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VISUAL THINKING STRATEGIES (VTS) IN THE CLINIC: HOW THE HUMANITIES AFFECT THE WAY WE MAKE VISUAL DIAGNOSES WITHIN MEDICINE

Mitchell Smith

Honors Thesis

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by
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ABSTRACT

VISUAL THINKING STRATEGIES (VTS) IN THE CLINIC: HOW THE HUMANITIES AFFECT THE WAY WE MAKE VISUAL DIAGNOSES WITHIN MEDICINE

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Bachelor of Arts

Visual Thinking Strategies (VTS), a system of humanistic critical analysis that was developed in the 1990's by Abigail Housen and Philip Yenawine, affords viewers of art the opportunity to have an increased level of interaction with artwork through the use of questions posed by an instructor. For viewers, such a process of critical analysis affords greater visual literacy. The same is arguably true of medical personnel who have trained to use said process in the making of medical observations and diagnoses. The purpose of this study is to understand if VTS has direct application within the realm of medicine, and by extension, if the humanities have a direct application and benefit in the applied sciences. Within the realm of the humanities, many visual concepts are taught and discussed (such as line and form) to help viewers to have an increased sense of understanding and comprehension of visual stimuli. It's possible that when these humanistic concepts are applied to other disciplines, they allow for increased levels of comprehension and understanding. This thesis highlights some of the perceived benefits of VTS within the clinic, as well as their potential impacts on the U.S. healthcare system.

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TABLE OF CONTENTS

LIST OF FIGURES

Introduction

In the United States, it has become increasingly more commonplace for healthcare practitioners to rely upon technological devices to aid them in the physical diagnosis of patients (a.k.a. tests, assays, and imaging equipment such as MRIs, X-rays, etc.) Ever since the introduction of these methods, it's been apparent that new insights and perspectives into the physical diagnosis of patients has become available to physicians. Substantial amounts of research have been conducted to legitimize these forms of physical evaluation. As a result, physicians over the years have grown increasingly more confident in the empirical results that have been produced via these methods. In light of these findings, it comes as little or no surprise that medical practitioners are becoming more partial towards these external diagnostic procedures than to more traditional modes of observation within the practice of visual diagnosis.

However, despite the warm reception received by these new preferences, they (quite literally) do not come without a cost. According to U.S. expenditure data, it is estimated that the U.S. healthcare sector expends somewhere between 17.2 and 27.9 billion dollars on tests and procedures that do not improve health outcomes (Shrank, 1504). According to the World Health Organization (WHO), the United States healthcare system spends a higher percentage of its Gross Domestic Product, 18%, than any other country, but ranks a mere 37th in world rankings in terms of qualitative care provided (Papanicolas 1024). Clearly, additional tests and uses of external diagnostic devices are not always the solution to improved healthcare. Effective medicine might not be as much about how many tests or diagnostic scans can be made when making a medical diagnosis,

but more about physicians' abilities to piece together valuable pieces of information within a decision-making process.

This process can be succinctly described as critical thinking: the ability to form judgments that are both reasoned and reflective of how someone should think or act (Facione 4). However, the real question is this: how can critical thinking be taught? How can practitioners learn the skills that will have the greatest impact on their own medical practice as well as the lives of those with whom they work?

Within the clinic, physicians must rely upon a process of critical analysis to help them to determine the cause(s) of their patients' undesired condition(s). Some of these causes can be identified within the process of physical diagnosis itself, such as the observation of physical patterns that exist in regard to the patient's body, as well as other causes or factors of disease that aren't strictly medical (such as sociological effects of behavior, race, gender, social stratification, religion, secularization, and deviance, etc.). Within the realm of medicine, many of these factors are critical in patients' processes of healing and thus are of the utmost importance to be observed and accounted for within the process of physical diagnosis.

In a routine medical diagnosis conducted by a physician, there are usually four stages that are constituted: observation, auscultation, percussion, and palpation (Smith).

Observation refers to the visual analysis which is undertaken by the clinician in question as they determine the perceived physical state of a patient. This can also include the accounting of insights into a patient's physical, mental, emotional, and temporal well-being. Auscultation involves listening to body sounds via stethoscope, which most commonly occurs in the heart, lungs, and intestines (Mount Sinai). Percussion is a

method of tapping a patient's body parts with one's own hands, fingers, and small instruments with the purpose of measuring auditory, tactile, or neurological responses. Finally, palpation involves the method of feeling with the hands or fingers of another's body to measure things such as consistency, texture, tenderness, and location (Swartz).

While all of these techniques within the process of physical diagnosis are needed to understand the cause(s) of a patient's medical condition, the one component in which students purportedly find themselves the most lacking is the process of observation. Because of this, it's possible that many students seek to use other methods such as (X-Rays, MRIs, CAT scans) to compensate for a lack of observational power.

Perhaps one of the best ways to develop one's own critical thinking and reasoning skills is through a regular study of the humanities. The humanities (visual art, language, literature, poetry, music, drama, dance, etc.) require interpretation in order to uncover reasonable answers about their artforms. Through critical analysis, humanist scholars are able to find meaning in challenging scenarios that warrant interpretation.

However, one of the ways in which this lack of observational proficiency has been proven to be reversed is through a study of the humanities—most specifically, a process known as Visual Thinking Strategies, (or VTS).

This technique was introduced in the 1990's as a relatively new process of interpretation to be used within humanistic fields, which emphasized the critical analysis of interpretive works such as visual art (Nelson 282). Today, this same approach can be used through a series of specialized questions, asked by a VTS-trained facilitator to their students in order to help them to analyze pieces of art in a way which would allow them to learn by a process similar to the Socratic method found within the Platonic Dialogues.

The ancient Greek philosopher Socrates developed an approach which involved a facilitator who posed questions to help students to identify their own patterns of thinking—or metacognition— as well as respond with the reasoning behind their perception and understanding of concepts. Such a 'call and response' process proved to be tremendous in the process of thinking critically, gaining visual literacy, and being able to render improved inductive reasoning skills (Boghossian 44) (Nelson 282).

With all of this in mind, if a humanistic process of inquiry such as VTS were applied to the way that physicians create physical diagnoses in the clinic, would there be an increased level of diagnostic efficacy in the US healthcare system? Would the humanities indeed have a positive effect on the way that doctors think and problem-solve within the field of medicine?

After having researched the different visual as well as metacognitive patterns identified within VTS, I felt that those same visual/metacognitive patterns could be directly applied to the process of making a visual medical diagnosis within clinical medicine. I believe it would be important to identify such a relationship in order to lobby the expansion of VTS onto a greater scale with the goal of finding a more efficient way to make medical diagnoses through critical thinking skills. I also believe this would also be impactful on a macro scale given that it could potentially both reduce the costs of healthcare in the United States as well as improve the delivery of care.

Literature Review

Visual Thinking Strategies (VTS), a procedure originally created, developed, and coined by Abigail Housen and Philip Yenawine, is a lecture-based educational module

that involves a facilitator who presents a selection of visual artwork within a museum and then asks students to answer a series of different questions regarding the respective works. As a doctoral student at Harvard in the 1970's, Housen began formulating VTS after she had been studying people's various experienced psychological states when viewing the same piece of art. After doing some research in the field of developmental psychology, she concluded that people experienced several stages of cognitive development and engagement (akin to those described by Jean Piaget and Lev Vygotsky) when viewing art. With this research in mind, she developed a theory of aesthetic development— which was inspired by the research of Rudolf Arnheim. Like Piaget's theory of development, in Housen's theory of aesthetic development, people must pass through five stages in order to become fully engaged and interactive with artwork. Karin DeSantis, a scholar of Piaget's research, found that that every stage of development is of equal importance and is proceeded through in the same order. Housen's stages of aesthetic development (akin to Piaget's developmental stages) include: *Stage I-Accountive*, *Stage II-Constructive*, *Stage III-Classifying*, *Stage IV-Interpretive*, and *Stage V-Recreative* (Nelson 283-284).

Stage I-Accountive viewers like to look at art in order to tell a story using their past experience with their senses, memories, and personal relationships. Judgments are made based on what the viewer knows and has preference for. Emotions are a prevalent aspect of this stage. *Stage II-Constructive* viewers would progressively seek to build a framework to help them to look at art using the most logical tools and resources (for example, the natural world). If a piece of art doesn't "look right" to them, the viewer might judge it as weird, lacking, or of little value. *Stage III- Classifying* viewers pretend

that they're acting as an art historian would, wanting to know what time, place, style the work was created in. They also believe that when facts about the piece are organized well, the meaning of the art is able to be revealed. *Stage IV-Interpretive* viewers seek to have a relationship with the art by exploring it, letting its meaning come to light, and appreciating the nuances that exist between things like color, form, contrast, pattern, texture, shadowing, lighting, etc. Each new encounter with a piece of art allows for a new set of insights or interpretations. *Stage V-Recreative* viewers have had enough experiences with artwork to accept any type of artwork as art, even though it many potentially contradict their own personal beliefs. They understand everything semantically, interpretively, and affectively about a painting, but also acknowledge its ability to evolve like a living organism would. They also wholeheartedly agree that art is the "happening" or "manifestation" of truth in real-time as proposed by Heidegger (Housen 17-18).

Abigail Housen's stages of aesthetic development became a special topic of interest when museum curators at the Museum of Modern Art (MoMA) in New York wanted to measure levels of engagement among participants in the educational programs that they were conducting. After performing research in 1991, Philip Yenawine, director of education at the MoMA, discovered that those participating in their educational programs were struggling to remember and articulate what exactly they saw and experienced after they had been presented with different pieces of artwork. Because of this, Yenawine wanted to develop a method that would allow audiences to interact more deeply with the art being presented, regardless of their own respective levels of "aesthetic development" or engagement (Nelson 284).

In order to respond to this need, Housen created a system dubbed VTS that would help lead students toward higher levels of aesthetic development through three main Socratic-styled questions: “What’s going on in this picture?”, “What do you see that makes you say that?”, and “What more can we find?”.

These three questions not only helped the viewer to engage and interact with what they were viewing, but also allowed them to “explore” the artwork, as well as take the needed steps toward being able to critically analyze it. In Nelson’s article, she explains that after the first question, “What’s going on in this picture?”, respondents typically answer with a response that is associated with their own personal level of aesthetic development. For example, a *Stage I-Accountive* viewer might observe that there are different people or objects within the painting, while another student who has aesthetically developed towards *Stage III-Classifying* could classify what type of brush strokes were used by the painter, or what kind of style the painting would be classified as (neoclassicism, impressionism, realism, cubism, etc.) (Nelson 284). Housen purportedly created VTS specifically for *Stage I* and *Stage II* viewers, in order to help them to progress to a higher level of aesthetic development, and thus interact with art more deeply (Yenawine 315).

In addition to answering questions posed by the facilitator, after students looked carefully at a piece of art, they were encouraged to back up their ideas with evidence, listen and consider the views of others, and discuss many possible interpretations (Reilly 251).

The ability to distinguish between observations is a key skill to have in clinical practice. Due to the many natural differences that arise in perception, such a practice of

comparing and contrasting different perspectives made within the observation of patients can aid in uncovering personal biases that exist within one's reasoning. For example, one type of personal bias is known as availability bias—which is a psychological phenomenon that occurs when someone searches for immediate, popular, and available non-factual solutions to explain a certain occurrence. For example, after the year 2020, some physicians might be tempted to think that their many of their patients have been exposed to COVID-19 after displaying all of the same physical symptoms that patients with confirmed cases of COVID do.

Another important aspect of making a good medical diagnosis involves physicians being able to ask questions about their patient's condition(s) while conducting a physical examination simultaneously. This multisensory approach to analysis can be replicated as a student analyzes a visual painting while at the same time answers questions about it (A. Miller 435). Perhaps the VTS-trained instructor asks the question, "What's going on in this painting?" and the student responds with their first impression. The professor can continue further on with this Socratic dialogue and then ask, "What do you see that makes you say that?" and "What more do you notice about this painting?" This process of exploring the students reasoning helps the student to recognize if they are indeed making logical connections between different statements and can help them to identify faulty assumptions in logic due to individually held biases. This also helps the student to identify what they already know about the subject, as well as use context clues to make logical connections to arrive at a logical conclusion. This helps them build their "mental set" or 'scaffolding' towards discovering an answer to their question that is both logical as well as intuitive (Fletcher 1966).

It wasn't long before other art museums learned about the practice of VTS through published articles in the Journal of Museum Education. Once they became familiarized with Visual Thinking Strategies, they subsequently used it as an instrument to create a joint venture with other professional programs such as medical and nursing schools to create professional development opportunities. After a while VTS made such an impact that Harvard University held a two-day conference highlighting the usage of VTS and its subsequent benefits. A lot of these partnerships purportedly began around the year 2001 and have been on the increase ever since then. Although there may be many reasons behind the partnering of medical schools and art museums, some have concluded that perhaps the most predominant reason is that medical schools have been trying to find ways to add a sense of balance between an already very science-heavy curriculum with one that is more interpretive. Also, museums are always trying to appeal to different types of audiences (Nelson 284).

One of the perceived benefits of VTS is its ability to help students to create better analyses of visual stimuli (art) and help them to navigate what are referred to as "interpretive challenges": situations in which people must exercise judgment and interpretation in order to better understand and describe an otherwise ambiguous entity. For example, a student might be looking at a Picasso such as the one shown in Figure 1, and have to "practice confronting the ambiguity of interpretive challenges that do not yield easily" (Alvarez 59-60). This activity increases a student's ability to assess metacognitively their own awareness of [analytical] discomfort and gives them an opportunity to practice critical reasoning strategies via the use of "questions, observations, experience, knowledge, and teamwork (Alvarez 59-60).

With the help of VTS, visual patterns of disease in medical specialties such as histology, dermatology, radiology, neurology, and several others, became more and more noticeable for students who had learned how to use Visual Thinking Strategies in their medical training which subsequently allowed them to make more accurate visual diagnoses of different clinical cases. During the 2004-2005 academic year, Harvard Medical School (HMS) and Harvard Dental School (HDS) invited their students via email to participate in a pilot course titled: "Training the Eye: Improving the Art of Physical Diagnosis", a spring-term elective credit that taught the fundamentals of how to use VTS in the clinic.

As part of the course, there was a study that was performed that included a combined set of 58 medical and dental students. Twenty-four of the students participated in the new VTS-driven course (which was the test group), while the remaining 34 acted as a control group by following the standard curriculum. The study occurred immediately before and after the course had taken place (labeled as pre-test and post-test in Figure 1 found below.) Before the course started, all study participants were shown five different visual images— three of which were photographs of medical conditions such as Deep Vein Thrombosis, Wallenberg Syndrome, and Relapsing Polychondritis, and the other two were a selection of artworks. The students in the study were asked to write down their interpretations and observations of the things that they had seen and then submit them to be reviewed in a single blind fashion at the end of the study. The same process was carried out at the end of the study to compare the pre- and post- test results. (The images on the post-test were different to the ones at the beginning but were similar enough to conduct an apt analysis.)

Results found that students in the test group were significantly more able to make correct diagnoses of the medical photographs as well as give a much more in-depth description of the art works which they had seen earlier (Figure 1) (Naghshineh, 991-997).

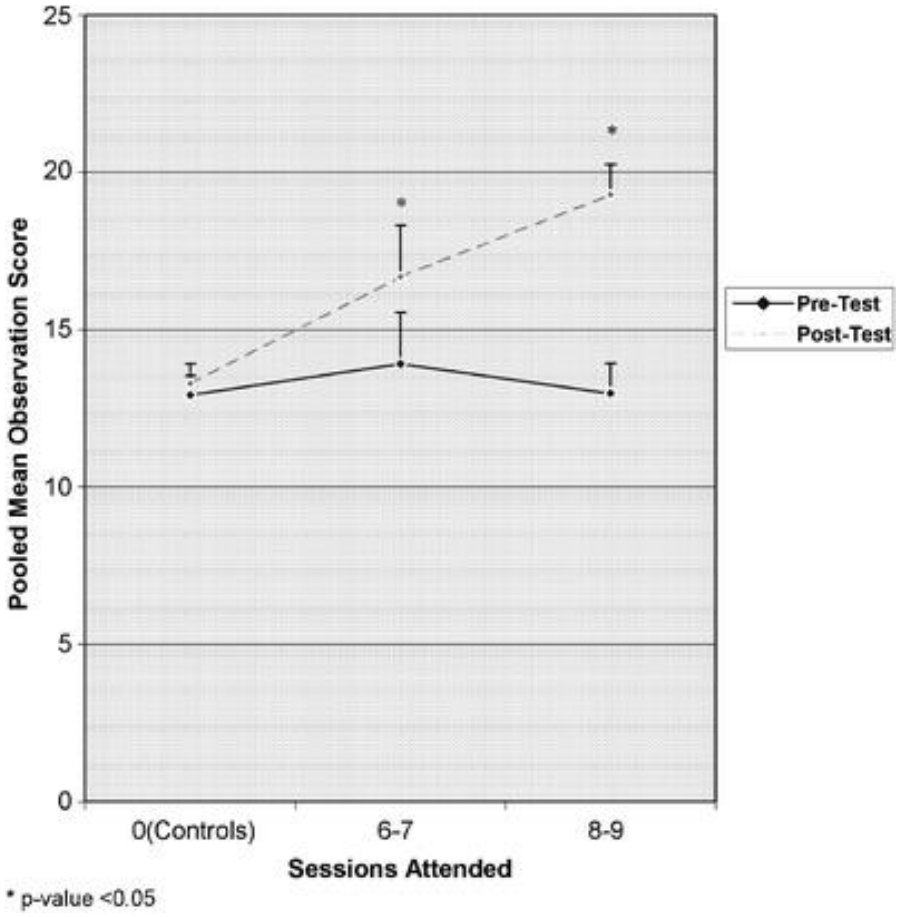

Figure 1: Graded impact of attendance on total mean observation score from pre- vs. post-test observations of all images from Naghshineh et. al.

Figure 1 displays how the number of VTS sessions attended by medical students in the previous study affected the overall mean observational score for students in three categories. The first category served as a control as participants participated in the VTS

sessions zero times, the second category pertained to those students who participated in the VTS sessions six to seven times, and finally the last category was for students who attended eight to nine different times. Although all three categories of students had their mean observational scores improve with time (pre-test vs. post-test), those who attended the most VTS sessions saw the largest increase in their pooled mean observational score. (Pre-test scores were measured among all participants before the first class, while all post-test results were measured immediately among all students following the final VTS session.)

In another study, similar results were recorded when 38 third year medical students were divided up into two different groups, where one group was exposed to a series of clinical photographs and paper cases while the other was trained solely by only analyzing art and dance in three two-hour classroom sessions spaced out over six months. In this study, those students who were presented with clinical photographs held an edge over the other group who only studied art and music exclusively. This confirmed the hypothesis that in order for VTS to be more effective than traditional forms of medical observation training, it was essential for some type of medical photographs to be integrated into a VTS medical course in order for it to be effective. Both studies also concluded that observation skills, pattern recognition, and interpretation were critical elements in student's abilities to make successful medical decisions (Shapiro 263) (Dolev 286).

Thus, we can see that from both of these studies, that those who use Visual Thinking Strategies in a medical context with actual case photographs are better equipped to notice details that they hadn't before, as well as give deeper consideration to the finer

details of what's going on after they have thought critically about the subject—a type of exploration that reveals the inner workings of what is truly going on within a piece of art or type of visually observable disease.

However, some might go on and ask, "What are the specific criteria/artistic elements that students and facilitators are looking to identify while using VTS?" In the Harvard course, "*Training the Eye: Improving the Art of Physical Diagnosis*" some of the art principles which had been assigned students to observe while employing VTS were the following: color, light and shadows, contour, form, texture and pattern, line, and symmetry, as well as balance. These are some of the art principles that are commonly used from an interpretational standpoint within the humanities that allow the viewer to be able to gain insight, as well as critically analyze the things that exist within a painting that have the potential of rendering an affective emotional experience on them (Naghshineh 991-997).

For example, lighting and color help to determine what we might consider the tone of the painting. Lighter, warmer, and brighter colors (such as reds, yellows, and oranges) and/or greater light saturation within art can lead to feelings of positivity, happiness, and/or high energy. For example, the color red can be associated imaginatively with the concepts such as emotion and passion, making it a favorite choice among artists looking to create a memorable affective experience for their audience (B. Miller 461). Conversely speaking, paintings with darker tones and hues (blues, greens, and purples) also have the capacity to evoke emotions such as calmness, coldness, an absence of energy, and perhaps even dread at an extreme.

This theory of identification between colors and lighting also shares interesting parallels when it comes to the world of medicine and physical diagnosis. Although artwork itself may have a greater ability to affectively convey different emotions, both art and visual diagnoses have a way of telling us a story about what's exactly going on within a patient's life. When it comes to strictly making physical diagnoses, lighting and color can signify several things.

For example, in dermatology, lighter skin denotes less melanin pigmentation, and perhaps a greater susceptibility to skin cancer. Also, very pale skin tone can be traced to multiple things: poor circulatory flow, a decrease in body temperature, the onset of physiological shock, and several other conditions. Due to instances like this, we can see the importance of being able to notice the fine details within the observation of a patient's medical condition. It really can make the difference between a successful and unsuccessful diagnosis. For example, another instance in which it could be possible to observe the finer details that might lead to saving someone's life include those found within the specialty of general surgery. When light purple blotches are noticed and identified on the lungs, surgeons are able to detect lung damage caused by exposure to toxic chemicals. Likewise, within general surgery, whenever a general surgeon is performing a routine colonoscopy, noticing (or not noticing) very small papules on the interior of the large intestine may result in a life-altering consequence.

In the documentary *Making Rounds* (2001), two internal medicine doctors at Mt. Sinai Hospital in New York City recorded their interactions with patients, and were able to teach residents how to make visual diagnoses by just using their eyes, hands, and observation skills. For example, with one patient, they were able to diagnose her with a

heart condition based on the observation that one half of her body had a greater fluid pressure within the veins than the other (Brick). The physician's ability to make such an observation was dependent on past diagnostic experience, but also because of a high level of visual literacy. While such experience in the clinic can help a doctor to significantly increase their levels of visual literacy, another way that they can do this is through a process of pattern recognition within art.

Figure 2: Transverse Lines. Wassily Kandinsky. 1923. Oil on Canvas.

For example, a student might view this Kandinsky above in Figure 2, and then be able to recognize and observe similar visual patterns that exist within the human body. For example, many bones within the human skeleton have a curved appearance akin to the lines which Kandinsky fashioned. Many blood vessels have an asymmetric appearance like the forms in Figure 2, while many straight and elongated structures overlap each other much like muscle fibers and skin cells conceivably would. Throughout all of these many arrangements of patterns however, the one that is the most fundamental

and principal to mention would be that of line. There are several different types of lines that are shown in the painting above; including straight lines, curved lines, parallel lines, intersecting lines, and lines that convey depth in reference to the page by crossing over other lines. Thus, in our analysis of art, the study of lines is critical. In medicine, the study of lines is also of great importance. There's a huge variety of different and distinct patterns lines can form in the study of anatomical structures and physiological functions. Let's take a look at the microscopic structures of bones, for example.

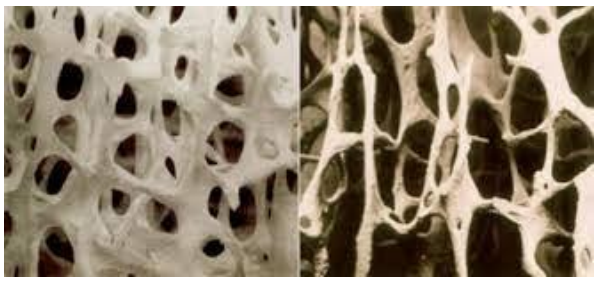

Figure 3: Varying bone structure densities

Here we see a microscopic cut of human bone. This makes for an interesting case presentation due to the difference in the types of lines that we see. For example, in the image on the left we see a normal construction of bone as we typically would, with thicker bone structures and consistency. When considering the thickness of the lines we see in the bone here, we also are able to infer that since the bone on the left has a much thicker appearance, it has greater three-dimensional depth to it, and we can assume that it can afford more strength and resilience towards withstanding outer forces. By

comparison, the bone on the right appears to be much thinner, but because the similar negative spaces between the different bone structures on the left and right, we can tell that the structure of the bone is indeed a lot thinner and isn't an optical illusion of observational distance. Thus, we can see that lines are a principal element in that which we experience on a day-to-day basis. Perhaps a physician in this case would observe the bone structure shown here and ask himself: "What is going on here?" "What do you see that makes you say that?" "What more can you find?"

Such a process of physical diagnosis has the potential of helping physicians to make discoveries about a clinical case that potentially wouldn't have been able to be made before, as well lead them towards a correct diagnosis within a shorter amount of time. As you might have guessed, the above image depicts osteoporosis, or thinning of the bone.

The process by which this was figured out was very similar to the adapted VTS questions and process that had been mentioned earlier. They asked the patient what they personally thought was going on, "why" they were led to think that, as well as searched for other possible causes that could have been contributing to the patient's undesired condition. In addition to this VTS-similar approach, the physicians also employed more traditional methods of observation by palpating the patient in the affected areas, checking the patient's airways, breathing, and circulation, performing routine ear, nose, and throat exams to look for inflammation, checking heart rate and lung respiration sounds, and taking of vital signs. With so many diagnostic tools and techniques within the physician's arsenal, this also served as a valuable teaching moment for the residents on the floor who were learning the most efficient ways to make medical diagnoses—even without the

costly use of diagnostic technologies including MRI, fMRI, CAT, and X-Ray machines (Brick).

The response to VTS among medical students has been interesting to read. Some have said, “People would say things, and then I’d see new things I hadn’t seen before. My perceptions would shift.” “The painting became richer because different eyes focused on different things” (Reilly 991-997). “There was an openness to each other’s ideas, an acceptance of different conclusions.” “My brain passed over the things that others brought to my attention. The painting didn’t change, but my perceptions of it changed throughout the process.” “We each had different perceptions of each other’s observations. We all analyze information uniquely.” “The facilitator kept touching the painting and drawing us back to the details. He held us responsible for our responses” (Reilly 991-997).

Methodology

One of the things that I wanted to personally research was this: “Can a humanistic type of thinking have a direct positive effect in the way that science is applied in the clinic, and even lead to more accurate results?” Earlier, it was mentioned that visual concepts such as line, form, color, lighting, texture, shadows, and symmetry all play a role in determining the way one analyzes visual pieces of information. I wanted to see how we can take those ideas and apply them to the way that we critically analyze and classify diseases visually through the use of VTS.

For this, I performed an extensive literature review to inform myself on the history, reasoning, and application of VTS, as well as contacted those who were teaching

a similar course to the original *Training the Eye: Improving the Art of Physical Diagnosis* at Harvard Medical School (HMS), where the principles of VTS were taught to clinicians seeking to improve their medical observation skills. The current course, *Training our Eyes, Minds and Hearts: Visual Thinking Strategies for Health Care Professionals* is part of Harvard's continuing medical education program, taught by Dr. Joel Katz who has been teaching how to use VTS in clinical medicine for over 20 years at Brigham and Women's Hospital in Boston; one of Harvard's premier teaching hospitals. After holding a discussion with Dr. Katz, I sought to apply a set of principles which he had brought forward, as well as analyze a few case studies which he'd conveyed to have high importance in the discussion of how VTS could best be used within the clinic to improve patient outcomes.

Results

Dr. Katz explained that VTS is most useful while doctors are in the observational stage of making a physical diagnosis; the other stages mentioned earlier are still of great importance, but VTS has the greatest impact in the realm of observation. When he is in the hospital training medical students and residents, he asks himself a similar style of VTS-like questions to guide him through the process of observing a patient, and instructs his residents and medical students to do so also. In this way, this humanistic process of reasoning does indeed have a place within applied science and medicine, and acts as a critical component to advancing the quality of care within a science-driven healthcare field.

Every year as part of Dr. Katz's class on how to use VTS within medicine, he takes his classes to the Harvard Museum of Fine Arts and introduces them to new

artwork that he uses to teach humanistic principles of analysis such as color, form, shadow, line, and symmetry.

Some of the pieces of art that have been used in the past include these below.

Text Box 1 Examples of Observation Exercise Concepts, Corresponding Didactic Sessions and Viewed Art Works

From: Formal Art Observation Training Improves Medical Students' Visual Diagnostic Skills

Observation Focus	Didactics	Examples of Art Work*
Color, light, shadows	"Color and Luminance"	Paul Gauguin, *Where do we come from? What are we? Where are we going?* 1897–1898, oil on canvas
		Joseph Mallord William Turner, *Slave Ship (Slavers Throwing Overboard the Dead and Dying, Typhoon Coming On)* 1840, oil on canvas
		John Singer Sargent, *The Daughters of Edward Darley Boit*, 1882, oil on canvas
Contour	"Contour in Thoracic Radiological Imaging"	Edward Munch, *Summer Night's Dream (The Voice)*, 1893
		Pablo Picasso, *Portrait of a Woman*, 1910
Form	"Linking Form to Function in Pulmonary Pathophysiology"	Seated Bodhisattva, Chinese, Eastern Wei dynasty, about A.D. 530,carved limestone
		Jan Steen, *Twelfth Night Feast*, 1662, oil on canvas
		Edward Manet, *Execution of the Emperor Maximilian*, 1867, oil on canvas
Texture and pattern	"Texture and Pattern Recognition in Dermatologic Diagnosis"	Jackson Pollack, *Number 10*, 1949
		Star and Crosstiles, Iran 13th Century, composite body (quartz, clay, and glass frit)
Line and symmetry	"Line and Symmetry in the Cranial Nerve Examination"	Susan C Waters, The Lincoln Children, 1845
		Power figure nkisi nkondi, Kongo people sculpture, 19th–20th C, wood glass, metal, pigment
Balance	"Detecting Balance and Imbalance in the Neurological Examination"	Claude Monet, *La Japanaise* (Camille Monet in Japanese Costume), 1876, oil on canvas
		Shiva as Lord of Music (Shiva Vinadhara), Southern India (Probably Tamil Nadu), (Female figure dancing)

*Images of the artwork are available through Google.com Image searches

Figure 4: Excerpt from Naghshineh et al. of a potential VTS curriculum curated by HMS Staff.

For example, in Figure 4, we can see that the course curriculum is divided up into different focuses of observation. On the days that Dr. Katz wanted to focus on observing texture and pattern, he used a Pollock, or, in the case of the figure above, a multi-medium piece from Iran that served as a good example of both. Most recently, Dr. Katz has used African textiles from the Harvard Art Museums to highlight the commonalities that exist between patterns and textures in both art as well as in human tissues and organs. For example, the process of being able to identify patterns within VTS could be used to tell the difference between different types of skeletal muscles like the latissimus dorsi and

trapezius, which can all be differentiated by different arrangements of striations within the tissues. This skill could be particularly useful in many applications, including those invasive processes that surgeons undergo in order to navigate a person's body when performing surgery. No two bodies are exactly the same, and so being able to orient themselves with critical thinking techniques involved with concepts such as line could serve well to orient themselves.

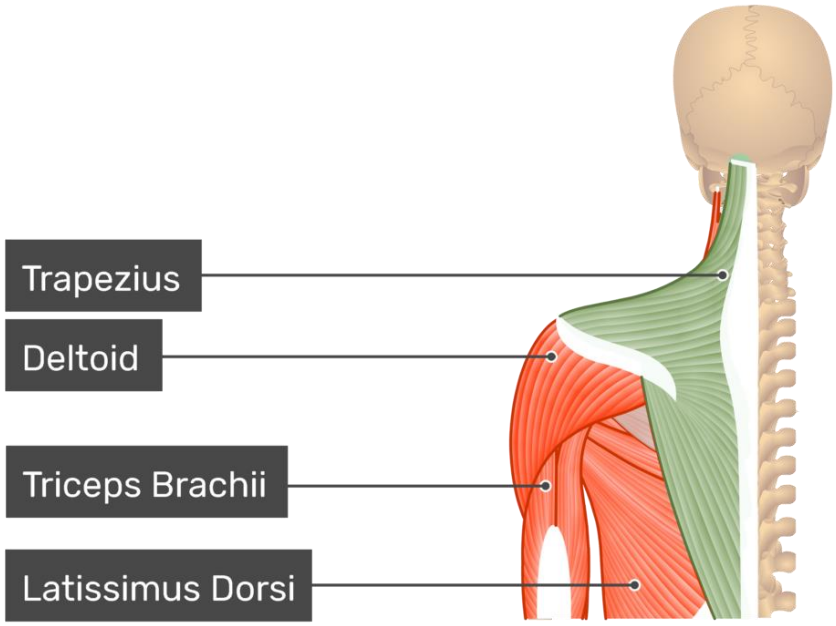

Figure 5: Different types of muscle striations found between trapezius and Latissimus Dorsi. Image Credit: GetBodySmart.

As a result of this study, we can see that there are definitely instances in which the process of using VTS to identify specific visual patterns within artwork can indeed be directly applied to the way that physicians make medical diagnoses. I have found that by posing the same set of questions that VTS does, such as, "What's going on here?", "What

do you see that makes you say that?" and, "What else can we observe here?" doctors will have an increased ability to make more accurate observations in their practice of diagnosing patients with visual conditions. Hopefully this will also allow them an increased skillset during the times in which they are searching for the correct condition, but are struggling to find it due to ambiguity (and other potential limiting factors like scarcity of resources.)

Discussion or Analysis

As part of Harvard Medical School's course on VTS, students were asked to complete out-of-class assignments in order to help them to identify the patterns between visual art and disease. For example, according to Naghshineh et. al., students were asked to carefully observe and document three other people's physical characteristics in relation to line and symmetry. I believe that the purpose of this assignment was to help the students to better understand how fundamental lines truly are to our bodily shapes and perceptions, as well as help us to see how symmetrical the human body really is (Naghshineh, 931-933). I agree that such an assignment would be useful because lines would be the first thing that physicians should search for when attempting to diagnose a disease, and will render them the greatest success in a successful prognosis.

Another assignment that was given out to the students asked them to practice the technique of contouring by sketching in their own notebook. I believe this assignment would help them to better understand the role that lighting, and shadows play on an object, as well as how such lighting can be manipulated to have the audience perceive an object in a certain way for a specific purpose. I certainly agree with the value of this

assignment because of its ability to help the student to wrestle with the different theories of multiplicity and ambiguity within art as mentioned by Naghshineh et. al. There is a wide variety of different diseases that exist out in nature, and often times disease can be caused by multiple factors. Helping physicians to recognize this in the process of making physical diagnoses can be incredibly beneficial to them in understanding that problems may occur from a variety of reasons occurring simultaneously.

In another assignment, students were asked to observe the texture and pattern of skin lesions that were encountered on other people, to help them to better understand the roles of patterns, colors, and textures when creating a correct medical diagnosis. For example, in the field of dermatology, as well as in other medical specialties, it can be quite common for physicians to use a differential diagnosis flowchart in order to help identify different conditions that exist.

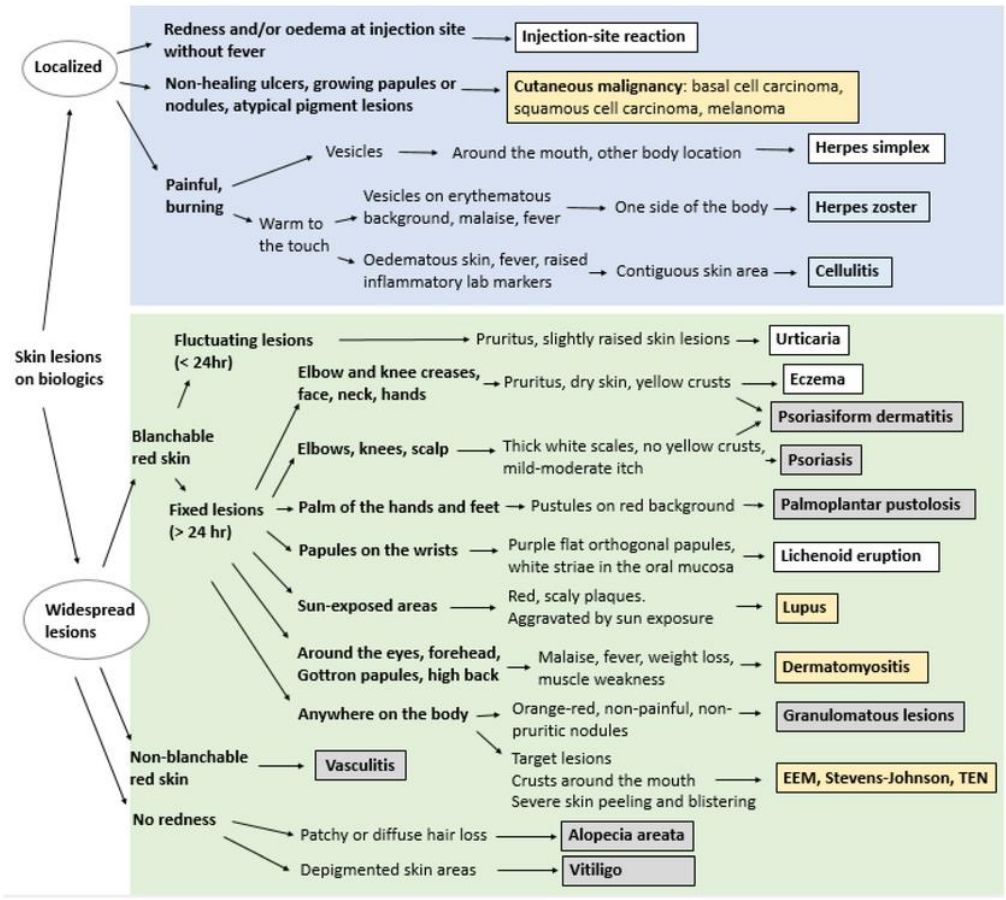

Figure 6: Differential diagnosis flowchart for skin lesions within dermatology.

Image Credit: Journal of Clinical Medicine.

Such a flowchart is often times incredibly useful due to its ability to guide a physician towards the correct diagnosis through a series of questions that require a yes/no answer. For this reason, I believe that the observational skills developed by VTS are of enormous value when it comes to medical strategies such as this. The keener and more aware a medical student can be of the visual symptoms of one's condition, the more able they will be in noticing the things that are characteristic of disease.

The concept of form was also similarly addressed in one of the assignments. Students were instructed to note in their journal the things that they noticed to be

interesting about other people's bodies: whether it be their bodily posture, or be it their bodily proportions. I agree this would be beneficial given that each and every person's body is different in some way, and so there might be instances in how the physical mechanics may differ by structure. Finally, students were also instructed to make notes about the different characteristics of color that they observed in other people's features, including their skin, hair, iris, sclera, conjunctiva, as well as evidence of jaundice/pallor/cyanosis/lesions (Nagashineh, 931-933).

Let's imagine a student in an art gallery with a piece such as this one below, and their respective VTS facilitator might ask them a series of questions such as: "What's going on in this picture?" "What do you see makes you say that?" "What more can you find?" This process of critical analysis has the potential of opening up a whole new set of perspectives never before perceived by the student, and also adds to the student's understanding of how multifaceted this piece of art can truly be.

Figure 7: *Daniel-Henry Kahnweiler*. Picasso. 1910. Oil on Canvas.

While the analysis of visual art is often classified as an interpretive discipline, so can be true of those that are thought to be traditionally empirical, such as medicine. Within medicine, subjects such as chemistry and biochemistry, biology, physics, anatomy, and physiology, are combined and synthesized into an artform akin to that of a beautiful painting like the one shown above. Each empirical subject plays a special role within medicine, just like each different stroke of paint plays a role within a piece like Picasso's. When combined, they have the potential of orchestrating an effect that is both physically and emotionally palpable as well as life changing. Just like it is impossible to have two original paintings be made exactly the same by an artist, it is also theoretically impossible to say that an application of medicine should be the same for each and every patient. Each patient is anatomically and physiologically unique, and thus requires their physician to be able to physically tailor their needed treatments to best match their anatomical and physiological demands. Because medicine isn't a one-size-fits-all bandage, it is crucial that physicians be completely comfortable with the concept of ambiguity; for example— in reality, there are no bodies that are made exactly the same, and so sometimes recognizing diseases will require a difficult and strenuous 'deciphering' or 'decoding' of each patient. Since each body has its own way of reacting to physical stimuli and manifesting symptoms, (due to its differences in physical structure and anatomical and physiological development), physicians must be comfortable with an inductive reasoning style (bottom-up processing; physical observation/manifestation to theoretical cause or diagnosis—not top-bottom processing where a condition is thought of and then physical evidences are sought after.)

In order to develop diagnoses within medicine, a similar if not identical type of thinking of VTS has to be executed: “What does the patient think is going on in their body?” “What does the patient see and sense that makes them say that?” “What else can I find that could potentially be the cause of this patient’s undesired condition?” These inductive reasoning skills are preferred over their deductive counterparts due to their ability to allow physicians to look at patients who differ anatomically and identify the patterns between abnormalities in real time, rather than having to collect individual data over a period of time in order to achieve a firm conclusion.

Performing deductive medical research (the scientific method) with a small sample size can often skew and misrepresent data for true populations, which can often lead to erroneous conclusions. In some instances, this inductive approach is preferable to physicians in the clinic when restraints are placed on the necessary capital/resources needed to collect the appropriate data to support the traditional deductive approach. For example, for physicians who are called upon to perform emergency medical procedures, they need to be able to perform a quick and succinct type of research specific to each patient in order to provide appropriate care during an emergency. In such cases, a more traditional form of deductive research (the scientific method) is unavailable due to an insufficient sample size and time constraint. This is why being able to make specific observations in a timely manner, and being able to correctly recognize patterns of disease is of such importance to today’s physicians practicing medicine.

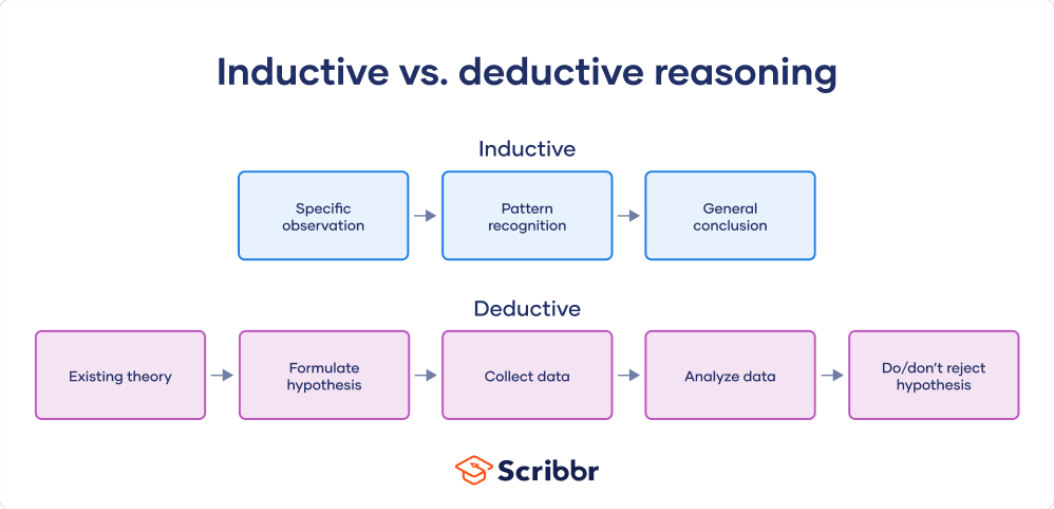

Figure 8: Inductive vs. Deductive Reasoning. Image Credit: Scribbr.

Another possible argument for the application of VTS in the clinic include efforts to root out personal biases, especially on those of race. Many visual techniques of observation taught to early physicians were developed to help make diagnoses on the faulty assumption that there were significant biological differences in race. For many years, people have thought of race as a biological factor that holds social consequences, but the more we learn how false the notion of biological race is, the more we realize that race is a false social structure that has numerous biological consequences because of medical malpractice.

For example, many doctors in the United States still use an updated version of a diagnostic tool developed by a physician during the slavery era, a diagnostic tool that argued for the biological justification of the practice of slavery. In the 1850's, Dr. Samuel Cartwright, a physician from the Deep South who graduated from the University of Pennsylvania Medical School before the Civil War, was considered an expert in a field known as "Negro Medicine". He promoted a racial perspective of disease which stated

that people experienced similar diseases on the basis of race, and experienced different diseases than people of other races. Cartwright also promoted a biological justification for slavery based on a perceived observation that he personally made. He believed that he observed that African Americans had a smaller lung capacity than whites, and that forced labor would be beneficial to their health because of the positive effects it had on blood circulation. In order to support this theory, he helped to perfect a medical device known as the spirometer, a device that measures lung capacity. He helped to create this device in order to show the presumed deficiency in lung capacity of blacks. Today, many doctors still uphold Cartwright's claim that black people have lower lung capacity than whites. This has also led to a faulty assumption in the manufacturing of modern medical devices that allow physicians to change settings on the device to allow for the 'correction of race' (Roberts).

As we can see, not only does VTS and the humanities have the potential to help doctors to make better visual diagnoses through improved techniques of visual critical analysis and reasoning, but it also has the potential to help them to identify the flaws in their own thinking as well as recognize their own personal biases. I believe that if VTS were made standard across medicine in America, it could help us to root out problems that lead to undesirable medical conditions in today's society.

According to some, the use of Visual Thinking Strategies could be interpreted as something that's not really discipline-specific, but rather something that's more of a general concept. However, after reviewing VTS for quite some time, I came to realize that many of the aims of VTS align very well with some of the aims that we seek to achieve in the humanities.

One of the related aims that we seek to achieve in the humanities is that of having multiple perspectives on any given topic. The humanities often allow us to have new perspectives that we've never had ourselves, and are able to introduce us to new forms of thought and inquiry. Many times, these new perspectives and avenues of thinking allow us to discover new solutions and insights that haven't been as accessible within our realm and scope of life experience. For example, someone who has been raised and educated in the United States their entire life might have difficulty in relating to others with experiences in other places that include different living conditions, economic states, social statuses, issues, customs, norms, ideologies, and beliefs, etc.. Through a study of the humanities, we are able to have a much greater understanding about those who have had very different life experiences compared to those of our own. From a medical point of view, this would be very useful for a physician when developing a successful patient-provider relationship. This also allows doctors to have increased empathy towards others, and be more aware of the different issues (both medical and non-medical) that can contribute to a patient's condition.

Another way in which multiple perspectives can be brought to light through the humanities is through encounters with ambiguity. As humanists ask questions such as "What else can I find?" "Am I missing anything here?" and finally, "What else haven't I noticed yet?", a host of new insights and viewpoints can be discovered. Since these questions align well with VTS, it could be argued that VTS can serve as a vehicle to help the humanities to achieve its goals including considering new insights, slowing down our processes of thinking instead of speeding them up (as mentioned earlier), and building increased empathy towards others with very different backgrounds.

Conclusion

Ever since VTS began to be taught in medical schools at the start of the 21st century, data has been recorded that shows that it does indeed have a positive effect on student's abilities to make visual diagnoses in the clinic, as well as increase their own awareness of how to think critically. VTS is able to pose the needed questions to allow people to justify their own logic from a Socratic pattern of thought, and help them to confidently arrive at correct solutions.

Even though there has been a dramatic increase in the number of physicians who utilize alternative means of making observations with visual diagnoses—for example, imaging machinery(MRIs, X-rays, CAT-scans, etc.), protein, enzyme, and antibody testing, and other computational methods of diagnosis— there has not however been an increase in quality of care delivered in the United States, (according to the World Health Organization). This discrepancy should rather be attributed to a lack of preparation in students', residents', and physicians' methods of observation and to how to properly encounter instances of ambiguity. Due to the research that has been performed on the topic, it seems that many believe that VTS has the ability to engage people through topics that help boost memory retention, increase personal affective experiences with exploring the artwork/ subject of analysis, as well as help participants to think more deeply and more critically about any provided subject matter. Although its origins are found in the world of visual art, its systematic style of applied reasoning can be applied to several disciplines.

Perhaps one of the greatest challenges we face in today's society is a lack of attention to the finer details in the world by which we are surrounded. This level of inattention has the ability to negatively affect the quality of not only our perception, but also the process by which we learn. In a world that has begun to equate an increase in speed with increased quality of life, VTS reminds us to take a moment to slow down and ask ourselves the necessary questions that are directly tied to a pattern of sensible logic. The patterns taught by VTS of asking and answering questions are essential to the proper development of intelligence, and the asking of reflective questions allows students as well as instructors to look for doors that haven't been open, and to look for paths that haven't been trod. The questions of “what's going on here?” “what do I see that makes me say that?” “what else can you notice?” can be applied to any discipline which we are learning and wish to expand our expertise in. According to the research that I’ve conducted, I believe that such a practice of VTS would be incredibly beneficial for many students, regardless of their primary discipline of study. Currently, I believe that there is still much work to be done in this field of study, and I believe that if research were to continue in this topic, it would ideally involve a long-term longitudinal study where physicians who have been trained to use VTS over several years self-report from year to year how influential they believe VTS to be in their practice, as well as if it helps them to arrive at correct solutions at a faster rate through observation.

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Appendices

Appendix A:

From: Formal Art Observation Training Improves Medical Students' Visual Diagnostic Skills **(Naghshineh)**

Color, light, shadows	Carefully observe and document characteristics related to color in up to five strangers, including such features as: skin, hair, iris, sclera, conjunctiva, evidence of jaundice/pallor/cyanosis/lesions
Contour	Please pick five advertisements, which use people to sell a product, from a magazine of your choice. While analyzing each image, first make a quick sketch of it in your journal. Go on to describe the role of color, contour, and shading in each picture, and how it affects the way you look at it. Please include how these elements influence your eye movement while observing the image
Form	Carefully observe three people, whom you see regularly, and document in your journal any new observations that you previously had not noticed. Please pay attention to form, including posture, shape, and body proportions, in your general assessment.
Texture and pattern	Carefully observe and document dermatologic findings in up to five strangers, including such features as: (1) skin color, and variations, (2) common skin lesions (patterns, colors, texture, size), and (3) uncommon skin lesions—blisters, vesicles, facial deformities, port-wine spots, angiomas (patterns, colors, texture, size)
Line and symmetry	Carefully observe and document characteristics related to line and symmetry in up to three people
Balance	Please complete the other half of the portrait