 1987). Schmeidler's (1965) study concluded that there is only a minor but a significant correlation between mental imagery's vividness and creativity.

Unfortunately, what is typically not tested in such studies of vividness of mental imagery and creativity is the ability of those who are more efficient at tasks that demand the utilization of mental imagery, which is also typically greater in its vividness (Betts, 1909[26]; Marks, 1972; Denis, 1982; Cornoldi et al. in Logie & Denis, 1991). It appears obvious that the practical usage of much of Tesla's mental imagery and its remarkable vividness played crucial roles within his creative designs and products. Perhaps many creative individuals have more

[26] Betts (1909) poses the following questions: "1. A squirrel is clinging to one side of a tree, and a man is standing opposite on the other side of the tree. The man walks around the tree, but the squirrel also moves around the tree, so as to keep just out of the man's sight. They continue this movement until each has gone entirely around the tree. has the man gone around the squirrel, a. in the sense of having been in front, behind, and on both sides of him? b. in the sense of having been east, west, north and south of him? 2. A three-inch cube, painted red, is sawn into inch cubes. a. How many of the inch cubes have paint on three faces? b. How many on two faces? c. How many on one face? d. How many have no paint on them?"

productive endeavors than undergoing experimental investigations and studies concerning their psychological states and behaviors.

Tasks that require the imagination of the manipulation of objects in order to complete them successfully involve ways of ranking subjects, whereas self-reports and surveys, attesting to the vividness of mental imagery, may include individuals who cannot give accurate accounts of how vivid their mental imagery is in comparison to others. fMRI machines, however, enable practitioners to confirm or disconfirm individuals' relative judgments about the vividness of their own mental imagery.

People sometimes dwell within fantasy worlds of mental representations within which they manipulate mental images, i.e., day dreaming or voluntarily imagining greater details of objects and more events. Other times we experience what is strikingly consistent with reality by means of our sense perceptions. On some occasions our sensory experiences are mistaken for our imagery. In other instances our imaginations are erroneously thought to be our sense perceptions. As our images increasingly become more vivid to us, they tend to become more 'realistic' and tend to be deemed 'real' and 'external' rather than 'internal' and 'imaginary' more often by the individual.

According to Mardi Horowitz (1970), a clinical psychologist who uses cognitive science terminology, the term 'vividness' should be utilized quite differently than Hume's use. Mardi Horowitz working hypothesis is that objects that we experience are real and external, which we are able to represent mentally through imagery that is internal. Hume was not willing to concede that

objects are real and external because it is conceivable that they are, wholly or partially, imaginations. Hume was skeptical about several characteristics attributed to the world. Most importantly, Hume realized that we may discover that the sensory perceptions, concerning our conscious experiences of things within our environment, are inaccurate, but can also be more vivid than some of the mental images we may form of those very same things, despite their accuracy levels.

Basically, cognitive scientists may be considered to assume to often (i.e., involving hypotheses that interfere with observations) that we live in a world that possesses the following characteristics: the world is external to the inner world of subjects and exists constantly and continuously rather than discretely or discontinuously. Hume explains this within his *Treatise of Human Nature*.[27]

[27] **Argument Concerning the Belief in Existence and of the Existence of the External World within Hume's *Treatise*:** Hume maintains in Book I sect. II.vi. that the ideas of (a) existence and (b) external existence are: (1) challenging to explain, like (c) space and (d) time; (2) when (a) through (d) are explained we may be better prepared for an analysis of knowledge and probability; (3) moreover, all impressions and ideas are conceived as existent (e.g., the idea of God exists (for some atheist) because this thought or idea exists); (4) from memory and consciousness "the most perfect idea of assurance of being is derived" (Hume's *Treatise* Book I sect. II.vi.); and (5) as a result of (1) – (4) a dilemma follows, which is, namely, because "we never remember any idea or impression without attributing existence to it, the idea of existence must either be derived from a distinct impression, conjoined with every perception or object of our thought, or must be the very same with the idea of the perception or object" (ibid).

(6) if we take any two impressions that are conjoined (e.g., seeing the brightness and shape of the sun), then we can separate the two impressions (e.g., forming one impression of something shaped differently that is bright). (7) All ideas and impressions are considered to be existent; thus, "the idea of existence is not derived from any particular impression" (ibid). (8) It follows from (7) that the idea of existence is identical with the "idea of what we conceive to be existent, which means merely that to reflect upon any particular thing in a simple manner and to reflect on something as existent are the same. So, "whatever we conceive, we conceive to be existent" (ibid). (note: the latter statement is about the mental contents of the individual conceiving or people conceiving something in which case we do take the objects of our consciousness or states of consciousness to exist).

Mardi Horowitz (1970) argues that there are four different categories of mental images, which are distinguished by their degrees of vividness and include:

- **Hallucinations**
- **Pseudohallucinations**
- **Thought images**
- **Unconscious images**

All of the four mentioned categories of mental imagery are completely internalized images, which means that the imagery is not reacting to external stimuli via sense perceptions. "A hallucination" is a mental image that is vivid and appears to be real.[28] An object like a pineapple, for instance, may be thought of as if it were an external object being viewed through the hallucinating person's eyes, like an actual pineapple. However, the pineapple is only a

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Consequently, "any idea we please to form is the idea of a being; and the idea of a being is any idea we please to form." (9) "nothing is ever really present with the mind but its perceptions or impressions and ideas, and that external objects become known to us only by those perceptions they occasion. To hate, to love, to think, to feel, to see; all this is nothing but to perceive." (10) Because (9) and the fact that all ideas are derived from impressions, we cannot form a conception of anything that is in any way different from impressions and ideas. Therefore, "the farthest we can go towards a conception of external objects, when supposed SPECIFICALLY different from our perceptions is to form a relative idea of them, without pretending to comprehend the related objects. Generally speaking we do not suppose them specifically different; but only attribute to them different relations, connections and durations" (ibid).

We may conclude from some of Hume's work within the same section of his *Treatise* within Book I that although many people tend to claim: (1) objects continue to exist when they are not perceived; (2) objects exist external to the perceiver (i.e., objects in the world are different from any impressions or ideas of them); (3) object constancy is also attributed to objects with the same given characteristics as (1) and (2).

[28] Hallucinations appear to be the results of prolonged sensory deprivation in many cases. One possible explanation for this is that data processors of the nervous system lower their thresholds for noise when there is a lack of a particular type of data, and this absence results in the amplification of this kind of data into arbitrary patterns that confirm signals and result in hallucinations, which are basically random confirmations and excited expectations (Dennet, 1991 p. 13).

figment of the person's imagination and thus it is considered to be internal. Moreover, hallucinations seem involve real and external objects without any immediate contributions from an external sensory apparatus.[29]

A "pseudohallucination" is an internalized image that appears less vivid than a hallucination, and more vivid than a thought image. The pseudohallucinatory images are extremely vivid but "lack the sense of reality found in hallucinations" (Horowitz, 1970, 9). The criteria that generally distinguish these sorts of images from thought images and hallucinations are behavioral and emotional responses performed by the individual.[30] The person may claim that s/he does not believe that these images are real, but s/he may act toward the images as if they were real. For instance, a person might imagine that his mother was in a terrible car wreck and that she died on the way to the hospital. Even if this event did not happen, he might cry uncontrollably. However, if the person is asked to recall the event it would not appear as vivid as before and it would not evoke the same kind of emotional response.

Thought images are typically the category of mental imagery that cognitive psychologists focus on because these are the ordinary images that are more closely related to discovery and creativity, and they occur more frequently during consciousness. One's range of vividness may be dull to very clear. Geometrical figures, syllogisms in logic or sexual fantasies are a few examples of the content

[29] If there is even the slightest contribution of one's sense perceptions to the formation of the image, then the experience is referred to as an illusion rather than a hallucination, according to Esquirol (1838 as cited by Horowitz, 1970).
[30] In Karl Jasper's 1913 book, *Allgemeine Psychopathologie*, it is argued that the accompaniment of behavior is more important, with respect to the diagnosis and prognosis of the psychosis or neurosis of the individual, than the mere report of the hallucination, which may be more or less fantastical.

of thought images. According to Horowitz, images may be categorized as unconscious, which is an image that was once conscious but is deliberately forgotten because it presented some sort of psychological conflict. This line of thinking is generally attributed to Sigmund Freud and psychoanalysts. Unconscious mental images are repressed. David Hume never considered the unconscious nature of ideas or imagery in his writings.

According to Horowitz (1970), in a few studies it has been possible to relate the direction of one's eye movements to the depictions of movements in contemporaneous dream experiences, and it is plausible that eye movements during dreams are not following dream images that were already formed but are influencing and evoking particular images. In 1910 an experiment performed by C. W. Perky illustrates the paramount role that eye movements[31] and perception have on mental images.

Perky told her participants to fixate their eyes on part of a blank screen while they visualized objects, which included a leaf, book, tomato, lemon and orange. While the subjects formed mental images there were projections on the screen of very faint patches of color, which were the sizes and shapes of the objects. These projections were barely above the normal threshold of visibility

[31] According to Findlay and Gilchrist (2003 in Ch. 3.8), "{a}ttention allows us to select part of the visual information available for further or more detailed analysis. The fovea provides the primary mechanism for such selection to occur. Items that are not fixated receive greatly reduced processing particularly in terms of acuity. In addition it is possible to attend to items without moving the eyes. This covert attending also confers some processing advantage but these effects are small in comparison to the advantage associated with fixating the item of interest. Both the behavioural and physiological evidence suggests that this covert orienting is closely related to overt saccadic selection. The spatial selection processes works alongside mechanisms that allow feature-based selection; these mechanisms can guide eye movements to behaviourally relevant items."

for people. These projections were so faint that the subjects did not realize they were looking at images on the screen.

Interestingly, the subjects thought that the projected images of light on the screen were their mental images and products of their own imaginations. The projections influenced the mental images of the participants to such a great extent that some of the subjects expressed surprise when they attempted to imagine the objects in particular configurations, but they ended up forming their mental images in a different fashion, which corresponded to the projected pictures, according to the accounts. For instance, one of the participants was completely surprised to find that he was imagining an elm leaf when he had first attempted to visualize a maple leaf.

The Perky experiment illustrates David Hume's idea of resemblance, one of the three thought transition principles. Arguably, in the experiment the participants' thoughts were altered via the principle of resemblance in such a manner that the subjects transited their thoughts from what they had first imagined to what the screen resembled.

Impressions generally feel undeniably real, but so do hallucinations, whereas ideas are typically faint. Hume thought that the mind could be subdivided into two separate parts, impressions and ideas. Hume did not know exactly what phenomenon would distinguish between these two parts, although he did understand: (1) that the differentiation between thoughts and sensations lies on a spectrum; and (2) the shades of variation that range from vivid to faint differ in some sort of intensity.

Hume did not know the physiological mechanisms that determine the vividness and intensity of an experience, whether it is an idea or an impression. Furthermore, because Hume was unfamiliar with cognitive science, he was unable to see the overlapping degrees of electrical and physiological intensity and vividness that ideas and impressions contain. Put bluntly, some ideas are more vivid than sensations, but generally it is the other way around, and the importance of such presumptions is at least doubtful.

Image transformation occurs when objects are thought of as rotating or shifting. Obviously, when it takes longer for objects to shift or rotate there is a greater distance involved in the rotation, if we assume that the objects shift at the same speed. Likewise, imagined objects take longer to rotate if the imagined object is thought of as shifting a greater distance, and at the same speed (See Ch. 1.B). So, if we have an object at point A, and then we shift the object to point B, the greater the distance between points A and B results in the experience of a greater period of time than the time needed if the two points were closer during the movement. The latter is true for both the world that we perceive through our senses and the imagined world, which consists of mental imagery.

So, it is also questionable whether (or to what extent) the mental constructions of spatiality and temporality are superimposed upon objects within the environment (or the environment with its objects) during sensory experiences since the mental movements and time that elapses share similarities. In philosophy as well as within theoretical physics, for instance, this becomes a major problem, which concerns observations in general. Einstein, for instance,

attributed properties to space-time, such as curvature, whereas Nicola Tesla[32] maintained that space has no property whatsoever. Philosophers have debated for centuries about whether space and time are purely subjective or mind-dependent or not.

The mental imagery rotation phenomenon, concerning spatiality and time, involves a high positive correlation between the distances of travel for both sensed and imagined objects and the amount of time that takes place. R. N. Shepard (1984 as cited by Wilson & Keil, 1999, 388) argued "that this occurs because, due to natural selection, certain laws of physics have been internalized in the brain and act as constraints on the imagery process." An alternative explanation that is perhaps consistent with the latter is that "motor programs guide imagery and, consequently, objects are mentally manipulated in the same manner that real objects would be physically manipulated" (Wilson & Keil, 1999, 388). Additionally, some motor areas of the brain have actually been shown to activate during mental imagery rotation experiments, and imagery is actually referred to as motor imagery in some cases (See **Fig. 3**).

When we consider the vast differences between the two major philosophic approaches as well as the theoretical physicists arguments, concerning space and time related to mental imagery rotation, it is beneficial to understand the theoretic presumptions that may lead one to scientific hypotheses, such as

[32] Tesla (1932) in the New York Herald Tribune claims "I hold that space cannot be curved, for the simple reason that it can have no properties. It might as well be said that God has properties. He has not, but only attributes and these are of our own making. Of properties we can only speak when dealing with matter filling the space. To say that in the presence of large bodies space becomes curved is equivalent to stating that something can act upon nothing."

Shepard's (1984) idea that external physical laws of space-time have been internalized and thereby provide the individual with imagery rotation abilities akin to physical rotations. What we begin to see again is a commonly formed dichotomy within cognitive science that results from the inner-outer way of thinking about the subject and objects and which results in speculative hypotheses that are not grounded within rational argumentation. For the latter types of cases philosophers prove useful as academics skilled specifically in the art of critical thinking, reasonable argumentation, and methods for evaluating arguments.

Let us now consider the two following studies, which were created in order to determine to what extent our physiology contributes to our mental imagery. Many cognitive psychologists assume that area V1 of the visual cortex is a crucial focal point for both sensory perceptions and mental imagery. The reasons for this are as follows: (1) it has been noted that damage to a particular section of the V1 region of the visual cortex has been associated directly with blindsight[33]; and (2) visual sensations are thought to be focused in area V1 because "cortically adjacent features correspond to retinally adjacent features" (Kosslyn as cited by Kuzendorf and Hall, 2001, 80).

Many researchers believe that the retina and movements of the eyes play another crucial role in image formation. Guerrero-Figuero and Heath (1964) analyzed a schizophrenic subject with electrodes set in his optic tract (Kunzendorf and Hall, 2001 p. 80). What Guerrero-Figuero and Heath found was

[33] Blindsight is a disorder where the individual cannot consciously perceive visual information, but interestingly, the information can be correctly guessed at levels that are better than random guessing.

that larger evoked potentials in retina ganglion cells took place when the subject hallucinated brighter images and smaller evoked potentials occurred when objects were hallucinated as dimmer.

Robert Kuzendorf and Scott Hall (2001) performed an experiment on 66 participants who received electroretinograms (ERG). There were two groups in the experiment. One group was the 60-second group, and every individual was told to visualize a bright light for 1 minute. The second group was told to visualize a bright light for 10 seconds. The ten-second group engaged in imageless thinking for 50 seconds, they formed images of a bright light for 5 seconds, and then 5 seconds later the participants viewed a bright light. The 60-second group formed images of a bright light for 1 minute, then they viewed a bright light 5 seconds later.

Kuzendorf and Hall (2001, 79) found that "the B-wave of the ERG was smaller when vivid imagers spent 60 seconds imaging a bright light prior to flash onset than when they engaged in only 10 seconds of pre-flash imaging." The results of this experiment suggest that imaging a bright light for a longer period of time actually fatigues the retina in the same manner that seeing a bright light for a longer time does. However, the subjects' eyes were not fatigued to the same extent as if their eyes were actually sensing a bright light. So, there are some interesting parallels with Hume's principle about sensations being more vivid than ideas, if we consider greater brightness to be one type of greater vividness.[34]

[34] Hume's degrees of vividness should be thought of as being determined by the varying degrees of physiological intensity that takes place when one senses and imagines; thus, humans respond to sensed and imagined stimulus in different shades of physical intensity; and this somehow determines the degree of vividness. Of course, the more

Interestingly, the physiological aspects of eye movements and retinal fatigue play vital roles in the production of mental images and visual sensing. In fact, they play such a crucial role that under Humean guidelines it would be impossible to distinguish whether specific images are ideas or impressions. Hume was unable to explain what he meant by the assertion that ideas are different from impressions to the extent that ideas vary in the degree of their less forceful nature and faintness.

However, we may typically distinguish ideas from sensory impressions perhaps by the greater degrees of intensity of the sensory impressions that the retina and eye movements evoke via electrical, physiological responses, but perhaps these distinctions are not always misguiding during irregular instances, such as hallucinations and pseudohallucinations. Again, the overall importance of such distinctions between mental imagery and sensory experiences is, however, doubtful, especially considering the fact that a scientific observer maintaining accuracy levels concerning the observed contradistinctions between

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intense the electrical activity is in the visual cortex and eye the more vivid the image looks; this is why the 60-second group in Kuzendorf's experiment possessed retinas that fatigued more than the 10-second group.

But this still does not make clear the distinguishing characteristic between a hallucination of an object and a sensed entity. For Hume, the intensity and vividness is exactly the same for hallucinated objects and sensed objects, or the hallucination might even be more vivid than an object that is sensed. Here, Hume is at a loss because he simply refuses to make the assumption that external objects exist, which would allow for a differentiation between hallucinated objects and sensed objects.

Under the mentioned assumption hallucinated objects are different from sensed objects because we react physiologically to external objects, so hallucinated objects are merely caused by a physiological response that is not rooted in the actual presence of an external object. And as mentioned before, vivid images that are not the result of external stimulations, hallucinations, are typically the results of sensory deprivation in regard to the particular image and disorders, like schizophrenia. This explains why many people often think they see familiar people who have been deceased for years.

veridical sensory experiences, pseudohallucinations and hallucinations is problematic.

It is ambiguous whether Hume would consider the imagery in these experiments to be impressions or ideas. This sort of ambiguity resonates throughout Hume's writings because he does not define what the word "vivid" means, and he was unwilling to explicitly assume that objects exist externally because he strictly adhered to his maxim that "anything conceivable is possible."[35] So, it was conceivable to Hume and, therefore, possible that objects appear to be real and external but are not. Within the following sections we shall see how the concept of possibility should be incorporated within certain aspects of theoretical and scientific investigations in respect to a definition of "possibility" that approaches an operational definition or at least allows for more easily understandable and testable scientific hypotheses, which incorporate the concept of possibility, to be more efficiently utilized.

C. Concepts, Conceptualizing and Possibility Concerned in Investigations

Preconceptions are always carried into theoretic and scientific investigations, which is why the concept of the object, i.e., that is about to undergo investigation, lacks the sophisticated content and elaborate descriptions that the concept of the object after the investigation contains. Beck (1961, 7)

[35] Hume maintains within his Treatise (Book I, Part II, Sect. II) that: "'Tis an established maxim in metaphysics, That whatever the mind clearly conceives includes the idea of possible existence, or in other words, that nothing we imagine is absolutely impossible."

describes this scientific process as follows in his book *Notwendigkeit und Moeglichkeit* (i.e., *Necessity and Possibility*):

> "THE PRECONCEPTION OF THE "BEING": If a botanist wants to know about the fine inner structure of a type of bloom, then he has before the investigation and after the investigation a concept of its bloom. The concept, which he has before, is weaker with respect to content than that which profited through the investigation. A certain minimum content must, however, be possessed in any case by him, or else the botanist could not begin his investigation at all: If he still thinks nothing at all with respect to "blooming" before the investigation, he also does not know about which object he now should establish something. Such an investigation as the basis of the concept of the object of this investigation is what we call the "preconception" of the appropriate object out of which the investigation's resultant concept is the same as the "full concept." The latter is with this, however, not already a "total concept" of the object of investigation, since it does not portray the outcome of an absolutely exhaustive knowledge, but rather means only an again self-restricted improvement of knowledge.
>
> In this sense we now want a "preconception" of the "being" to search to form, and from the preconception to reach a possibly sufficient "full concept" of the being. This will, according to nature, become evident first in the further course of our modal ontological investigations."

The line of thinking that "anything we can think of is possible" has the potential to lead to grave misconceptions. For example, such misconceptions also extend beyond the mistaken assumptions, influence and misguided use of the imagination via Titchener (See **Ch. III.A**). Obviously, the latter scientist in Beck's example may very well consider a different set of possibilities with respect to the behavior of the plant before the investigation than he considers after the investigation.

Moreover, the concept is said to be "full" because it is "filled with the knowledge attained from the investigation" but still lacks the totality of the concept. Since mental imagery and creativity involve hundreds of efficient investigations contributing to the concepts of mental imagery and creativity, we are confronted with concepts that sophisticatedly incorporate the investigative

findings of mental imagery and creativity but still lack the entirety of the both concepts.

There tends to be a wider range of potential or possible occurrences, according to what scientists consider before any investigation, i.e., until the investigation yields results, and then the concept of the theme of the investigation begins to involve restrictions, sufficing to illustrate behavioral patterns associated with the fuller concept. The reason why the scientists consider a broader range of possible occurrences, concerning the object about to undergo the investigation, is that scientists do not know what to anticipate because discovery is an aspect of scientific experimentation. Also, allowing their expectations to incorporate vaster amounts and measures can prevent mistakes and disasters.

For instance, a new and upcoming mixture of chemicals may be considered to be highly explosive before the mixture as opposed to after they are mixed. Thus, considerations of improbable occurrences become aspects of the preconception as well as the cognitive process of the attribution of ranges of possibilities. From the preconception to the full concept, which consistently incorporates the observations of the object after the investigation, what may be illustrated is a cognitive process of conceptualization that always involves some individual's observation of an object within the environment. Interestingly, the latter example of the chemicals suffices to encompass at least one level of observation and analysis that involves mental imagery and creativity directly (i.e., chemicals are necessary conditions for such neurocognitive processes).

The relations between conceivability, possibility and imagination are theoretically problematic and directly concern mental imagery in more than a few respects (Kind, 2005). Moreover, there are typically many false presumptions that coincide with the mode and concept of possibility (Hartmann, 1938). Since the concept of possibility is important in many respects here, it is worthwhile to address these issues from the standpoint of common misconceptions.

For cognitive science "possibility" also concerns a set of cognitions that are intricately involved during different phases of the cognitive process of realization (i.e., possibility formations involve more specified cognitive processes within the more general process of recognition as well as realization). However, the concept of possibility is typically used in order to partially explain (i.e., possibility as an *explanans*) all other concepts and is used within all other disciplines, incorporating each and every level of analysis and observation.

This latter and almost all-inclusive conception of possibility[36] (i.e., including every concept, except for impossibility) is very difficult to avoid and to manage in respect to explaining theoretic concerns and applications within science. For how does the skeptic, who claims an event is unreal and insignificant, argue against the scientist who claims the event is possible and thus incorporates the event into his preconception? What is questionable is to

[36] The latter usage of the concept of possibility incorporates everything, including the kitchen sink, the house and the car, because anything that is real is encapsulated by this concept as well as many things that are unreal, such as the book you have not written and will not write and the skinny girl who could be standing in the doorway but is not. Thus, the latter concept of possibility incorporates all of those things to which we attribute the mode of possibility, including what has not yet happened and what may not (or might never) happen as long as it is not impossible.

what extent the formations of possibilities, regarding the preconception of an investigation, can interfere with the observations and methods of science.

Mental imagery formations are also involved in the formations of possible objects and events. For instance, the imagination of the girl in the doorway may typically involve mental imagery formations (i.e., as opposed to thinking or imagining with language rather than mental imagery), which may typically lead one to attribute possibility to the girl in the doorway, despite the fact that she is not there. The latter attribution is a modal attribution, which is less important than the modal attribution of unreality, for instance, because the latter modal attribution is at least more accurate (i.e., when both modes are correctly attributed).

The cognitive attribution of location is important with respect to the modal attribution of possibility because the attribution of certain spatial relations to the girl may well provide enough specification to allow for the formation of a mental image of the event, despite the fact that there is no attribution of a temporal relation (i.e., at what time the girl is located there). The lack of the temporal relation (i.e., at what time exactly that girl stands in the doorway) partially describes a difference between the visual mental image and the visual sensory experience, say, of a girl in the doorway.

On the other hand, many attributions of possibility to events and objects even lack the spatial relation. For instance, the girl in the doorway could be a number of girls in any doorway around the world, but the modal attribution of reality, existence or being there (i.e., Kant's *Dasein*) typically includes a loose

conception of spatiality (i.e., perhaps not pinpointed but still located). For the latter reasons the modal attributions of reality and unreality are more accurate than attributions of possibility (i.e., assuming each attribution is correct). Since science concerns specifying and measuring that which concerns space, mass and time, and the characterization of objects and events as possibilities lacks specification and measurement, the role of the involved concepts of possibility is quite mysterious. Yet possibility involves all of the exceptions to so-called rules, the occurrences that are unexplainable and improbable and what many would claim "can happen," "can be" or "could have happened," despite at least seemingly contradictory claims that "it never happened."

In the latter sense the two following statements, presumably uttered by two people at the same time and place, are typically considered by most systems of thought to not involve a contradiction: (1) "The skinny girl is not standing in the doorway now"; and (2) "It is possible that the skinny girl is standing in the doorway now." There are systems that would consider the latter two statements to be contradictory, including the Megarean[37] and Spinozan systems (Hartmann, 1937). It does appear that if the two people see the same empty doorway, and the second person utters (2), then he is being insincere or appears to be asserting less than he knows since the incorporation of the expression of possibility sometimes denotes that the expresser would like to express his or her uncertainty about the matter.

[37] Megareans maintained that if something never occurs, then it is impossible, which suggests the presumption that the world in its entirety is a finite system. Moreover, Megareans argued that anything that is possible is real at some point, and anything that is unreal is also impossible because, for instance, "that which never happened did not possibly happen."

Additionally, the attributions of causes and effects concern modal attributions, which may directly involve mental imagery formations of suspected causes and effects. When one interprets an event as a "cause," the individual may typically form mental imagery that consists of what the individual considers to be the effects of the cause. Vice versa also occurs insofar as the interpretation of an event as an "effect" may generally lead the individual to form mental imagery of the cause. In both of the latter formations of mental imagery of the cause and effect the imagery may suffice, under certain conditions, in order for the individual to judge that the events, represented by the mental images, are possible ones. Such judgments need not incorporate any specific location or temporal point in order to be judged as possible.

Creativity, creative thought and creative expression also concern the productive outcome of some creative possibility that occurs within a cognitive selection process that may involve considerations and judgments about other possibilities that could have been expressed as outcomes. Creativity does not always involve accuracy or the most relevant and important modal attributions to objects and events. So, stories, such as Jonathan Swift's *Gulliver's Travels*, may involve a diversity of ideas, including the idea that sunlight can be extracted by scientists from cucumbers, which require different types of modal attributions because they are based upon fantastical presumptions, or they assume the fact that readers are accurate concerning their modal attribution skills and make outrageous claims in the form of irony, sarcasm or other forms of speech (Brant, 2012).

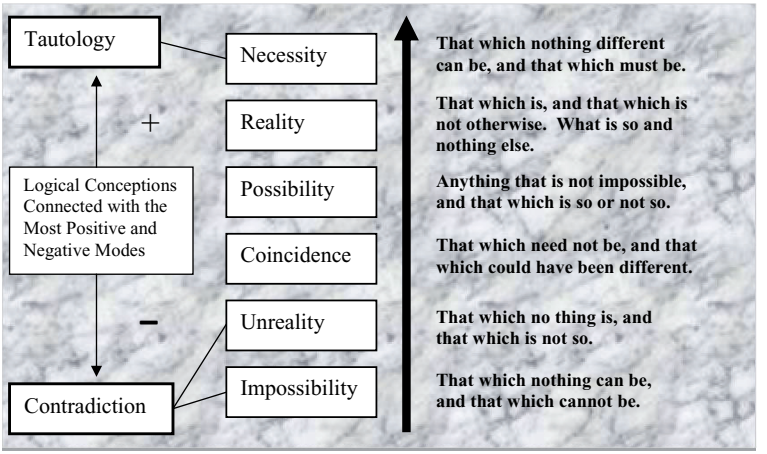
The “mode of possibility” is related to five other modes, and all six of these modalities range from positive to negative in the following order, according to traditional modal analysis: *Necessity*, *reality* and *possibility* are positive, according to traditional modal analysis, and *coincidence* (or contingency), *unreality* and *impossibility* are traditionally viewed as negative (Hartmann, 1938; Baumann, 1955; Beck, 1961; Forsche, 1965).

The idea that impossibility is strictly negative coupled with the idea that impossibility is the negation of possibility led to the traditional way of thinking that possibility is a positive mode, despite the fact that something completely unreal may be consistently conceived as being a possibility, according to the traditional framework. The “possible but unreal” was thus clarified as the “coincidentally unreal” (i.e., also known as the ”contingently unreal“ and “possibilia” (Marcus, 1975; Lycan, 2002; Menzel, 2012) rather than the necessarily unreal (i.e., the impossible). **Figure 9** illustrates these relations and definitions.

On the other hand, the idea that necessity is strictly positive coupled with the idea that coincidence is the negation of necessity (i.e., because a coincidence is something that is unnecessary) led to the idea that coincidence is a negative modality. The theoretic problem with the traditional modal analysis, which is destined to become a practical problem within cognitive science, concerns the obvious contradiction that although coincidence is a negative mode, and possibility is positive, every coincidence is considered to be a possibility within this traditional framework. Thus, there is a serious misconception with

respect to the ways of understanding these modes via positivity and negativity as well as in respect to their ranking orders within a hierarchy to some extent.

Fig. 9 Traditional Ranking Order of Modalities



Misunderstandings of the modes leads to inadequate explanations in science concerning the cognitive process of attributing modes to objects and events. The major theoretical problem at hand concerns the concept of possibility because “possibility” is defined within most systems of thought as that which incorporates the entire content of all the other modes, except for impossibility, of course. So, possibility, i.e., as that which is the unreal, coincidental, real and necessary, presents some serious misconceptions, especially when the concept is applied to cognitions concerning realization and

recognition. Let us call the latter definition of "possibility," which is portrayed within **Fig. 9**, the "traditional modal misconception about possibility."

I suggest that one way to envision the misconception is to first ask what all there is within the entire world. One uncontroversial answer is "everything" (Quine, 1948). We may very well consider that the conceptualization of everything excludes what is unreal (i.e., the coincidentally unreal and impossible), but the concept of everything or totality includes possibility, even if possibility merely concerns some cognitive act, say, during the process of recognition.

Additionally, it is worth considering that our thoughts about what is possible (or about what are possibilities) are involved within the cognitive process of realization.[38] Many of these realizations, if not all, are involved within the creative process because the cognitive processes involved with a system forming possibilities about some object or objective directly concern the interrelated process of the filtering out of possibilities (or restriction of the range possibilities) about the object during the recognition and realization process.

If we conceive of possibility as some important aspect of the process of realization, then we are not faced with another misconception that contributes to the traditional modal misconception about possibility, which is *the problematic idea that possibility includes absolutely everything*. The latter idea, that

[38] Thinking about what is possible is also involved in the recognition process, say, of faces or facial expressions, especially when misrecognitions occur prior to successful recognitions within the recognition process. Moreover, recognitions of faces and expressions may necessarily involve formations of mental images of the faces and expressions, which can be matched in similar ways to the ways that the figures were matched in **Fig. 1** within the first chapter.

possibility is all that is real, presents a vast overgeneralization that undermines the role of the concept of possibility within or as a function of thought. Thinking results from various interrelations with neurocognitions, the body and environment, and social cognitions involve the individual's considerations of the realizations and formations of possibilities of others, which differ from one's own cognitions, such as mental imagery.

The notion that "possibility is just everything" appears to render the concept of possibility as an abstract and almost meaningless one because the concept of possibility would not appear to be any different from the concept of the real or reality, if everything were included. However, the latter reason has led most academics to distinguish possibility from reality and two other concepts of possibility insofar as one concept of possibility incorporates the following:

- **The necessarily real**
- **The real but unnecessary (i.e., coincidentally real)**
- **The unreal but unnecessary (i.e., the coincidentally unreal).**

What I am asking you to consider is an epistemic conception of possibility that is specified insofar as it is a two-part cognitive process and involves: **(1)** *neurocognitive creations of representations of objects and events* (e.g., in the forms of mental images, language etc.) *at some points before the investigation of the object or realization of the event*; and **(2)** regarding the same theme (i.e., the object or event under consideration but with the accompaniment of more attained knowledge), *neurocognitive creations of representations of the object after the investigation and realizations about it*. **(1)** and **(2)** concern a concept of

possibility that aids in revealing functional and structural characteristics of neurocognitive abilities.

Moreover, **(1)** may be mistaken for a modal conception of possibility and might therefore account for totally irrelevant cognitive attributions of possibility to some type of object or event, despite the fact that the investigation revealed patterns that suggest that the range of possible outcomes are less broad than originally anticipated and show that the earlier attributions of possibility become, at best, extremely improbable outlying outcomes or impossibilities.[39] That is, the preconception concerns a wider range of possibilities (i.e., the investigator's cognitive attribution of possible outcomes), which are erroneously labeled "possibilities"[40] once the conception of the object has been defined via experimentation and investigative analysis because the concept, becoming more specified, involves a selection process (i.e., either filtering out or restricting from entrance) of outlying and extreme outcomes of the realm of the fuller concept.

For example, before the investigation a scientist may form visual mental images that involve greater electrical activity visualized within certain regions, incorporations of more elaborate interconnections between parts of an object, etc.; however, the visualizations are creative productions of the individual rather

[39] See Brant (2012, 221-243) for the distinction between the physically and logically possible and impossible. Typically only physical possibilities are utilized within the scientific preconception because logical possibility incorporates too much irrelevancy because a logical possibility is what is physically possible EXOR physically impossible.
[40] The possibilities, creatively formed before the investigation, and realizations of the object undergoing investigation are, in the beginning, less restricted by the patterns that are discovered within the investigation, which tends to allow the cognitively creative formations of possibilities to have greater ranges, considering a comparison with the much broader conception of possibility (i.e., considered as a mode that incorporates all that is real as well as everything that is unreal but not impossible).

than the object being observed by the individual. Thus, the attributions of possibilities to the object on the basis of the visualizations may best be considered irrelevant once the regions of the greater electric activity and more elaborate interconnections are uncovered.

The visual mental images, which form content that is conceptualized, involving ranges of possibilities associated with the object, may indeed be undermined by the scientist's realizations and recognitions of patterns he later attributes to the object. According to Vaidya (2011, Sect. 1), "{h}umans have a natural tendency to modalize. A tendency to think about, assert, and evaluate statements of possibility and necessity. To modalize is to either entertain a modal thought or to make a modal judgment." Although Vaidya (2011) focuses mainly upon the attribution of modes to statements, the focus within the present investigation concerns attributing modes to objects, events, experiences, imagery etc. (i.e., modalizing), which is a cognitive process involved during realization (i.e., recognizing objects and events as real and unreal). According to Kind (2005, Sect. 3), there is a tradition of thought originating at least as early as Descartes, which can also be explicitly seen in Hume's philosophy that incorporates imagination, imagery and possibility:

> "{I}magination is supposed to give rise to knowledge of possibility as perception gives rise to knowledge of the actual world. Our knowledge of the world in which we live is grounded largely in perception. But, since we have no sensory access to what is not actually the case, perception can afford us no real insight into non-actualized possibilities. In contrast, the imagination is not limited to what is actually the case. This feature of the imagination, in conjunction with the close connection between perception and imagination, is what seems to lead us to rely on the imagination for knowledge of possibility."

There are various reasons for the distinctions we make between *what is possible* and *what is real* (i.e., what is actual, what has being, is a being, and what exists).[41] For instance, the combination of concepts of control and choice-making partially depends upon the distinction between the concept of possibility and reality because executive decision-making processes that result in the guidance of an organism toward one option versus another alternative allow the organism to consider both options as possibilities, even after the choice has been selected, which contributes to the learning process. Many would argue that the latter argument is necessarily true because in order to claim that "one should do something" it must be possible for one do that.

Without attributions of possibility to potential choices there would be an absence of motivation directed toward specific alternatives and a lack of control, concerning the decision-making process, to intelligently select on the basis of motivations. Occasionally we select less intelligent alternatives because our

[41] Many philosophers have either argued for or have assumed sometimes vast differences between claims, such as "x exists," "x has being," "x is actual," and "x is real." Some of these distinctions, however, have neither proved to be used consistently nor employed usefully to other disciplines, except for perhaps literary and film theory. They have not provided scientific works with enough evidence for usefulness to draw such distinctions in order to form testable scientific hypotheses. Some examples of philosophers who make such claims include David Lewis, Benjamin Schnieder (2007), and Bertrand Russell (1903, §427) who asserted "{b}eing is that which belongs to every conceivable term, to every possible object of thought. Numbers, the Homeric gods, relations, chimeras, and four-dimensional spaces all have being, for if they were not entities of a kind, we could make no propositions about them. Thus being is a general attribute of everything, and to mention anything is to show that it is. Existence, on the contrary, is the prerogative of some only amongst beings." The value in this theoretic use of these interconnected concepts for cognitive science is dubious and requires further development. Russell's usage may incorporate the concept of being with each of the modes, including necessary being, real being, possible being, unreal being, unnecessary being and impossible being (Forsche, 1965, 21-22).

decision-making processes fail to reflect our best interests in the forms motivations for the selection of certain objects as opposed to others.

So, even the concept, which maintains that possibility includes absolutely everything, is misguiding in virtue of the argument that possibility is a type of cognitive judgment that is made about objects and events, before or after they are realized, as either real or unreal objects and events. The reason why the former conceptualization of possibility is misguiding is because what we may consider particular alternatives for the individual are often altogether absent with regard to his decision-making process, which may simply result from the individual failing to consider them. Moreover, certain options are given less consideration with respect to better conforming with the best interests and (ideal) motivations of the decision-maker selecting them. So, the individual is limited with respect to the number possibilities s/he can consider.

Another interconnected idea with the latter modal concepts concerns the existence of an individual's inner world as opposed to the externality of the environment as a whole, which some theorists would at least label a "theoretic possibility." The idea that objects do exist externally has been an influential assumption in cognitive science; it is thereby presumed that objects do exist as external entities and that there is a vast difference between a mental image or idea[42] and sensory impression,[43] for instance, because of their different temporal

[42] An idea is a physiological response that is not the reaction to an external stimulus, under the assumption that objects are real and external. There is, however, not a vast difference between thinking and perceiving without the abovementioned assumption, and thinking could be viewed at least largely as "delayed physiological reactions."
[43] An impression is a physiological response to an external stimulus, under the assumption that objects are real and external.

and spatial relations with objects. There are better theoretic assumptions than the internal and external dichotomous one, which has already been illustrated to present additional misconceptions described in the first chapter.

Typically, distinctions are made between **(1)** an individual's mental images of objects x, y and z etc., **(2)** an individual's sensory experiences of objects x, y and z, and **(3)** investigated objects x, y and z, concerning what is within and without the individual. However, the knower and the known are both implicated, and there is already a presumed cognitive process of realization occurring during observations and meta-observations (i.e., observations of observations), according to Francisco Varela (Luhmann et al., 2003).

Moreover, **(3)** concerns no more than a combination of **(1)** and **(2)**, except that **(3)** also concerns multiple individuals' agreements about x, y and z as well as measurements. The significance of agreement with respect to observation and analysis provides science with a form of intersubjectivity that may depend upon culture and involve anthropocentricism or false assumptions, resulting from the limitations of our observational and analytical skills, despite the aid of technology and measurements (Henrich et al., 2010).

Less arbitrary assumptions for theoretic frameworks, that contribute to yielding testable scientific hypotheses, may very well consider the process of mental imagery formation as a necessary aspect of the cognitive process of realization (i.e., when something, like an object, outcome, or event, is recognized and/or confirmed as being real or unreal) rather than as a mental process with a nature that is inferior to other psychological phenomena. For example,

presuming the inferiority of mental images in comparison to sensory perception with respect to vividness, the attainment of knowledge, information processing etc. may be arbitrary.

Francisco Varela (Luhmann et al., 2003) considered the biological foundations of cognitive phenomena and maintained that they are fundamental to immunology because the body's defensive system is no greater a defense system than the brain is a defense system. Immunology, for instance, also fundamentally requires cognition and, therefore, incorporates mental imagery and creativity within its compass. Mental imagery, cognition and creativity refer to special adaptations to environmental factors which concern the evolution of immune and defense systems as well as finding and specifying certain ecological niches, enabling the support of offspring, for instance.

The latter interconnected ideas involve cognitive problem-solving, which includes satisfying basic needs for survival, and even the latter sorts of problems are solved via creative means. Creative solutions are facilitated via mental imagery, concerning the environment and consisting of sets of images that involve the cognitive process of forming possibilities from which the individual may select its best alternative for action. Of course, the selection of the ideal alternative for action is not always instantiated.

Perhaps the fact that spending time away from problem-solving, which requires creative solutions, has been demonstrated to increase the frequency of creative solution (i.e., incubation) may further lead us to suggest a role concerning the imagination, possibility, and mental imagery formations within the

creative process, which may allow a greater diversity of mental images than sensory experiences may allow (Smith, 2011).

D. Cognitive Possibility Formation, Realization and Narrowing the Framework for Possibilities: Mental Imagery and Creativity

Ideas or mental images are not always less accurate representations than sensed images or sensory experiences. For example, the visual illusion of the oar in the lake, which appears to be in two parts, may lead us to compare one who forms a mental image of the oar in the water without the illusion that the oar is split in two parts. So, mental images may even be more accurate in certain respects than what is experienced via sense impressions. Ideas or mental images cannot, in general, be definitively known to be less accurate than sensory impressions because if this were known, then there would be evidence that looking at something red more closely resembles reality than thinking about red or envisioning redness.[44]

The insistence that the sensory impression is more accurate than the idea or mental image is equivalent in some instances to claiming that our sensations of the real world are more accurate than our ideas of the real world, despite concerning the same things with respect to their relation to our beliefs,

[44] This sort of conclusion would be impossible to find because the only reality testers we have are our senses, which can be enhanced through instruments like telescopes, microscopes and amplifiers, for instance. So, how could we possibly know if our thoughts are more accurate representations of reality than our senses or vice versa? Moreover, our memories of prior sensory impressions may be formed as mental images and do indeed impact our sensory perceptions of objects, including colors (Delk & Filinbaum, 1965; Epstein, 1967).

expectations and choices (e.g., choices about what to experience via sensations). Since the cognitive processes, involved with our mental constructions or models of the world, are interconnected with our formations of beliefs, predictions, knowledge and desires about aspects of the world, our mental imagery plays important roles as parts of these cognitive processes.

Mental imagery may provide the colorfulness or spatial elements of our mental models of the world that are reconfirmed via consistent sensory experiences or perhaps disconfirmed by other experiences that call for reconstructive models. Moreover, formations of mental imagery that involve memories of prior sensory experiences often affect our current and coming sensory experiences.

We cannot compare our sensory impressions and mental images to the actual world, which is what consists of many properties that are independent from the impressions and images, in order to assess that one or the other is a more accurate representation of the real world. Why? For all we know the real world could be very different from the manner by which our sensory experiences, language and mental imagery have us depict and describe the world. So, we are sometimes not justified in claiming that our impressions or mental images are more accurate than the other, and they both involve the means by which we form beliefs and knowledge.

Immanuel Kant (1783, Sect. 30) explains an important aspect of the latter concepts more thoroughly when he distinguishes between appearances (i.e., *Erscheinungen*) and things within themselves (i.e., *Dinge an sich selbst*

noumena). Appearances obviously have many forms since they involve any form that appears to us and which we experience via any of the sensory modalities (i.e., entire ranges of sights, sounds, tastes and touches are all appearances).

Hypothetical realism is a theoretical stance that maintains that these appearances are not entirely derived from the perceptions or imagery since the appearances partially arise as a result of independent causes (i.e., independent objects that are necessary conditions for the appearances to arise). Reality is therefore larger and more complex than mere realization. Realism asserts that the reason why appearances are not entirely derived from mental images, ideas or sensory experiences is that there are things in themselves that are the causes (i.e., as necessary conditions) of the perceptions, appearances and experiences.

We may even consider that the perceptions and conscious experiences of the objects themselves involve a direct awareness of those objects and that the objects are necessary for the perceptions and experiences to arise (i.e., naive or direct realism), despite the occurrences of illusions, hallucinations and dreamt objects that are mistaken for objects that one experiences during the waking state.

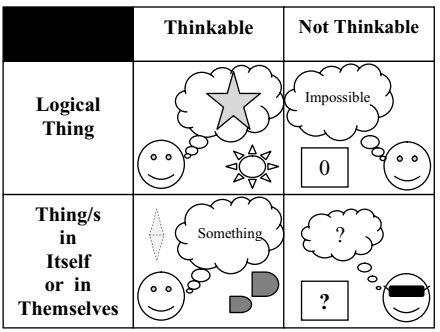
If the thing within itself were absent, then in many (or most cases) the experience and perception of the thing would not be undergone, according to theoretical or hypothetical realism.[45] Additionally, concerning appearances

[45] This is true, unless the individual would have experienced an hallucination, dream, or illusion involving the same phenomenal aspects of that thing or would have undergone an experience *as if* the phenomenal experience were brought about by that thing, even if the thing was not there. However, the latter types of experiences, regarding the absence of the objects, seem intuitively unlikely or false for a theoretical construction. For example, the latter exception is akin to considering that if you walked into some

involved with sensory experiences (i.e., via any means, such as microscopes, telescopes, recording devices etc.), there is no assurance that the characteristics that we attribute to them are identical to the characteristics of the things within themselves that cause the sensory experiences, although the characteristics are especially practical concerning the level and mode of observation and any measurements of them.

Agreements about the characteristics of appearances lead to practical measures and technological advances, for instance. **Figure 10** depicts a roughly accurate portrayal of the distinction between what appears to us and what cannot appear to us.

Fig. 10 Thinkable and Unthinkable Things



kitchen where a kitchen table stands, then you would *plausibly* have the same experience of the table (e.g., via hallucinating etc.), if the table had not been there. Of course, there are some phenomena that include filling in the gaps and holes, such as listening comprehension when one listens to somebody with poor grammar and misusages of the language and understands what he means without recognizing his various mistakes and misuses, but it is rarely considered plausible that one would hallucinate the objects if they were not there.

Only the logical thing that is thinkable can appear to us, but our thoughts may lack accuracy with respect to descriptions of the appearance of the logical thing insofar as the sensory experiences are more complex (as well as the object independent from thought and experience, according to realism). **Fig. 10** illustrates the complicated nature of the sometimes equivocated meanings of the word "thing."

Logical things that are thinkable concern thoughts that refer to these objects (i.e., things), which the thoughts represent, because one is able to think of them. Logical things that are unthinkable may involve misconceptions or impossible objects and impossible events, such as drawing a round triangle. *Things in themselves that are thinkable* concern objects that exist independent from perception and thought that we can only at best think of as independent objects because their characteristics as well as their individuality or plurality are unknown.[46]

For example, a table may be considered to be a thing in itself (or things in themselves) but only with respect to the aspect of the table that is, in principle, unknowable and unable to be perceived because this unknowable aspect, for instance, involves the causation of some of the appearances, which we may call "the table's characteristics that are necessary for our experiences of it to

[46] Similarly, Karl Reinhold (1791, 31) describes the complicated nature of the "thing" within Kant's works as follows: "The *thing* is generally called, to wit, the *thinkable*, or that which no thought is; whereupon it, however, allows a thought to refer. But this general meaning comprehends two very different ones beneath it; it can mean the *logical thing*, i.e., the thinkable, insofar that it is thinkable, which is the thing *insofar* that it will refer to a possible or actual thought, provided that it depends upon thinking: but thing can also be the *thing in itself*, which means the thinkable insofar that it is not thinkable, which means the thing insofar that the possible or actual thought will not be referred, provided that it does not depend upon thinking."

emanate." The latter characteristics are off limits to any observation and concern pure speculation regarding their incorporation within any analysis.[47]

Things in themselves that are unthinkable concern those speculated objects about which we can know nothing because they can concern no conception, perception or thought with which we can be familiar. They present confusion for ontology, epistemology, psychology etc. We may presume that things in themselves cause our conscious experiences, and the general working hypothesis ascertains that *we may attain objective knowledge of their being, despite the fact that their being is, largely but partially, incomprehensible since it is irrational in accordance with our conceptualizations*. Their incomprehensibility suggests indifference. Roberto Poli (2012, §2) states:

> "Objects are indifferent as to whether or not they are known. Whilst knowledge is relevant for the knower, it is of no importance for the object itself. Knowledge uncovers aspects, brings to light dimensions and properties of objects. Knowledge introduces a divide between that part of the object which has been captured by knowledge and that part which remains to be known. The former is usually typified and then represented by concepts."

The *concepts of categories* are the attempts to grasp the resoluteness of the being of the object as copies or images. Concepts of categories are merely rational shortcuts to the hypothetical representations of being (Hartmann, 1949,

[47] For instance, generally we do not observe the inside of a wooden kitchen table, unless we saw it or split it apart, but that part of the table is observable. Moreover, perhaps we could never accumulate, separate, observe and analyze each atom that composes a table, but the chemical elements that make up the table are still observable. What is, in principle, unobservable is the aspect of the table that determines, in part, our experiences of the table to arise. Since the latter aspect is still the questionable aspect, say, with the observation via a microscope or other tools, this aspect of the object is totally unobservable.

36). Through *pure concepts of the understanding* we are able to experience, know and understand objects, which appear to us. Concepts of the understanding are the fundamental predicates, from which the most basic descriptions of objects come.

We are unable to transcend the boundaries of the concepts of the understanding in order to remove ourselves from the confines of our structured ways of understanding the environment for the purpose of explaining the environment via means that are independent from any subjective elements of observers or thinkers. Forms of thinking are agile, and categories proceed according to their own laws (See **Fig. 11**). The father of ethology, Konrad Lorenz (Lorenz & Wuketits, 1984, 99-100), argues consistently with Kant that:

> "When we consider our understanding as the organ's function, against which the minimally valid reason cannot be proposed, then our closest answer to the inquiry about why its functional form would apply to the actual world is simply this: Each of our individual experiences are determined by the forms of intuitions {i.e., space and time from which the possibility of experience depends} and the categories and apply for the same reasons to the outside world as does the hoof of the horse even before its birth on the soil, and the fin of the fish before its egg slips into the water into which it fits."

The neo-Kantian and Hartmannian, Konrad Lorenz, also argued that the categories are quite different from ways of thinking because categories do not change with the time period and do not refer to anything that is a singular. Categories are general and necessary and involve oppositions, such as the *mode* opposed to the *structure* or the *form* as opposed to *matter*.

The categories do not depend upon thinking, which is subject to anthropomorphizing natural phenomena, for instance. Categories are not

concepts, but we need concepts in order to refer to the categories via testable hypotheses. Poli (2012, §3) maintains:

> "The problem is that categories do not allow direct acquaintance as objects do. Concepts are names of ontological categories, which implies that concepts are partial, static, separate representations of items that in themselves are both essentially dynamic and inseparable from other ontological categories."

Sciences, such as biology, provide ontology with the material to reveal the categories. Tremblay (2013) argues that Hartmann's systematic ontology provided the metaphysical basis for Hennig's superior biological classification system. Hennig's phylogenetic systematics ignored what could be certain arbitrary characteristics held in common between individuals (e.g., leglessness) in order to classify descriptions of genetic relations with a temporal dimension instead of a description of what may sometimes be fairly arbitrary relations. Arbitrary relations often involve static views and descriptions of similarities amongst the species or individuals.

For instance, pictures or images of larvae share many apparent similarities with worms, despite their vast genetic differences. The early developmental stage of larvae of insects have often deceived biologists who classify the larvae mistakenly as "legless worms," but insect larvae later develop six legs.

The overall purpose of the ontology is to attain knowledge of structural laws of the real world instead of mere appearances (i.e., we construct models of an apparent world from appearances), which can deceive us, like the larva and

worm.[48] Mental imagery concerns a form of neurocognition that probably contributes to the cognitive process of understanding relations and distinctions of deceptively similar and deceptively different organic and inorganic objects.

The understanding consists of a complex combination of concepts and sensory experiences that allow the object of the understanding to be grasped and known and which typically involves intelligent behavioral patterns in reaction to the object of understanding. What Kant has so convincingly argued is his greatest contribution called the "Copernican Revolution in Philosophy."

First, think of the ways adults and adolescents understand the world, and then consider infants' understandings in order to envision Kant's argument. Kant ascertains that it is obvious that the objects, existing independent from our perceptions of them, can lead us to change our beliefs and increase our knowledge and understanding about them. For instance, if you believe your keys are on the kitchen table and have a vivid mental image of them being there, your

[48] The biologists Konrad Lorenz, Max Hartmann and Willi Hennig (1950), the founder of phylogenetic systematics for classifying biological beings, all utilized Nicolai Hartmann's ontology, maintaining that the structure of reality consists of irreducible levels, including the inorganic (e.g., stars, planets, molecules, atoms, including their processes, laws and attributes) and organic (e.g., kingdoms, genera, species, multi- and unicellular organisms, cells, including their processes, laws and characteristics) levels (Tremblay, 2013, 57). The *inorganic* and *organic* are also categories, which are subdivided into various other ontological categories.

Knowledge of the categories only comes indirectly through experience because experience can be deceiving with respect to the categories in several respects (e.g., the larva and the worm); such knowledge must combine a priori and a posteriori knowledge since the categories are not a priori principles and the knowledge of categories requires a priori knowledge. The complete contradistinction between the a priori and the a posteriori is solely a distinction of knowledge rather than any difference of being. This is why Hartmann (1949, 34) argues that "to say that causality is a priori has as little sense as saying that justice is blue. On the other hand, it makes sense to say that the knowledge of causality is a priori. The a priori can therefore concern the knowledge of categories, if one speaks about the connection of the categories of being of apriority."

beliefs and knowledge can instantly change when you step on a set of keys in your bedroom.

Consider the less noticeable cognitive processes that must occur in order for us to form beliefs, knowledge and understanding of the keys in the first place. The latter consideration requires us to refrain from viewing cognition as our knowledge and thinking conforming to sets of objects, although we tend to think about beliefs conforming to sets of objects when we consider how we perform our cognitive skills, which can be misleading.

Indeed, such ways of thinking about cognition probably come from the fact that our beliefs change when we realize that they are inaccurate because the beliefs do not conform to what we consider to be objects and events and their locations (e.g., the change of belief concerning the keys). Kant maintained alternatively that we must fundamentally view *cognition as thinking of objects which conform to the various ways we can believe, know and understand*.

We should reverse the ordinary view of cognition so that we think of objects in the world as conforming to our ways of knowing, rather than viewing cognition as thinking during which our beliefs conform to sets of objects. The latter view also undermines the already briefly explained notion of the preconception (See Ch. **III.C**). Perhaps the misguiding way of understanding the cognitive formation of beliefs with respect to objects is indicative of our current tendency to fail to always associate a relation of desire, for instance, with each belief about some object.[49] Of course, mental imagery also involves associations

[49] Margalit Ziv and Douglas Frye (2003, 859) argue that: "It is important to study both belief and desire because the findings from one may not generalize to the other.

with desire relations (e.g., desire, indifference, dislike etc.) as well as relations of belief (e.g., belief, indecisiveness and disbelief).

By analyzing the idea that objects, existing independent from perception, conform to our cognitive abilities, which enable us to understand them, we are given the pure concepts of the understanding in some sense. The latter claims allowed Kant to derive concepts of the understanding, which act like filters for the objects' aspects (i.e., what is able to be received via our receptive powers or sensibility), concerning the process by which the objects become understood and known to us via these twelve manners, which are shown within **figure 11**.

Kant's table provides some basic ways for us to come to understand and experience objects because all concepts are interconnected with the concepts of the understanding in **Fig. 11**, and these are argued to be the structures of knowledge as well as the conditions and forms for the possibility of experience. The concepts in **Fig. 11** are argued to be a priori, which means that they involve the application of reason or organization that is prior to experience, judgment, discernment and knowledge (Hartmann, 1941, 209). We understand objects

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Specifically, results for belief may create mistaken conclusions about the development of desire understanding (Schwitzgebel, 1999). . . . people typically engage in actions because they believe those actions will satisfy their desires . . . We understand other's actions, in turn, by inferring their beliefs and desires. . . . Despite the theoretical importance of desire in children's belief understanding, children do not seem to have been questioned about desire in the standard theory of mind tasks" (861).

We might qualify this with idea that people perform actions because they believe these acts, i.e., as opposed to the others that they consider as possibilities and viable options, shall satisfy their desires, which include the desires of others that they may prefer to satisfy before their own (Brant, 2012). The range of possibilities for the individual is limited at any given time and concern the relevant beliefs, including expectations and considerations of behaving differently in order to attained desired outcomes. The "range of possibilities" is a set of cognitions that arise before goal-directed behavior. They play a crucial role in the learning process of realization (i.e., recognition of something as real or unreal) as well as the selection of the best alternative way to behave in order to satisfy the relevant desire.

because the objects are partially presented through these concepts, and objects are partially presented to us through sensibility (i.e., the receptive powers of the mind via different sensory modalities), which is the basis for our experiences of objects in relation to space and time.

Fig. 11 Transcendental Table of the Concepts of the Understanding

QUANTITY	QUALITY	RELATION	MODALITY
Unity (measure)	**Reality**	**Substance**	**Possibility** **(Impossibility)**
Multiplicity (the size)	**Negation**	**Cause**	**Being there** **(Not being there)**
Everything (the entirety)	**Restriction**	**Collective (interaction)**	**Necessity (Contingency or Coincidence)**

Kant has maintained that before one consciously experiences something there is an expectation that what is experienced will already be conceptualized in at least four of the manners in **Fig. 11**, which grounds some of the preconditions for experience and knowledge. For Kant the understanding is spontaneous and indirect, presenting objects via concepts, whereas sensibility differs insofar as it is receptive and direct, presenting objects through space and time.

Sense is also a precondition for experience and knowing, but sense, as a concept, can only be understood through the latter system of basic concepts, say, as a substance, cause or collective type of interaction, involving restriction or finitude, possibility, being and reality. Mental imagery, objects and events too can only be understood through the latter concepts of the understanding.

So, for instance, concerning our knowledge of anything with which we will be confronted, we generally portend to know beforehand, according to our common ways of understanding that what we shall face will either be one singular object (i.e., a unity), multiple objects or everything (i.e., the totality) in virtue of the ways we will understand objects and events given to us via at least some sense, despite accuracy or inaccuracy. Additionally, we tend understand any object or event as either necessary or coincidental,[50] possible or impossible, and as being there or not, and we anticipate the judgment of causation so that

[50] Hartmann (1938, 61) maintains that the differentiation between the modes presents us with a difficulty in respect to judging and defining the appearance of the coincidence within the actual being: "Particularly, the coincidence and the actuality are still subjected to the double meaning. That is a type of similarity between them and not entirely external. Both belong surely cramped together. Only the actual can really be coincidental; the nonactual can certainly also, but it plays no self-sustainable role alongside the actual. The actual is simply therefore so mistakable because through its separableness in the vicinity of the coincidental it appears to be cast aside."

Since coincidence is a negation of necessity and therefore negates impossibility (i.e., negating the necessarily unreal) in addition to what is a combination of both real and necessary, and because coincidence only involves what is unintentional and impartial with respect to outcomes, coincidence is a type of negative social cognition, attributing the outcome of the coincidental event to absolutely no determination of any will or volition. So, the judgment of the coincidental nature of an outcome disallows a judgment of blame concerning its cause because the judgment that an event is coincidental subsumes the judgment that the event was unintentional. Such judgments appear to prevent us from blaming others and the determinations of their decisions for bad things that happen to us when they are present, involving a separate judgment and realization probably more complex than many formations of beliefs about others' decisions.

events, which we expect or about which we are surprised, will be organized by us and labeled causes and effects or collective interactions.

Perhaps one telling sign of the fundamental nature of the concepts of the understanding is the fact that cases of brain damage that leave individuals partially functional, regarding their neurocognitive skills, still do not entirely disable the individuals from utilizing these concepts. For instance, we do not observe the inability to recognize causation, concerning associated events with striking correlations and unwavering and shared conditions with each other, even with patients who have great functional deficiencies regarding memory. We certainly do not see patients with functional cognitive abilities who are unable to form or judge objects or events as possible.

The understanding possesses these formal structures labeled in **Fig. 11** within which each appearance is ordered, i.e., fundamentally included within sets of concepts of the understanding, whereas sensibility possesses the formal structures within which appearances are provided (i.e., the ability to sense contains the anatomy with which appearances are given). The question is how the understanding provides the orders of appearances within and according to the concepts, considering that the understanding always necessitates that the objects be ordered concurrently with the concepts.

THE IMPORTANCE OF POSSIBILITY AS A CONCEPT OF THE UNDERSTANDING: There is a tendency for academics in all fields to assume that possibility is an all-encompassing category or concept, containing not only everything that is real (i.e., absolutely all things and events) but also various

things or events that are unreal (e.g., what did not happen but could have happened). The latter tendency presumes that other systems are misguided, despite a lack of knowledge about them, such as systems that maintain that something that never happens is an impossibility[51] (e.g., Megarean, Spinozan, and other systems that presume finitude with respect to the number of events).

The conception of reality, unreality and possibility, which may be quite misguiding, appears to provide usages of ordinary language, involving the imagination and creativity, insofar as thinking about possibilities, especially those that are also unrealities, concerns creative expressions about what can happen but will not occur (or what could have happened, if what occurred had not happened). These are indeed creative expressions. They may contribute to the formation of alternative hypotheses. The expressions typically fail to be productive for science and philosophy, which is interconnected with science, insofar as such expressions contribute to theories' abilities to yield testable scientific hypotheses.

For instance, a creative novel could be based upon what would have resulted if the Germans, Italians and Japanese had won World War II. Theories that yield productive hypotheses are not based upon such unrealities though. Theories that result in knowledge, i.e., rather than the mere attainment of

[51] Several notions coincide with this view, which may arguably assume that judging that "something in particular could have happened" means or is equivalent to the judgment that "some object's movement or the event possibly happened." One argument maintains either that "if something never happened, then it did not possibly happen," and "if something at a specific location and time does not happen, then it does not possibly happen." So, something that never happens is likewise impossible. In order to argue accordingly the concept of contingency or coincidence needs to be undermined insofar as such judgments of coincidentally real and unreal events describe nothing in addition to what is actually real and unreal.

information, say, concerning teachings of opinions about opinions, are based upon real possibilities instead, including improbable events that happen but not coincidental unrealities, which involves a dubious concept.

Often events that have failed to ever happen are unsuitable for theoretical construction because they did not even possibly occur. For example, philosophical zombies[52] are unsuited for theoretical constructions for the latter reasons. Philosophical zombies as theoretical entities, although entertaining for students during academic discussions, have not enabled or facilitated the construction of testable scientific hypotheses.

Zombie-talk has succeeded to engage academics into a wide array of opinions, which have been mistakenly judged as viable possibilities with respect to reality. All of the latter improper modal attributions come from speculative responses about these unreal things, which has involved people ignoring the more important mode of unreality with respect to their judgments about zombies and focusing upon the attribution of the mode of possibility or possibility itself instead as if possibility is a viable ontological category of reality.

One way of describing possibility is as a specified cognitive process that concerns realization and planning, for instance, which appears to be absent in respect to the abovementioned but important concept of possibility. One example of such a cognitive process may involve the expectation that something

[52] A philosophical zombie is a fictitious creature that appears to be exactly the same as a living breathing and conscious person, despite the fact that the zombie completely lacks all of the qualitative aspects of conscious experiences that we all presumably have experienced. The idea of philosophic zombies formed decades after studies of blindsight, which involve individuals who can distinguish between certain objects via the use of visual skills, although blindsighters claim to lack any visual qualitative experience of the objects they discriminate, such as different colors.

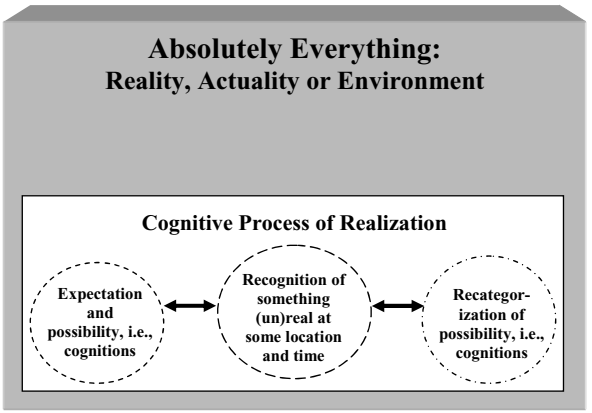
may or may not happen (e.g., the outcome of some event may be indeterminate, such as the outcome of a coin toss), the recognition of something as unreal at some time and location/s, and the recategorization or recognition of possibility that arises.

Insofar as possibility is conceived as a concept of the understanding rather than as an independent category, which is descriptive of the structure of the real world independent from thinking, our inquiry in cognitive science may begin with a quite abstract question about systems (e.g., organisms or artificially intelligent systems): How exactly does a cognitive system categorize something as possible before it recognizes the object or event or realizes that the object or event is unreal? Similarly, what neurocognitive processes determine the difference between the latter recognition of, say, the unreal event and the recategorization of the event as being an unreal event at a certain time and location but possible?

Figure 12 illustrates two specified notions of possibility that are interelated within the cognitive process of realization. The first conception of possibility involves the cognitive formations of the expectation of some object or event, which is a cognitive assessment or judgment of possibility before realization.

The second concept of possibility involves both the first conception as well as the recognition and realization of the real or unreal event or object. Additionally, the second concept may typically provide a more specified judgment that is more accurate and more relevant to the realization but which still involves what may never happen.

Fig. 12 The Real and the Cognitive Process of Realization



The cognitive process of realization may involve mental imagery as well as abstract ideas. For example, if one is presented with three objects, and she expects that one object can be used as a tool to solve a problem (i.e., the first cognitive formation of possibility, which can involve the use of mental imagery related to problem-solving), then she may use the tool and recognize that the object is too short (i.e., realization of the latter expectation as an impossibility or unreality). However, although the usage of the latter object is realized to be too short by itself, she may attach it to another object or consider the usage of the third object, which involves a repetition of categorizations (i.e., the second concept of possibility concerning recategorizations of possibility) and excludes the usage of the first object by itself because it is too short.

Imagery plays a paramount role in creative thinking and functioning; this fact can be seen from anecdotal and historical accounts as well as research in experimental cognitive psychology. The word 'creativity' is defined as "a cognitive process that leads to the production of something that is both original and worthwhile"[53] (Sternberg, 1999, 510).

In a typical experimental setting experimenters describe an object on a scale ranging from creative to uncreative, which allows the experimenters to determine how creative a particular idea or invention is, for instance. The rating on the overall creativity of something may be determined by the originality, practicality, sensibility or a combination of these factors. This is how the following experiments concerning creativity were rated.

According to Wilson and Keil (1999 p. 205), "creativity is usually defined as the production of an idea, action or object that is new and valued, although what is considered creative at any point in time depends on the cultural context." There are five stages that comprise the creative process, according to the *MIT Encyclopedia of Cognitive Sciences*.

The five following stages are commonly thought to take place when an individual derives something creative: (1) *preparation*, which involves study, experience and curiosity, for instance; (2) *incubation*, which involves unconscious processing that allows apparently random connections to take place; (3) *insight*,

[53] This is an operational definition of the word 'creative,' which implies that discoveries, inventions or creations have to be pragmatic or useful rather than simply innovative. The latter definition of "creativity" faces problems concerning judgments of individuals' creative expressions because the creative endeavors may be judged to be uncreative during one age but incredibly creative and useful centuries later. For instance, Hume's most creative masterpieces were not well-received during his lifetime (i.e., his philosophy), although his historical writings earned him much fame and fortune.

which includes that phenomenal feeling of accomplishment that occurs as a result of the creative experience; (4) *evaluation* is the stage where the creative thing is assessed within the restrictions, conventions and rules of the domain and context of which the creative thing is categorized; and (5) *elaboration* involves all of the changes that the idea or creative thing goes through.

Albert Einstein claimed that he used mental imagery and imaginative thoughts, which allowed him to discover some of his theories. For instance, Einstein said that he imagined himself traveling beside a beam of light, and he thought about what the world would look like during this thought experiment. According to Einstein, these contemplations led to his discovery of the concept of relativity through "combinatorial play" with mental images. These sorts of anecdotes suggest that mental imagery may be used as a mechanism for creation, discovery and invention.

Ronald Finke (1990) argued that preinventive forms are useful for invention; these types of forms are mental images and ideas that are utilized by the person before he or she conceptualizes a particular product. Finke came up with a new method in the laboratory for observing the discovery of creative inventions. A group of approximately fifteen objects were presented to participants who were told that their tasks were to manipulate three randomly selected geometrical figures from a total of fifteen shapes and then interpret the forms as if they represented a "pragmatic figure or design."

In the first condition out of three the participants were allowed to choose one of the following categories before they chose their figures and combined

them: furniture, vehicles, personal items, science instruments, appliances, utensils and tools, weapons, toys and games. In the second condition the experimenter randomly selected one of the categories before the subjects constructed their figures.

In the third condition the subjects constructed the figures into a single form and then the experimenter chose the interpretive category randomly. Finally, the inventions or formations of the three united objects were rated according to their originality and practicality, and the final figures were denoted either creative or noncreative by the experimenters at which point the scores were compared.[54]

It was found that when the experimenter randomly selected the category, the finished products tended to be more creative than when the participants chose the category beforehand. Interestingly, the most creative inventions were those derived from the subjects in the third group under the third type of condition. So, constructing the figures into a single form, and then categorizing the finished product into the category that the experimenters chose, which was randomly selected after the figures were manipulated, resulted in the most creative inventions in this experiment rather than the subjects picking the categories themselves.

Thus, postponing the search for creative interpretations after the configurations are completed increases creativity. Finke's findings also suggest that this concept of forcing individuals to place objects in a category that they

[54] Finke also conducted another experiment, which was an altered version of the ones mentioned. The subjects manipulated the objects, but they were told to link the completed figure to an idea in subjects like biology, for instance. Of course, the term "category" is being used by Finke and psychologists quite differently than with the neo-Kantian philosophy.

would not have normally selected produced more creative ideas as well as inventions.

Finke found that creativity in inventiveness is facilitated when the number of objects and object categories are restricted to a few. And it is better to start with specifics first and later move to the more general or to imagine preinventive forms of interest and possible potential usefulness, and then to establish an object category or idea that encompasses the creative configuration. We may consider an additional condition for future experimentation so that the third condition is modified in such a way that the subjects are given the opportunity to suggest a category but then the experimenters select categories that are either opposite-ended (e.g., furniture and weapons) or slightly different from each other (e.g., tools and weapons).

What we may very well be able to conclude from Finke is that when a person tries to produce creative insights, the best way to proceed is to search for potential solutions without specifying exactly what the nature of the solution must be. Finke's findings further suggest that people who force themselves to categorize in a different area than they would have chosen are avoiding restricted limitations, like mental sets and functional fixedness.

When solving problems people generally place the problems into a "mental set," which is a model for representing information that results in an inadequate representation of the information when the person is in the wrong frame of mind. The following problem tends to facilitate a fixation of individuals upon a strategy that typically works well but does not in this example: a butcher

is 6' tall with a 34'' waist and wears size 12 (US) shoes. What does he weigh? In this particular problem the three numbers, 6, 34, and 12, tend to make people think that the answer is also going to be a number, but the problem cannot even be solved with an answer that is a number. In fact, without giving the information about the butcher's height, waist and shoe size, the question is much simpler because the information entrenches the problem-solving thinking within a mental set. So, what does the butcher weigh? The answer is "meat."

Functional fixedness is a mental set, within which individuals become entrenched, where they fail to think of an alternative function for something that has been known to have a specific function. In an experiment conducted by Duncker (1945 as cited by Darley, Gluckberg & Kinchla, 1988) participants were faced with the task of mounting a candle on the wall, but they were given a book of matches, tacks in a box and the candle. Approximately 50% of the subjects failed to realize that the tack box could be used as a platform to hold the candle on the wall, but when the box was empty it became much easier for the individuals to solve the problem.

The box becomes an item that is psychologically available to the person when the tacks are not presented inside the box or the tack box is explicitly labeled as a 'box,' which allows for the item to be psychologically utilized by the subject. The psychological availability of the box for different uses is an aspect of the cognitive process of realization, which involves problem-solving.

In Ronald Finke's experiments the individuals who attempted to classify the figures into categories, of which the subjects thought, were the least creative

participants. One reason for this phenomenon is that more of the subjects in this experimental condition are said to have become “entrenched in mental sets” where they attempted to place objects and ideas in categories that they had placed similar objects and ideas in the past.

So, the configurations the subjects produced were restricted by the individual categorization processes involved with the directedness of their attention spans toward the objects they chose. This focus upon the objects of choice appears to confine them to a set much like the first phase of the cognitive process of realization in **Fig. 12** confines the individual to sets of ranges of possibilities, arising from cognitions during some time and which often involve mental sets. Moreover, the notion that “everything is possible” does not aid in expanding the range of possibilities, which are typically limited via common patterns.

The latter conclusions account for the fact that the participants are more likely to be entrenched within a mental set when they are the ones who select the general category. A solution to the problem-solving thinking involved with understanding the optimal conditions, under which creativity is maximized, is to produce configurations that one would not normally produce under a previously chosen general category rather than conforming the finished products to the category that is chosen randomly.

However, the latter solution is difficult since the chosen category already leads one to think of configurations within confined ranges. According to the Nobel prize-winning Chemist, Albert Szent-Gyorgi: “Discovery consists of seeing

what everyone has seen and thinking what nobody else has thought" (Good, Mayne, & Maynard-Smith, 1962, 15). Such creative discovery or creative thinking that leads to discovery may be implemented via the latter techniques of considering abnormal configurations for some category.

In the second condition of Finke (1990) the subjects fell into a mental set where the experimenters named a category, and mentioning the category beforehand placed cognitive limitations upon the amount of configurations from which the subjects could choose. Less limitations appeared to be set for the group that was told the category only after they had already constructed their figures. So, when a person attempts to create an innovative idea, the least creative way to derive one is to begin with the most general category because the latter categorization restricts the number of ideas to a set of thoughts or a mental set.

Thus, one should proceed from specifics to the general rather than from general categories to particulars in order to maximize creativity in some cases since proposing that the creation of figures, ideas, actions etc. should first fit within the general category tends to entrench the individual within a mental set. Here, the person has access to particulars that only exist in the general category and the problem is that the individual is hindered with regard to considerations of specifics within other categories.

According to Steven Pinker (1997, p.360), "all of us (humankind) are creative." Every time you convince another person that your opinion is correct, interpret a movie differently or fool a kid into putting on his pajamas, you are

being creative. Consultants on creativity receive millions of dollars every year for turning managerial staff into Benjamin Franklins and Edisons via brainstorming workshops, for instance. Mental imagery plays a paramount role in the mental steps toward creative, innovative and inventive thoughts. There are, in fact, mental steps that people take and practice before they become creative or the creative genius.

Pinker maintains that creative geniuses typically do not make any valuable contributions for at least ten years. For instance, Mozart did not compose his first masterpiece until he was twenty, but he started composing when he was only eight years old. Therefore, mental steps that facilitate creativity are not easily acquired, even by the genius.

Mental imagery can be thought of as a component of a formula for deriving something creative. Mental imagery that is involved within the realization and categorization process may be restricted or optimized in the very same ways that Finke (1990) describes. Restricting the general category in the beginning of the creative process probably tends to reduce the number of sets or ranges of mental images formed by the individual, producing patterns of thinking that are less innovative, whereas waiting until something specific is produced, and then applying the object, service, product etc. to a general category requires additional creative thinking in order to derive something consistent with the first creation that was not created for the purpose of the category or with the general category in mind.

Mental images (or Hume's 'ideas') arguably form, and then combine, become subtracted and/or divided in some sense. This connection between different mental images can well be viewed through Hume's principles of resemblance, contiguity of space and time and/or cause and effect. Finally, the most important component of the formula is the categorization of the mental images and their connection under some general category, which serves an interpretive function, which is also creative.

Albert Einstein followed this formula for creativity when he came up with his theory of relativity. Einstein used mental images of himself and a beam of light traveling through space-time at the speed of light. So, the mental images were formed and they were connected in the manner mentioned. Finally, Einstein categorized his thought experiment under the general category of physics, which is the study of the most fundamental forces in the universe that include relationships between energy and matter via nuclear, gravitational and electromagnetic forces (Asimov, 1966). This is what allowed him to derive his new theory of relativity.

The formula for creativity may be undertaken in the following manner. First, the individual forms a limited number of mental images. Second, mental imagery is combined, subtracted and/or divided by way of the three transition principles: (1) resemblance; (2) contiguity of space and time; and (3) cause and effect. Next, an individual's creative interpretation of his or her imagery needs to be withheld until the mental images have been connected in some new fashion.

The reason for this is to avoid problem-solving errors, such as mental sets and functional fixedness.

The last step is the one in which a person actually derives a creative thought. Lastly, the connected imagery must be interpreted creatively, which means that the imagery should be categorized under a very general category. To facilitate the last step an individual may require him or herself to categorize within general categories that he or she normally would not have considered, and an incubation period can aid in discovery.

The creative genius, like Albert Einstein, Tesla, Beethoven and Thomas Jefferson, is an individual who has a wide array of knowledge over a particular category or categories before he or she applies the creative formula. Therefore, the genius possesses more categories through which he or she can make creative interpretations. The genius is able to categorize imagery more easily because the categorizations are readily available to him or her. Interpretations are, in fact, the association of ideas with one another for a conceptual framework.

What would allow an increase in the number of creative interpretations to be present to one's conscious mind? According to Douglas Hofstadter (1999 p. 673):

> "It is a common notion that randomness is an indispensable ingredient of creative acts. This may be true, but it does not have any bearing on the mechanizability—or rather, programmability! —of creativity. The world is a giant heap of randomness; when you mirror some of it inside your head, your head's interior absorbs a little of that randomness."

Hofstadter's argument maintains that creativity is, in fact, programmable in computers because a computer, similar to humans, can absorb various sectors of the random world, for instance. The concept of randomness is one more paramount addition to the creative process. Randomness was also applied by Finke (1990) to the final interpretative stage during which the most general categorization of the specific production occurs.

Obviously, categorizations typically depend upon our observations. Observations play crucial roles concerning the limitations of possibility for objects and events. Since reality is both bigger and more complex than realization (i.e., assuming hypothetical realism), the object being observed by the observer is often able to viewed at multiple levels and consistently conceived as containing even more potential levels of observation than any set of actual observations of it. The object can be observed from multiple angles and from various micro- and macro-levels.

The biological cell of an organism, for instance, appears to us when we peer through the lens of a microscope set at a certain magnification level and photons lighten the cell and our eyes, although closer observations would demonstrate to us that the cell is not describable as merely a single entity since it absorbs and emits other things, for instance. Moreover, there are many vantage points and levels of observation from which the cell is never observed generally. Meta-observations (i.e., observing observations) place more flexible standards upon our attributions of possibility since we may think of certain things as being

unreal and/or impossible but realize that others and perhaps even experts attribute possibility and reality to them, for instance.

Insofar as observation is necessary for the cognitive realization process it is also crucial for both the formation of mental imagery, regarding that process, as well as creativity, which places cognitive demands upon the individual to produce more than mere copies of previous productions (e.g., creative ideas, actions, discoveries and inventions).

E. Observation and Meta-observations: Cognitions Concerning Science

One of the greatest obscurities in the sciences involves observations of observations or *observing observations of the observed*, which can be necessary in order to make progress in science, especially interdisciplinary studies, such as cognitive science, because improving techniques of observation enables greater consistency, concision, precision etc. Mental imagery appears to function somewhat like meta-observations (i.e., observations of observations), enabling the scientist to image the scientific observations during any stage of the methodology.

In order to improve techniques of observation the observers must be observed along with their methods, assumptions, and experimentation. Gumbrecht (1988; Luhmann, 2003, 8) maintains that “whether I observed observations observed or observations of observations is, in hindsight, the

empirical difficulty and, in hindsight, highly relevant to the discursive connectivities."

For example, during our current information age with the world-wide internetwork, which connected the online web into outer space via satellites and the international space station ever since 2010, we are confronted now more than ever with the problem of assessing good and honest science. Assessing efficient science involves observing scientists as observers in order to reduce misconduct and control for inefficiencies (e.g., sloppiness concerning methodology and overlooking relevant facts that provide contrast and comparison).

The importance of observing scientific observers and analysts should not be overlooked because failures to engage in meta-observations result in massive accounts, such as over 2,000 retracted research articles that Fang, Steen and Casadevall (2012, 17,028) analyzed in order to conclude within their essay titled "Misconduct accounts for the majority of retracted scientific publications" that the "percentage of the scientific articles retracted because of fraud has increased ~10-fold since 1975." These retracted articles concern massive amounts of uncreative works that were produced systematically.

So, there has likely been no other more appropriate time period throughout history for professional scientific observers to be observed than during this period of increasingly dishonest, sloppy and cheaper scientific productions. Books, professional scientific articles, bachelor and master's theses and doctoral dissertations are often purchased online before they are written.

False authorship is so rampant that there are thousands of interconnected websites in various languages linked to telecommunication systems that provide online essay mill services, producing any type of works that concern computer programming, graphic design and any type of written work to be sold for profit to students and professionals. Of course, many of the organizations produce some degree of misinformation, but many people have surely had articles and books published via false authorship within prestigious publishing houses and journals.

According to Sullivan and Rohrich (2011, 2496), “authorship indicates who is responsible for ideas and experiments, and can be used to hold people accountable if something is disproven or shown false.” Creativity therefore coincides with increased responsibility once it is expressed and should be carefully attributed to the appropriate originator. Basically, the scientific community’s accountability has decreased while dishonesty has increased and imposed itself within science, and science requires tedious and continuous repetitions and great attention to details and measurements, which interfere with personal or familial profit strategies.

Thus, leaving scientific observations unobserved and allowing any science to have the entire domain of its conclusions, concerning it specified levels of analysis, comes with great risks. Science is expensive, time consuming and requires enormous efforts that involve scientists having serious and even sometimes obsessive motivations in favor of creative productions on its behalf. Without observations of observations and observations of observers’ techniques, experimentation and methodologies in science we are faced with sifting and

filtering out deceptive misinformation as well as miscommunications in order to discover the good, hard and honest works of so many scientists.

Of course, observing scientists who make observations may appear to involve extra work and cost time, effort and money. The latter observations need not involve such costs because the education system is becoming global and meta-observations may well involve interactive learning strategies (e.g., in 2012 I taught for two American universities and my students lived in North America, Europe and Asia).

The following cartoon illustrates an example of meta-observation, which yields two-way benefits, namely, supervising the scientist in addition to allowing meta-observers to learn the methods of the investigation. Learning the scientific methods of the particular investigation allows one to form mental imagery that is more closely relevant to the findings and which therefore increases the chances of creative imagery and ideas within the domain.

The cartoon drawn by Daniel Dodd (2013; See the **acknowledgments**) for this book illustrates two youthful observers who observe a scientist investigating chemical reactions beneath a large magnifying glass, and which insinuates that the meta-observers possess knowledge that the scientist lacks in respect to the experimental investigation.

“Meta-observations” are observations of observations, which are becoming increasingly important for cognitive science. However, meta-observations become ever increasingly problematic as a result of more complex experimental designs as well as theoretically problematic.

Dodd, 2013

Most of us are familiar with making observations, observational humor, scientific observations and the like, which involve multiple types of sensations from the various sensory modalities as well as cognitively establishing order concerning the objects of observation, recognizing, and/or interpreting what is sensed.

Fig. 13 Multi-layered Approaches and Interdisciplinary Awareness Concerning Orders of Analysis

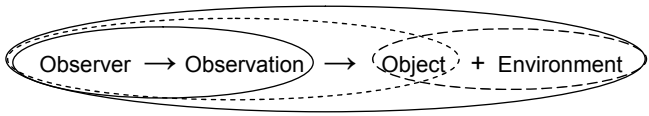


Figure 13 illustrates two roughly distinct types of boundaries, which include the environment (i.e., a specific type of environment, such as a desert or forest, or the world, which is conceived as either bounded or boundless with the largest oval) and the coupling of the observation and observer. The object may be something that is typically observed, such as a life form or something entirely inorganic and which is measured in respect to its mass, density and movements.[55] The object may also be a scientific observation or the observation of a subject within a psychology experiment, in which case the observation is a meta-observation.

However, sometimes observers think that they observe objects and agree upon their characteristics, but further specification allows for the consistent and conceptual rejection of the idea that the object under investigation was actually observed because, for instance, the observer may undergo perceptual illusions, which are mistaken as veridical perceptions and observations of some distinct

[55] Olivier Rieppel (2006, 478) maintains the following: "{h}owever, 'it is not possible to think that things are the objects of order, events the objects of rationalization, because there is no principal difference between things and events' (Hennig, 1950, p. 5). This, of course, is exactly the conclusion Cassirer (1923) had reached on the basis of quantum mechanics and Einstein's theory of relativity as reflected by Ziehen (1934): things are condensations of energy. In that context, Hennig (1950, p. 5) approvingly cited Nicolai Hartmann (1882-1950) who had stated that 'natural things are nothing but systems of causes.'"

object. For the latter reason the two sets of dotted lines in **Fig. 13** are utilized in order to distinguish the object from the observer and the observation.

The boundaries suffice for the construction of a conceptual model that facilitates explanations via incorporating both: **(i)** a realization that characteristics of an object (i.e., an object that exists independent from perception) must conform to our processes of cognitively grasping them via the cognitive establishment of their boundaries (i.e., in respect to size, shape, growth and/or temporal limitations of decay, for instance) and after the reception of only part of the information concerning these objects, which is afforded to the observer through different sensory modalities (e.g., vision); and **(ii)** some of the characteristics we may, mistakenly, ascribe to an object, i.e., by means of descriptions, might be characteristics of the observation rather than the object, or descriptions are plausibly characteristics of the environment rather than some distinct object within the environment, in which case the cognitive process by which we establish borders, i.e., via comparing, contrasting and contradistinguishing the objects, involves some degree of arbitrariness.

The tradition of thinking of the observer as the "external observer" has a well known and long tradition within European culture since the period of Francis Bacon (1561-1626) and René Descartes (1596-1650). During this early modern period clear distinctions were made between "humans as the subject" and "observation as well as the world as the object" of their observations, which provided the underlying basic assumptions of investigation and analysis (Luhmann et al., 2003). The latter tradition led to the inclusion of humans

themselves as the objects of their own observation, from which epistemic theoretical problems arose as well as the systematic scientific study of human behavior and mental processes by the end of the 19th century.

The theoretic problems concerning the object, observation of the object and the concerned observer also played a role within arguments utilized in order undermine behaviorism as a dominant force within psychology before the arise of cognitive science. For instance, Betrand Russell (Skinner, 1957, 453) asserts within his *An Inquiry into Meaning and Truth*:

> "When the behaviorist observes the doings of animals, and decides whether these show knowledge or error, he is not thinking of himself as an animal, but as an at least hypothetically inerrant recorder of what actually happens. He "knows" that animals are deceived by mirrors, and believes himself to "know" that he is not being similarly deceived. By omitting the fact that he—an organism like any other is observing, he gives a false air of objectivity to the results of his observation.... When he thinks he is recording observations about the outer world, [he] is really recording observations about what is happening in him."

Cognitive science provides an interdisciplinary study, which always concerns multiple cognitions, memory, learning and "*mental* organization," whatever that may be, from multiple sources or part of the environment. In biology "cognition" is understood to be necessary for immunity and, therefore, cognitive phenomena are presumed to be necessary aspects of the immune system of the organism since the "defense system of the body . . . is a defense system no more than the brain is a defense system," according to Francisco Varela (Luhmann et al., 2003, 14).

Even mental imagery in combination with cognitive processes involved with creative thoughts and expressive actions can well be conceived as special environmental adaptations and as systems of protection that involve finding and occupying certain ecological niches. The latter findings would enable more efficient support of offspring and contribute to human evolution, for instance. Scientists, as paid professionals, are involved in their own personal discoveries of their own ecological niches, which allow them to survive in their own unique ways. This suffices to carry over individuals' intentions and interests into the work, which may superimpose upon their observations, investigations and analyses.

Multi-layered approaches of necessary and basic levels of reality (or levels of observations and interdisciplinary analyses of reality) contain the object, observation of the object, and any observer observing within an environment (See **Fig. 13**). The questioned object is analyzed because it undergoes a process during which measurements are taken in relation to other objects. The object is either solely within or without the environment (i.e., the object can be mistaken as existing independent from the observation but be an anthropomorphism or hallucinatory aspect of observation).

The observation and observer are interdependent upon each other as necessary conditions (i.e., an observation must have the observer, and any observer must make observations). It is questionable, however, to what extent and when exactly the observer does indeed observe because obvious physiological and anatomical factors interfere with observation (e.g., observation

is typically associated with the waking state rather than the dream state), such as blinking, yawning and pandiculation etc. (Walusinski, 2006).

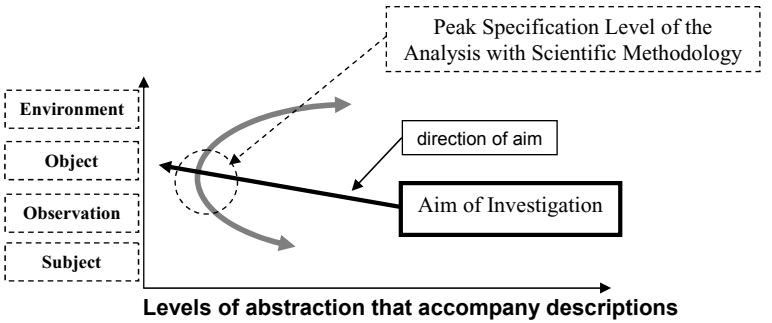
The distinctions, which are represented within **Fig. 13** above, are separated in an order from an analytic perspective where the observer and the observer's observation, observation and object, and object and environment are distinguished from one another in non-objective, imaginative, and arbitrary ways (e.g., they involve theoretic constructions that may very well lack the ability to form any testable scientific hypotheses) so that there is no precise location at which some substance, which can be observed and/or measured, resides in order to create any border between subject-observation, observation-object, or object-environment.

The observer-observation-object-environment model is interconnected with the preconception insofar as measurements of objects play major organizational roles, which create fuller conceptions and specify or further determine the direction of observations in order to contribute to greater knowledge of the object within the environment. Measurements in science change the attitudes, beliefs and enhance the knowledge of scientists. The status of the objects' measurements often become decisive for subsequent actions to be taken and for the formations of consequently remaining testable hypotheses that may contribute to an even fuller concept of the object.

The dotted lines in **Fig. 14** represent the connection between the observer and the observation and the object at which they are directed; the object does not always subsist without the observer and observation, i.e., as a separate entity

that is an aspect of the environment and that is totally independent of both the observer and the observation.

Fig. 14 Multi-layered Approaches and Interdisciplinary Orders of Analysis and Abstractions of Descriptions



Different levels of analysis begin from abstraction, become more specified, and then become abstract again, but abstract in a different manner (i.e., either environmentally abstract or subjectively abstract, which are both involved within any analysis), and this repetitive and returning process from abstraction to specification and back to abstraction occurs in two different respects:

(1) From subject to the observation via the subject to the object of the observation via the subject to the environment with the object of observation via the subject;

(2) From the environment to the object with(in) the environment to the observation of the object with(in) the environment to the subject's observation of the object with(in) the environment.

With each analysis there is both abstraction concerning the subject and environment, but there can be greater or lesser extents of abstraction concerning one or the other in relation to other analyses. However, there is always more abstraction concerning the environment because the environment subsumes the observer (i.e., the subject). For instance, one of the most important aspects of the subject is this individual's direction of observation from the particular vantage point from which the subject resides; moreover, that certain directional point of reference or viewpoint is interconnected with the environment that is with the object under investigation.[56]

So, for instance, one may consider the observations from the Hubble telescope, an amateur's telescope or a microscope with an amoeba upon a slide. In all of these cases there is no actual demarcation criterion by which we can non-arbitrarily ascertain that the observer or observation is within a different environment than the object of observation. However, there is, of course, a sense in which we claim that the desert is different from the tundra, which differs from the tropical rain forest.

The video camera in the rain forest or within the Antarctic tundra has a particular direction from which it pictorially captures, say, bears. In such cases

[56] It is arguable that the environment may exclude the object if the so-called object concerns a false belief with regard to the object though, but we may then include the object as an aspect of the observer's observation, which is included within the environment.

the subject may, arguably, not be the observer but rather the interpreter who may lack awareness about the coldness, dampness, smells and tastes that would have been obvious if the interpreter were the actual observer. In the latter sense the pixels that create the images and the audio accompaniment become the objects of observation, providing certain limitations to interpretations.

The aim of the investigation involves the co-workings of both interpreters and observers. Interpreters include philosophers, others involved with different levels of observation and analysis, and, of course, the observers themselves. Interpreters who productively contribute to the aims of the investigation should be incorporated into the teamwork via becoming observers themselves. For example, the philosopher, Thomas Metzinger, contributes via his rigorous philosophic investigations and conceptual reformulations and has become a well-disciplined observer who analyzes cognitive neuropsychology and robotics experimentation, methodology, and he has designed experiments etc., for instance. Metzinger serves as a good example of the tendency for philosophy to become specialized concerning subfields of philosophy interacting with the related scientific disciplines, which focus upon systematic measurements (e.g., philosophy of physics and physics).

(1) concerns the directions of analysis and return to abstraction (i.e., S→OS→OOS→EOOS) and appears to be a typical starting point for an analysis because the individual presumes that s/he is a subject who observes, and obviously many accounts call into question (i.e., via systematic doubt referred to as “perceptual skepticism”) whether the objects are illusory, accurately

perceived, hallucinatory and even dreamt, in which case the suspicion that arises about whether some object is being dreamt also raises the question about whether the entire environment is dreamt as well.

(1) thus requires a vast set of assumptions about whether the environment, which is partially being consciously perceived, is during the dream state or waking state. **(2)**, which is not only an alternative direction of analysis but one which also constantly imposes itself upon the interpreter and observer (i.e., E→OE→OOE→SOOE), is always involved in combination with **(1)** in regard to analyses so that the accuracy of the subject's observation or assumptions about the environment as a whole become the primary and leading assumptions from which the analyses are grounded.

The *aim of investigation* concerns the transcendence of the peak levels of specification of the analysis that results directly from scientific methodology and experimentation. Going beyond the specification of the analysis of the object with(in) the environment involves rigorous interpretation. Rigorous interpretation can be accomplished through certain methodologies involved with critical thinking and critical analysis (e.g., Hartmann's critical ontology provides one example further specification).

The transformation of the observer-observation-object system occurs via the implementation of systematic measurements in science. Images are required in order to form scientific explanations, theories and observations. For instance, even atoms and the curvature of space-time in relation to gravity are represented with imagery.

F. Conclusion Concerning the Unified Role of Philosophy and Cognitive Science

Overall, some of the assumptions that cognitive scientists have made about the world is that it exists: (1) separately and independent of our perceptions; (2) distinct from us; and (3) externally. The claim that the world exists independent of our perceptions entails that even if no one perceived the world at all, the world would still exist in the much the same way as if it were being perceived, for instance. These assumptions made by cognitive scientists are the complete opposite conclusions that philosophers called phenomenalists and scientific anti-realists make, such as George Berkeley; they are contrary to solipsism as well.

"Phenomenalism" is the set of theories that maintain that the real world and physical objects are merely analyzable as sets of possible and actual sensory experiences rather than as objects that exist independent from any experience. On the other hand, the assertion that the world is distinct from us or external to us entails that there are objects that exist separate from all of us. The latter assertion implies that theories, like solipsism (i.e., the thesis that everything is a figment of one imagination), are false. Phenomenalism does not imply that solipsism is false. So, it becomes problematic as a theory in virtue of its complicated interrelations with other theories, such as the evolution of species via natural, sexual and kinship selection processes.

What I have pointed out is that the latter sorts of philosophic assertions are typically irrelevant insofar as they do not possess the ability to yield scientific

hypotheses that can test theoretical frameworks because such speculative assertions have no grounding in any sensation or perception (e.g., accompanied by any scientific instrument, such as fMRIs, microscopes etc.) and do not pertain to any constructive basis for the anatomy and physiology involved in even the most incipient sensory perceptions or experiences.

Phenomenalism, scientific realism and solipsism are theoretical about theories (i.e., meta-theoretical) and have an absence of any interconnection with the practicality of theories that enable the frequent production of testable scientific hypotheses. Critiques of scientific investigations, which involve these meta-theoretical approaches, utilize forms of skepticism that are useless to the formation of scientific hypotheses and implementation of them via experimentation as well as ineffectual with respect to analyses that determine whether the results of experimentation present confirming or disconfirming evidence for the theory. Curd and Cover (1998 p. 1307) make the following assertion:

> "Scientific realism is generally taken to be the doctrine that the world studied by science exists and has the properties it does independently of our beliefs, perceptions and theorizing; that the aim of science is to describe and explain the world, including those many aspects of it that are not directly observable; that, other things being equal, scientific theories are to be interpreted literally; that to accept a theory is to believe that what it says about the world is true, and that by continually replacing current scientific theories with better ones, science makes objective progress and its theories get closer to the truth."

Within the introductory chapter I described several postulates in the forms of theoretical entities, which are useful for scientific investigation, (e.g., atoms,

photons, cells and mental images). Each of the theoretical entities are argued to possess characteristics that are assumed to exist independent from perceptions of them, but in reality any single type of object, such as a real cell (i.e., not just what is observed with the microscope but which is independent from observation and actually functions as a living microorganism or part of a living organism), is argued to contain a vast number of characteristics that exceed any description of the abstract idea (or general conception) of the biological cell.

What fails to exist is an object that exists independent from perception and which ONLY contains those characteristics of the abstract idea of a cell (i.e., with no other attributes). What is theoretically and practically assumed to exist is the cell, which exceeds the characteristics attributed to it via science. Now scientific antirealism, of course, is the rejection of scientific realism. However, neither theoretical stance provides any postulate in the form of a theoretical entity that would involve the formations of testable scientific hypotheses.

Scientific realism and anti-realism merely categorically and abstractly describe the theoretical entities themselves, which are postulates from which we begin our investigations. These forms of realism and anti-realism involve subjectively placing and arguing about opinions (and opinions about opinions for learning material) concerning those same Kantian categories (i.e., concepts of the understanding) within **Fig. 11** in respect to modality (e.g., existence or non-existence via negation) and relation (i.e., causation or naught), for instance.

These descriptions, however, involve attitudes, which may aim to take mental imagery more seriously as well as photons, atoms and cells or to,

alternatively, introduce skepticism about the ideas that we form regarding their general structures and functions. However, such attitudes are unnecessary at such a level of analysis because they are already (and should already) be involved with the reconfirmation of data about the theoretical entities.

Another problem with the current trendy philosophical approach is that the scientific (anti-)realism debate typically ignores making any contributions to observation and the various levels of observation (e.g., microscopic and macroscopic, such as what is viewed through the lens of a microscope and that which is seeable and touchable with the naked eyes and bare skin) because such philosophic works focus upon analysis and levels of analysis almost entirely. However, the major problem presents itself when we consider the fact that without the levels of observation there can be no analysis.

Without the meta-theoretic approach illustrating examples that ground it rationally with the observation at some specific level (i.e., rather than abstractly at all levels) and without rationally providing the basis for the level of analysis grounded at that very same level of observation, meta-theories are fantastical, whimsical and capricious. In the latter respects they, again, provide the groundwork from which the studies of opinions about opinions arise.

Solipsism is the thesis that all objects, perceptions and events exist solely within the mind of an individual. So, solipsism entails that the world is neither distinct from the individual nor external to the person. If we assume that the individual will cease to perceive at some point, then the world would also cease to exist because the world only consists of mental events and objects of the

imagination, according to solipsism. Solipsism is an example of one of these meta-theoretic approaches since it is able to subsume other theories within it, incorporating measurements and multi-levels of observation and analysis, despite the irrelevancy of solipsism and total abstraction concerning the subject (See **Fig. 14**).

Perhaps there is some sort of interesting psychological and sociological explanation (e.g., related to narcissism and social identity) that explains what I refer to as meta-theoretical ways of thinking, which are sometimes interconnected. For instance, phenomenalism or idealism (i.e., the thesis that the world only consists of ideas or that being is only either perceiving or being perceived) are interconnected with solipsism since phenomenalists or idealist would have trouble explaining why solipsism is false in accordance with their meta-theoretical approaches. Reconciliations of these problems tend to involve the formations of opinions about opinions with respect to learning and teaching methods. They fail with respect to any critical ontology, which indirectly relies upon levels of observation, scientific investigation and methodology and analysis.

Solipsists are types of phenomenalists and idealists. Interestingly, the observations of the world that we make are exactly what a phenomenalist, scientific antirealist and solipsist would expect the world to look, sound and feel like if it were the case that these theorists are correct. On the other hand, the observations and their descriptions can also be consistently placed within the realist, anti-solipsistic theorist's worldview of their being many other minds that evolved via evolutionary processes, such as natural selection. However, we

should be aware that we risk the serious danger of spending too much time, effort and money upon speculative endeavors that do involve certain amounts of irrelevancy and which sacrifice observational criteria and practicality for analytical and logical approaches, which sometimes include nothing more than opinionated, speculative ways of approaching less important aspects of subject matters within the sciences.

Some criticisms of the approaches taken by cognitive scientists include their unreasonable assumptions that theories, such as solipsism, phenomenalism and scientific antirealism are false when the judgment of irrelevancy is more appropriate. David Hume was unwilling to make such assumptions as a result of his skepticism, for instance. The best approach to these sorts of issues is that they (i.e., realism, anti-realism and phenomenalism in science) function as levels of meta-theoretical analysis that are greatly irrelevant to the hypotheses' formations, tests and even the relation of observation and evidence and hypotheses to theories in cognitive science.

It should also be noted that the assumptions being made by these scientists do not present problems in the experimentation and overall analysis of the experiments. The problems illustrated are merely linguistic concerns, but they are worth mentioning because they contribute to the manners by which we view the world and minds. Additionally, the overall lack of attention by cognitive scientists to comparative analyses of theories and even the meta-theoretical undoubtedly involves the development of cognitive science literature that is at odds with philosophic approaches on the very same topics.

Since the philosophic approach involves rational argumentation, logic and the use of scientific descriptions in order to form syllogisms and other deductive logical arguments, a greater division between two disciplines (i.e., philosophy and cognitive science), which really should be working in unison, occurs. One major function of philosophy as a field of study is to erase the irrational underlying assumptions through inquiry and doubt in order to prevent unreasonable theories without foundations from arising, like castles in the sky.

G. Relations to Creativity and Conclusions

From sociological to psychological levels of observation and analysis there are various relations with creativity, including certain types of disobedience, diversity and non-conformity that concern both levels. Contrarily, boredom, indifference, apathy, uniformity, institutionalization, conformity, regularity, obedience, repetitiveness and many more similar ideas are interconnected with the lack of creativity with regard to creative endeavors. Creative minds, creative thoughts and creative expressions do not necessarily involve disobedience, but such creativity typically lacks the strictest obedience to the rules of well-established institutions within society.

"Boredom," for instance, is defined by Fisher (1993, 396; Sommers & Vodanovich, 2000) in respect to his analysis of the workplace as "an unpleasant, transient affective state in which the individual feels a pervasive lack of interest in and difficulty concentrating on the current activity." Boredom is a type of

psychological state that reduces the amount of creativity of the individual or is a temporary reduction of creative thinking.

Another related concept is indifference. Indifference is best conceived as that which assumes a "middle ground" with respect to the directedness of attention in regard to the triadic and scalar model of desire-indifference-disgust. Indifference is that which is between the range from desire to disgust that is held for a particular object, accompanying one of the triadic relations of beliefs, i.e., belief-indecisiveness-disbelief (Brant, 2012). Both indifference and boredom probably involve reductions of the amount of vivid and interesting mental imagery as well as reductions of other cognitive processes that incorporate beliefs or disbeliefs of the individual about some object as well as beliefs and disbeliefs that are coupled with desires or disgusts, for instance.

Thus, the triadic model concerns some belief (or disbeliefs or indecisiveness) that is coupled with a single relation from the triad, namely, desire-indifference-disgust, with respect to some object. Without the belief the object may go unnoticed.[57] If there is a lack of desire or disgust that is attached to the belief about the object (i.e., there is indifference), no creative thoughts arise.

Festinger (1957, 74) states that "{i}ndifference . . . {is} characterized by lack of clear preference for one alternative over the other and also by indifference about the whole matter. The decision was highly unimportant for the subject

[57] The cognitive formation of belief entails some attention to the object of belief, and the belief that an object is in a certain location, for instance, does not entail that the individual holds a disbelief that the object is elsewhere because disbelief also requires cognition.

here." The triadic relation concerning the belief-indecisiveness-disbelief about an object in relation to the desire-indifference-disgust triad involves much cognitive activity, recognition or misrecognition.[58]

Creativity formed from creative thoughts requires the latter relations with the omission of indifference. However, indifference and boredom are states that are considered by inventors and others in order to increase entertainment and decrease indifference or boredom with their products. Creativity obviously arises more often concerning beliefs and desires (or disgusts) directed toward objects than during periods of indifference or boredom with regard to the objects.

Likewise, mental imagery does not appear to be formed by individuals who are indifferent about those same objects. So, mental imagery and creativity appear to be interrelated insofar as they arise in relation to the individual's directed attention toward objects of desire and disgust rather than indifference. Beliefs, disbeliefs and indecisiveness are attached to certain levels of desire, indifference or dislike for the event or object.

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[58] The observer forms observations on the basis of beliefs, indecisiveness and disbeliefs with some relation to desire or dislike or disgust for the object within the environment (i.e., as opposed to indifference). Measurements are made via scientific observations that have already undergone the former relations. Measurements provide the observer with new objects (e.g., the specific rates of outlying results and objects or events that lead to irregular occurrences) for discovery. The latter already presumes a process through which the preconception and fuller concepts have been formed (Beck, 1961; See Ch. **III.D**). Finally, the desire to attain an even fuller concept or comprehensive conception yields both creative mental imagery and other forms of creative problem-solving, concerning the construction of conditions that allow for observations to be accompanied and compared via measurements. The latter may involve groups for comparison, such as "experimental" and "control groups," for instance. Fuller concepts are formed (e.g., in cases with groups) via the comparisons of averages attained from both groups' results. Ranges are formed from the outliers or most extreme results of the individuals at the very minimums or maximums concerning the measurements. The concept becomes fuller as a result of its additions, revisions and overall improvements from the analysis of the findings of the scientific investigation.

"Indecisiveness" is a temporary period during which the individual neither believes nor disbelieves something in particular about an event or object, which may result from a lack of information. Indecisiveness may come temporarily from the cognitive process of realization during which something is recognized as real or unreal, especially when the prior stage of forming and imaging possibilities of alternative occurrences involves great inaccuracies and realization of the event comes slowly after a period of belief (i.e., false belief) and then finally disbelief.

The indecisive individual, in the latter sense, is undecided in relation to the event, withholding the formation of belief or disbelief about its location, instantiation or characteristics. For example, if a girl leaves her house with her keys, goes to the playground, and her keys fall out of her pocket there unbeknownst to her, then she is likely to return home, to reach for the desired object with the belief that they are in her pocket (i.e., belief and desire are attached concerning the keys, but the belief is false).

Moreover, there is a time period of *indecisiveness*, which occurs at some point between the time period she firmly *believes* her keys are in her pocket (i.e., since she probably would not have left the keys there if she believed they were there) until the period during which she firmly *disbelieves* her keys are in her pocket and then *decides* that the keys are somewhere along the path she had walked. The latter period of indecisiveness is neither belief nor disbelief, but is rather the undecided judgment about the desired object's location, which is important with respect to her decision-making process, concerning subsidiary

goals (e.g., searching her pockets and herself). It is crucial for making choices to return to the playground where her keys lie.

She may form mental imagery in order to visualize the keys beneath the swing on which she swung. She may think creatively via considering various possible alternatives that would allow her to enter her home or to retrieve the keys without merely walking back to the playground (e.g., calling a friend and meeting her halfway). Creative thinking, in the latter sense, involves problem-solving via thinking of the most innovative means to efficiently utilize one's time and effort.

Again, the beliefs, disbeliefs and indecisiveness are attached to certain levels of desire, indifference or dislike for the event or object. The girl's decision is based upon her steady desire for the keys, which plays a necessary role during her decision-making process, which begins to occur once she doubts her belief and then forms the disbelief that her keys are in her pocket. Such instances are important with respect to explaining the psychological activity that results in mental imagery formation and creativity. However, mental imagery and creativity can be analyzed from sociological levels of observation as well.

The ideas, such as strict adherence to rules, obedience and passive repetitiveness, such as watching television for hours every day, generally involve actions that are opposed to or may hinder learning, which requires stimulation, activity, active participation or observation, and diversity. Of course, obedient people can be creative, but freedom or generous sets of rules allowing sufficient leeway is required. Creative expression may also arise after extreme

repetitiveness. For instance, somebody who has played the same musical scale thousands of times may often produce beautiful and creative music from that scale, and it may be unique music, concerning the order of notes, rhythm, lyrics etc.

Finke's (1990) experiment demonstrates that for inventions to be more creative it is better for the inventors to create their unique figures first and then to superimpose a random category, or one that has not been considered by the inventor, to which the figure is supposed to be applied (i.e., since the application of the figure to the chosen category of the subjects is typically less creative). The latter order of events for one way of increasing creativity involves the creative production of some configuration and then the random categorization of that configuration into a category that had not been considered by the creator with respect to the configuration, which prevents the assignment of the configuration into some pre-established mental set.

Musicians often work in this more creative way since they create a whole piece of music, and then they often perform the music in front of audiences and change the music in ways that depend upon audiences' responses, applauses and interpretations of the music, for instance. Thus, the unexpected alterations of their music can be selected and improved once the crowds have responded well. Of course, creative music also requires the cognitive process of realization.

It has been argued that mental imagery serves a very important, if not necessary, function within the neurocognitive process of realization with respect to two sets of cognitive formations of possibilities, consisting of greater ranges

concerning some (generally larger) domain before something is realized, and then formations of possibilities that occur directly after the recognition of something as real or unreal (i.e., the cognitive realization process). Cognitive formations of mental images that serve as possibilities within the realization process are creations and are creative. Mental images are creative in virtue of their sheer diversity and their combinations with other modalities (e.g., visual and auditory mental images unified during the thinking process) as well as their applications to the more efficient realizations, requiring less time and energy.

Cognitive formations of possibilities as mental imagery may be artistically or functionally more creative than realizations themselves, despite what the realizations involve (e.g., fitting parts for innovative mechanical devices). In the latter sense the realization (i.e., realization as a process of becoming real) may involve the expression of creativity for social groups to observe, whereas the individual's cognitive formations of possibilities, which are not realized, during the realization process may involve creative thinking that is never expressed.

How many wondrous human thoughts have been forgotten before they were ever expressed? Forgotten and unexpressed thoughts are often referred to as "fleeting ideas" that we experience, which involve mental imagery, creativity as well as scientifically unobservable phenomena. Analogies and analogical reasoning often involves fleeting ideas, which concern our brief considerations of relations of objects and events to one another. It also seems that more innovative, irregular and creative fleeting ideas may be more difficult to

remember since they may involve less analogous connections with memories of other events.

Perhaps memorable ideas have greater and longer lasting vividness than the vividness of fleeting ideas when they are cognitively formed as mental imagery. The conceptual range of the "vividness of mental imagery" has been illustrated in this book to involve a range from scientific evidence for the less vivid mental imagery formations within minimally conscious patients to the anecdotal evidence for incredibly elaborate mental image formations of ingenious inventors, like Nicola Tesla who manipulated many objects as aspects of his visualization skills, and artists. The latter ranges perhaps illustrate much stronger and untested correlations between the vividness of mental imagery and creativity.

Other means of being or becoming creative concern various forms of exercises and sports. Diets can be creative, interesting and nutritious as can movements, training routines and ways of diminishing boredom concerning the repetitive nature involved within the practice of exertive activities. Rest and relaxation, travel and vacationing, work and business, in general or specifically, can all be creative and may typically involve preparations via mental imagery. Not only are the latter activities creative in relation to their ranges but inactive individuals who find the encouragement to participate in sportive activities may increase their creativity as well because they increase the diversity of stimulations and motor activities involving greater ranges of performances.

Working with systems that are stable, harmonious and unified typically involve outputs that are similar and lack diversity. For instance, the creative idea

that becomes a book with a copyright or an invention for a sport with a patent may shortly afterwards be produced in bulk and lose its luster or creative appeal, especially if it is adopted by a stable institution. For example, a university may utilize the book for a course that is mandatory for hundreds or thousands of students. The creative invention could be a pair of gloves that become incorporated within a sport and regularly worn in accordance with the rules. In both cases the creative book and gloves become common and involve strict adherence to institutional rules and indoctrination, especially if only certain types of critical evaluations of the book and uses of the gloves are allowed.

Contrarily, creativity for services is quite different than creative ideas for products because services often vary from individual to individual (i.e., those who are entrusted with the responsibility of performing the same service) and typically vary from time to time since the same individual cannot always perform the same task the same way that she previous performed it. Services may also be performed with far better quality when friends perform them rather than strangers or others who may dislike the customers. We can describe many services and other performances with bell curves, which illustrate the individuals' rises and falls of progress, efficiency and creative work in relation to age.

For instance, athletes improve, peak and then may gradually decline, and they may well be argued to perform a type of entertainment service. Athletes who form mental imagery of their expected or future performances before competitions tend to perform at higher levels than those who do not (Pavio, 1985; Roure et al., 1998). Sanders et al. (2008, 607) illustrates that professional

performances of surgeries tend to be enhanced more by mental imagery formations than textbook studies:

"**Context** Although surgeons and athletes frequently use mental imagery in preparing to perform, mental imagery has not been extensively researched as a learning technique in medical education. **Objective** A mental imagery rehearsal technique was experimentally compared with textbook study to determine the effects of each on the learning of basic surgical skills. Methods Sixty-four Year 2 medical students were randomly assigned to 2 treatment groups in which they undertook either mental imagery or textbook study. Both groups received the usual skills course of didactic lectures, demonstrations, physical practice with pigs' feet and a live animal laboratory. One group received additional training in mental imagery and the other group was given textbook study. Performance was assessed at 3 different time-points using a reliable rating scale. **Results** Analysis of variance on student performance in live rabbit surgery revealed a significant interaction favouring the imagery group over the textbook study group. **Conclusions** The mental imagery technique appeared to transfer learning from practice to actual surgery better than textbook study."

Mental imagery formations tend to increase the efficiency of performance concerning activities that one images beforehand, especially performances of activities like reconstructive surgeries. We experience and understand creativity during the process of realization similarly since images or imagination lead to enhanced performances of the events that become instantiated; that is, at least we realize that groups that form mental imagery of their future performances of an event tend to perform in superior ways, which are creative.

Being creative as opposed to being destructive both present different ways of exhibiting creativity. In the latter sense we may come to understand another relation as involving "creatively creating" as opposed to "creatively destroying," and the latter involves the zeal of scientists and other strategists concerning the innovative creations for the purpose of violence or war, which includes some of the purposes for funding technology described within this book.

Creative destructiveness is an important theme to research for the practicality of discovering preventive measures. Once more we are obviously confronted with a set of individual or group relations that concern some goal, objects, such as explosive devices, and complicated cognitive relations to these objects, concerning desire and disgust as well as beliefs, indecisiveness and disbeliefs regarding individuals' behaviors, expectations etc.

Creative destruction may also involve innovative forms of social dominance and competitiveness, which occurs in business, academics, sports etc. For instance, the realm of academics currently involves a vast amount of research that has been written anonymously and has been false authored by cheating academics at all levels (Page, 2004; Fang et al., 2012). Ghostwriters attempt to produce works that are less creative than their best efforts because they realize they will only receive single payments for their work and that others will attain recognition and be judged as having creative minds via the submission of ghostwriters' works coupled with false authorship.

The latter system of online essay mill owners, ghostwriters, customer service representatives, and customers creates two forms of competition, namely, in business and academics, which undermines education systems (i.e., sets of institutions that should contribute to the greatest production of creativity and discipline concerning relevant formations of mental images) via the reduction of trustworthiness (i.e., regarding the student-teacher and researcher-publisher relations) and increase in deception concerning our judgments about who exactly is creative.

What our challenge should become is the creation of significant alterations within the education systems in order to impact the global education system in manners that maximize productions of creative designs, thoughts, services and products. Both creativity and mental imagery often require sacrifices that involve making greater preparations at the expense of fewer performances (e.g., incubation periods and image formations of alternative possibilities require extra time but not necessarily any actual expression).

We may consider that it is creativity that we attempt to generate, which may sound plausible. However, such a consideration may inevitably lead us to inquire what the systematic and underlying conditions are, within which creativity appears (Kruse, 2013). If one tells another that she should "Do something creative!", this has a similar amount of absurdity to the demand for an individual to "Be spontaneous here and now!"

Prof. Peter Kruse (2013) also compares the command to "Be creative!" or to "Be spontaneous!" to the demand or suggestion for somebody to prevent himself from thinking about something specific (e.g., Do not think of a blue elephant with a pink dress!). We naturally think of the specific object rather than consider and follow such commands or suggestions. With humans there is a natural tendency to form mental imagery in such a way that each noun and adjective tends to evoke images.

Diversity is what increases creativity within a system, according to Kruse. Systems that are stable are uncreative. Unstable systems or systems with phases that include instability are able to be creative via excitations and

disorders in combination. Increasing the diversity within the system increases the instability.

The formation of creativity is involved in the process of the system's successful attempts to stabilize while incorporating diversity. Increasing the diversity within the system for the process of stabilization may involve the incorporation of random elements within the system's ordering and/or categorizing processes. When the final stage of development involves the application of some unique formation to some general and unconsidered category, there tends to be an even greater element of diversity from which the individual tends to derive something even more creative as a result of a lack of entrenchment within some mental set.

Several other factors are necessary conditions for creativity, including culture, the environment and arguably some element of randomness in order for new elements to be incorporated by the intelligent system. In fact, it appears that the random elements are best incorporated when they are applied as the final general category within which the creations are categorized (Finke, 1990). The latter variables are all related to diversity, which is required in order for any species to form more stable niches within the biodiversity of the environment.

As an advanced cognitive process that is crucial for realization and the interpretation or analysis of observations, mental imagery formations are intimately interrelated with imaginative and creative thought processes. Mental imagery contributes quite greatly to the incubation period preceding the expressions of creative ideas, and imaging is generally involved in our memories,

which typically play decisive roles during the later phases of the creative process since the earlier phases need to be recalled and may be remembered via mental imagery.

One important and often overlooked set of facts about the cognitive process of realization is that our mental imagery formations have no way of distinguishing realizations of events at one level of observation and realizations at other levels of observation. So, for instance, the individual utilizing the real-time fMRI machine in order to assess one's decision-making process may mistake the notion of determinism and the necessity of some choice between some specific time periods for the individual's inability to make that choice and thus the individual's lack of guilt, lack of an alternative etc.

However, guilt, innocence, shame and choice-making involve relations of individuals to situations that were obviously not originally assessed via computational and neurocognitive approaches because we made such judgments before such technologies existed. The latter concepts and relations are observable from our common perceptions and interpretations via our naked eyes, ears etc. without such technologies.

However, mental imagery, for instance, allows one to incorporate findings, such as the determinism involved during the choice-making process (i.e., discovered at the neurocognitive level of computational observation), as well as to combine such findings with other levels of observation, such as the observation of the guilt and guilty face of the convict who planned the heist and

got caught on tape (i.e., viewed via our most common level of observation as well as with video footage).

Inevitably, our creative capacities may lead us to assert that conclusions can be drawn from one level of observation to another. So, one trend concerns the assumption within criminal law that the neurocognitive analyses actually are in favor of demonstrating the lack of guilt of all criminals since the neurocognitive observations cast the concept of free will into doubt (Duttge, 2009).

However, in one sense such a way of envisioning and relating fMRI observations with observations of choices is analogous to envisioning and relating cells and skin. The skin is not observable under the high magnifications of the microscope like it is to for us who feel it and see it in the sunlight, and each cell is not visible to our naked eyes without the microscope because each observation is at a different level from which different types of analyses are formed. Likewise, the brain activity, which allows scientists to predict what simple choices one will make, is observed at an entirely different level of analysis than the one from which the concept of choice-making was originally derived (Soon et al., 2008).

With our creative powers combined with mental imagery formations we must demonstrate restraints and discipline in order for constructive, innovative and scientific, creative productions to arise. It is easy to lump any series of images together indiscriminately so that they would appear to the individual to possibly concern one's most familiar levels of observation and analysis, e.g., with the naked eyes and without technologically advanced machinery. However,

indiscriminately placing imagery of objects together that naturally derive from different levels of observation creates recipes for massive misconceptions.

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