DRAWING IN HEALTH AND WELLBEING

Marks, Signs and Traces

EDITED BY PHILIPPA LYON AND CURIE SCOTT

BLOOMSBURY

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Chapter 7

Touch and drawing to enhance observation and spatial awareness in medical education and practice: the Haptico-Visual Observation and Drawing method

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Drawing and anatomy

The field of anatomy is a fantastically visual one. Drawing continues to perform a vital function in the field of anatomical study (Backhouse et al. 2017; Keenan et al. 2017; Reid et al. 2018; Shapiro et al. 2020, 2023; Laakkonen 2021) from drawings at medical schools found on chalkboards, whiteboards, paper flipcharts and electronic touchscreens, to anatomical drawings in printed and digital anatomy atlases. These are drawings that communicate visual information to us, but the *viewer* had no hand in their creation.

Yet the rich historical and contemporary practice of observation and drawing (called 'observational drawing') in the field of human anatomical study has another vital function; as an effective and valuable means of observation and learning about the physical anatomy (Lyon et al. 2013; Backhouse et al. 2017; Lyons 2017; Reid et al. 2018; Shapiro et al. 2020, 2023; Branson et al. 2021). Indeed, observing the anatomy and drawing it by hand with graphite on paper or with a stylus on an electronic touchscreen is highly effective in the practice of observation. In this chapter, a novel method of observation is presented which results in the enhanced observation of the three-dimensional (3D) form of anatomical parts and improved 3D spatial awareness (Shapiro et al. 2020, 2023; Branson et al. 2021). It is called the Haptico-Visual Observation and Drawing (HVOD) method.

This chapter uses a style of writing that integrates the theory and the practice underpinning the HVOD method. Therefore, the theoretical discourse is followed by descriptions and practical examples.

The Haptico-Visual Observation and Drawing (HVOD) method

The Haptico-Visual Observation and Drawing (HVOD) method (Reid et al. 2018; Shapiro et al. 2020; Branson et al. 2021) is a novel observation method that crucially employs the sense of touch (haptics) as well as sight, coupled with the simultaneous act of drawing. While drawing is integral to the HVOD method, the primary function of drawing is to facilitate *enhanced observation.* Enhanced observation and improved 3D spatial awareness are crucial for anatomy students in their learning about the anatomy and for clinicians and surgeons in their clinical practice (Mathewson 1999; Marks 2000; Miller 2000; Keehner et al. 2004; Hegarty et al. 2007; Keehner and Lowe 2010; Keenan and Powell 2020; Langlois et al. 2020). The benefits of observing using the HVOD method include:

- **i.** the deeper observation of the 3D form of objects, including anatomical parts (Ernst et al. 2007; Reid et al. 2018; Shapiro et al. 2020);
- **ii.** the cognitive memorization (Hutmacher and Kuhbandner 2018; Shapiro et al. 2020) of anatomical parts as a 3D mental picture (Reid et al. 2018);
- **iii.** improved 3D spatial awareness (Reid et al. 2018; Shapiro et al.2020; Branson et al. 2021); and
- **iv.** an ability to draw (Reid et al. 2018; Shapiro et al. 2020).

‘But I can’t draw!’

Even though most medical students and clinicians consider themselves to be ‘first time drawers’ and ‘unartistic’, the learning and practice of the HVOD method does not require any previous drawing experience and every medical student and clinician who has taken the HVOD method workshop has been able to draw effectively. The drawings that result from this observation method can be seen as by-products of the observation process, where the primary aim is deeper observation of the anatomy being studied by the observer (Reid et al.

2018; Courneya and Cox 2020a, 2020b; Shapiro et al. 2020). The aim is not to make ‘art’ or a conventionally ‘pretty drawing’, although many of the drawing results are aesthetically pleasing (Reid et al. 2018; Shapiro et al. 2020).

Why is the sense of touch an important sensory modality in the observation of objects?

In our daily practice of observing objects we rely primarily on our sense of sight, to the exclusion of touch. When employing the HVOD method, the sense of touch is specifically utilized as an important sensory modality for observation, as the afferent nerves from the hand and fingers take up a relatively large part of the somatosensory cortex of the brain (Figure 7.1). Furthermore, the sense of touch is included together with the sense of sight in the observation process, to increase the quantity as well as the different qualities of sensory data and afford the observer a more holistic understanding of the object. There are strong neural links between the haptic and visual modalities which are deeply intertwined at almost every level of object processing (Lacey and Sathian 2020). Both touch and sight share perceptual and neural representations and are employed in tandem in order to obtain information about object properties (Lacey and Sathian 2020; Sathian and Lacey 2022). Haptic shape is encoded in somatosensory cortical areas as well as a region of the visual cortex called the lateral occipital complex (Sathian and Lacey 2022).

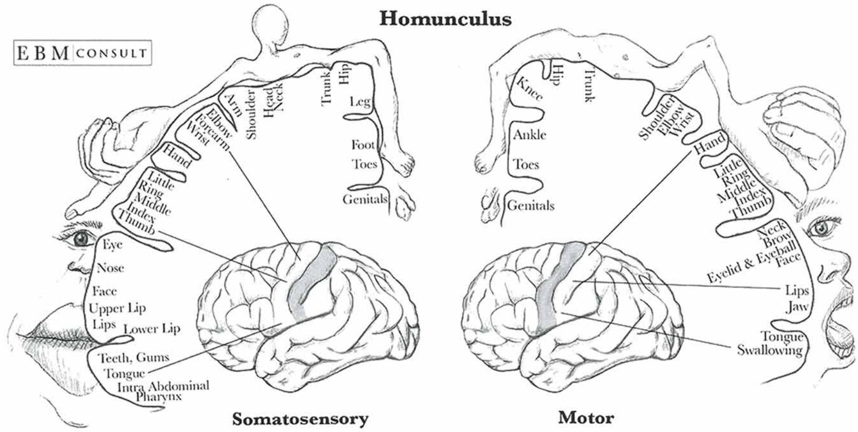


Figure 7.1 Homunculus: Sensory and Motor Cortex, n.d. Note the relatively large amount of afferent nerves from the hand and digits, represented in the sensory cortex of the brain. Source: Evidence-Based Medicine (EBM) Consult. n.d. https://www.ebmconsult.com/articles/homunculus-sensory-motor-cortex

How is observation using touch related to drawing in the HVOD Method?

Roberta Klatzky and Susan Lederman classified six Exploratory Procedures (EPs) (Figure 7.2) that we all perform with our hands daily, to extract object properties so that we can understand the object that we are handling (Klatzky et al. 1987; Lederman and Klatzky 1993; Klatzky and Lederman 2011). When practising the HVOD method we employ active touch; in other words, we actively and consciously apply the EPs when observing an object. In particular, we employ the EPs of ‘enclosure’ and ‘contour following’ (Figure 7.2) (Klatzky et al. 1987;

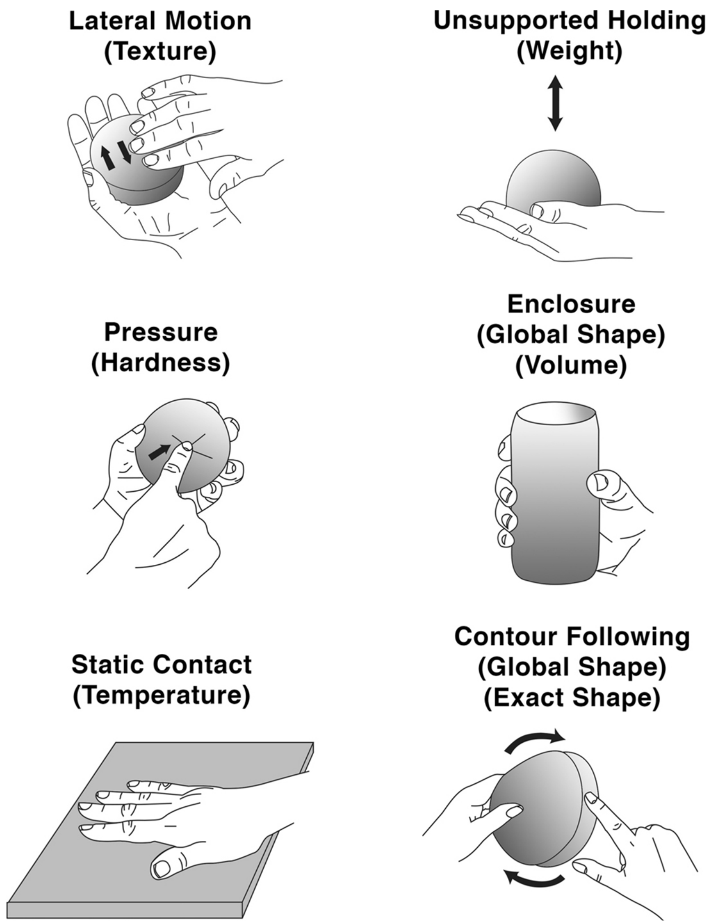


Figure 7.2 Exploratory procedures (EPs) and the associated properties that each EP is optimal at providing. Adapted from Lederman and Klatzky 1987, with the permission of the authors.

Lederman and Klatzky 1987). These two EPs are hand and finger gestures that are employed for the extraction of 'global shape' (also known as '3D form'). Unsurprisingly, the gestures performed when employing the EPs of enclosure and contour following closely reflect the gestures performed when employing the drawing approaches known as 'cross-contour drawing' and 'gesture drawing' (Nicolaïdes 1941). In other words, what we feel using gestures with our 'observing hand', we reflect as marks on paper using concomitant gestures with our 'drawing hand'.

The HVOD method workshop

Although HVOD may sound like a complex method, it is not. It is fundamental, direct observation with mark-making (drawing) as an integral part of the observation process. The HVOD method workshops are practical, dynamic and fun, with participant feedback encouraged. Shapiro teaches the HVOD method to medical students in group workshops online or in physical classroom settings. It takes only six hours to achieve competence in the HVOD method and this is completed over two consecutive days, three hours per day. When teaching online, if each student is in a different location, they will join the workshop via their laptop webcam and view the teacher on their laptop screen. If all the students are in one location (such as a classroom), they will join the workshop via a few strategically positioned webcams. In this scenario the teacher will be projected onto a single screen.

In an extended HVOD method workshop, different osteological material can be observed as well as prosections, wet specimens, dissected body donors and the living anatomy in the form of nude models. At the University of Cape Town, a mark-bearing, four-week elective Special Studies Module (SSM) is offered to third-year medical students from an array of various elective SSMs.

Workshop stationery and equipment

The following basic stationery and equipment are needed by each participant in an HVOD method course:

10 sheets of A4 80gsm paper
70 sheets of A3 80gsm paper (ordinary paper used for office laser printing)
1 x 8B cylindrical solid graphite stick or equivalent (it is important that this is cut in half so that it can be gripped between thumb, index finger and middle finger in order that both the broad side and end of the graphite stick is used to draw with)

1 HB pencil
a 250-gram ball-peen hammer
a humerus or more complex bone such as a vertebra or pelvis (either bone or plastic)
a box with dimensions that are larger than a human hand
a flat table to draw on.

Note that erasers are not to be used at all. All these materials are widely available globally from stationery and art shops or online. The drawings in this chapter that were made by the first-time drawers (Figure 7.4, Figure 7.5, Figure 7.8a) were completed in approximately fifteen minutes during the six-hour HVOD tuition period.

Three interconnected stages in the learning of the HVOD method

In our normal daily activities, we perform numerous repetitive and predictable upper-limb and hand movements: we do up our buttons, we tie our shoelaces, we stir the coffee, we turn door handles, and we turn keys in locks. However, when practising HVOD, we need to be able to make fluid, non-repetitive upper-limb and hand movements in order to produce marks on paper that concomitantly reflect the varied combination of EPs being performed as an object is haptically observed. As we have already noted, the EPs are in themselves hand and digit movements, or gestures.

The HVOD method is taught to workshop participants in three interconnected stages:

Stage 1. The preparation of the upper-limb and drawing hand to make fluid, non-repetitive movements needed to *reflect* the 3D form of what is being haptically and visually observed, onto paper using graphite (Figure 7.3a and Figure 7.3b). This is achieved during a thirty-minute guided exercise.

Stage 2. The haptic and visual observation of a 3D object, preferably a 250-gram ball-peen hammer. This hammer is used as it is light enough to be held and haptically explored using one hand, and it comprises a variety of geometric forms. This exercise is performed with the eyes open as well as closed.

Stage 3. The haptic and visual observation of the hammer using the EPs (active touch) and sight coupled with the simultaneous act of mark-making (drawing) (Figure 7.4). This is practised with input from the facilitator over a period of approximately two hours.

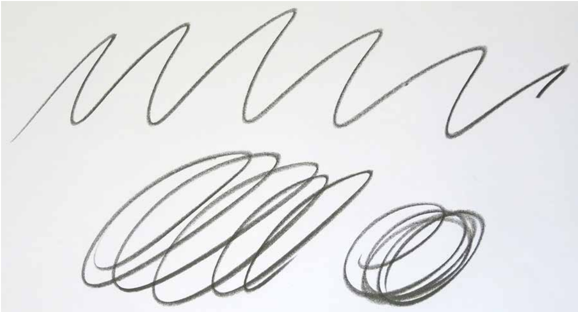


Figure 7.3a Examples of repetitive marks (3a) and fluid marks (3b) by the author, Leonard Shapiro.

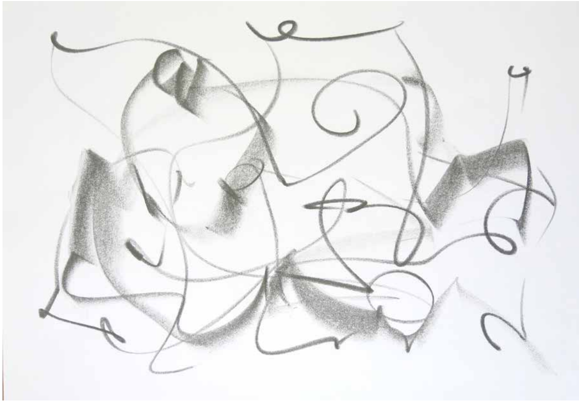


Figure 7.3b Examples of repetitive marks (3a) and fluid marks (3b) by the author, Leonard Shapiro.

Figure 7.4 Stage 3 of the HVOD learning process – the haptic and visual observation of an object together with drawing. Drawing by medical student Graham Taschner during a HVOD workshop led by Leonard Shapiro at the University of Cape Town.

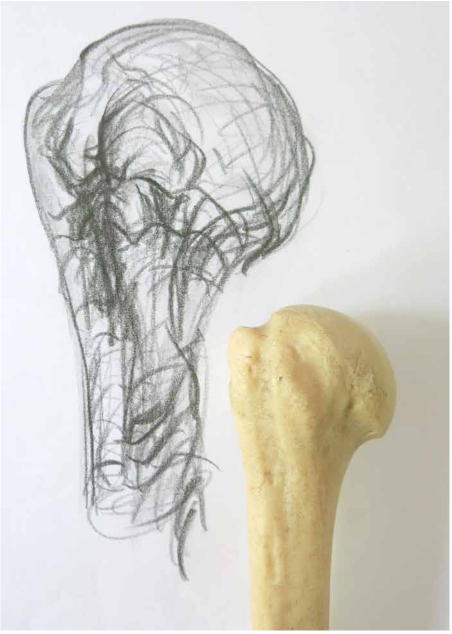


Figure 7.5 After observing and drawing the hammer, HVOD medical students proceed to observe and draw bones. Drawing of the head and neck of a humerus by Graham Taschner. Although Graham observed a bone humerus, the humerus pictured here is plastic.

On the second day of the workshop, a humerus (or a complex bone such as a vertebra or pelvis) is observed using this method (Figure 7.5). Following this, an exercise which includes the observation and drawing of the inside empty space of a box is performed to improve 3D spatial awareness. This may be followed by the observation and drawing of the interior space within a skull that has the calvaria sawn through the transverse plane to reveal the interior space.

What do student practitioners of HVOD have to say?

After a group of medical students learned how to apply the HVOD method, a research study was conducted and their comments recorded in interviews (Reid et al. 2018). Ethical approval was granted by the University of Cape Town (UCT) Human Research Ethics Committee (ref 582/2015) and permission to conduct research on students was obtained from the UCT Department of Student Affairs. The students' comments attest to the importance of developing and deploying their sense of touch, highlighting how the HVOD method enables them to understand texture and three-dimensionality and memorize objects more accurately:

> … not just observing necessarily with your eyes but observing with your hands and you, you get to feel like the texture and the curvature of the hammer. So then when you draw it you can get that across in your drawing and then when you remember it later on … you don't remember the drawing necessarily, you remember the actual object. [Participant C]
>
> … actually focusing your attention on something and feeling it with your eyes open and closed and kind of just a lot more intimately … I was able to kind of see a lot more of it. Also the abnormalities with it. [Participant B]
>
> … this style of drawing, it got through to me differently … I got more of an accurate sense of everything that encompasses the object. [Participant B]
>
> … I know the texture, I know the various characteristics that distinguish my hammer from everyone else's hammer … [Participant A]
>
> Whereas if you close your eyes and you're thinking about the object you really are creating that, that 3D perception in your mind. So it's all great having it on paper but the point is to mentally be able to see … what's retained in your mind. [Participant C]
>
> … So this way you kind of get more of a 3D sense of what you're studying but at the same time it increases your memory of the object whereas before it would be more about association. Here you are kind of taking it from the primary point being the object. [Participant E]
>
> … as opposed to just opening a book and looking at the pictures and learning the labels it's better to interact with the object; not just looking at it, but touching it and drawing it as you touch it. So then once you've had a good understanding of what … the humerus looks like, the different grooves and the indentations for the attachment of muscles and everything … when you see an abnormality in another bone it is a lot easier to identify. You can more intuitively tell that this is different as opposed to someone having to point it out to you or having to study it for a long period of time to tell that this is abnormal. [Participant D]

These student participants affirmed how the interactive nature of HVOD gave them a sense of deeper engagement with the objects they drew.

Combining drawing approaches for observation and understanding of three-dimensional anatomy

The teaching of the HVOD method is essentially a practical one, and although learners and practitioners of HVOD do not need to know the neuroscience and the drawing and semiotic theories which underpin it to practise HVOD successfully, they are presented here as a theoretical explanation for the reader.

Because this method of observation is practised using the sense of touch, a specific combination of two drawing approaches (colloquially called 'drawing styles') is proposed to aid the deeper observation of 3D form through the rendering of marks that reflect and describe 3D form. These drawing approaches are called 'cross-contour drawing' and 'gesture drawing' (Nicolaïdes 1941). The upper-limb and hand exercises in Stage 1 (Figure 7.3b) facilitate the production of movements that result in the ability of the observer-drawer to generate cross contour and gesture drawing marks on paper. In HVOD we employ the EPs of 'enclosure' and 'contour following' to extract the properties related to the 3D form of an object. These two EP movements are closely related to the movements made when practising cross-contour drawing (Figure 7.6a) and gesture drawing (Figure 7.6b). Gesture drawing is employed in combination with cross-contour drawing (Figure 7.6c), as the haptic exploration of the object by the observing hand is not linear and regular but non-linear and haphazard. As such, gesture drawing closely follows the non-linear, gestural nature of the movements (EPs) of the observing hand as it haphazardly traces many contour paths over the object. The combination of cross-contour and gesture drawing marks (Figure 7.6c) made by the drawing hand closely reflect the non-linear and haphazard exploratory hand movements (EPs) of enclosure and contour following.

Writing and drawing as signs

All human markings are descendants of primordial drawings in dirt (Dowd 2018). Drawing (the making of marks) preceded writing (Senner 1989; Texier et al. 2013; Henshilwood et al. 2018) and are closely related (Cohn 2012). Marks have a semiotic value to denote meaning (Cohn 2012) as do letters, words, sentences (Saussure 1966; Sanders 2004). Anatomically modern Homo sapiens appeared approximately 200,000 years ago (Mounier and Mirazón Lahr 2019). Evidence of the earliest human-made drawing dates back to approximately 73,000 years (Texier et al. 2013; Henshilwood et al. 2018). Writing appeared as late as

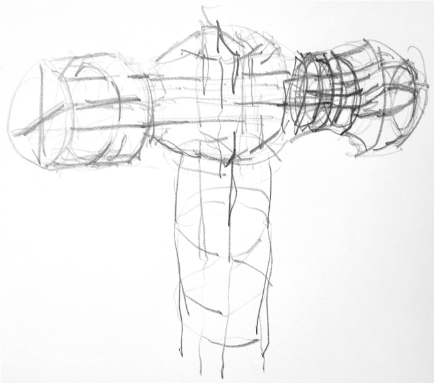


Figure 7.6a 'Cross-contour drawing', 'gesture drawing' and a combination of the two approaches which is best suited for HVOD. Drawings by the author, Leonard Shapiro.

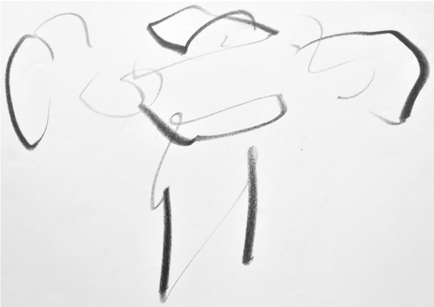


Figure 7.6b 'Cross-contour drawing', 'gesture drawing' and a combination of the two approaches which is best suited for HVOD. Drawings by the author, Leonard Shapiro.

Figure 7.6c 'Cross-contour drawing', 'gesture drawing' and a combination of the two approaches which is best suited for HVOD. Drawings by the author, Leonard Shapiro.

approximately 5,400 years ago (Senner 1989). The making of marks as a visual language containing semiotic or 'descriptive value' for communication was (and still is) far more fundamental than the formation of letters, words and sentences out of marks to convey complex meanings.

The letter 'A' may be constructed out of lines to form a 'sign' in a great variety of ways and will still retain its 'signification' and be understood by the viewer/reader as the letter 'A' (Figure 7.7). We each have our own writing 'signature'; our own 'style' of forming letters of the alphabet. Notwithstanding that ten people will write the letter 'A' slightly differently, all ten people will understand that what has been formed in marks by each other person, is the letter 'A'. However, when the combination of three lines used to construct the 'sign' 'A' are assembled such that they do not meet the criteria in their construction to signify 'A' to the viewer/reader, then the sign fails; it 'falls apart' and loses its meaning as a signifier (Figure 7.7). What appears before the viewer can no longer be understood.

Saussure defined language as a 'sign system', where signs 'signified'; they carried a signifying meaning (Saussure 1966; Sanders 2004). The formation by hand of the letter A is achieved by the specific configuration of three marks (Figure 7.7). This formation creates a 'sign' which attributes and signifies meaning to this combination of marks. These three single marks are configured into a specific form (a sign) that signifies the letter A. When we learn to read and write (in this case the Latin alphabet) we are taught what this sign means (what it signifies), how to form (write) it, how to pronounce it and how to use it in combination with other letters (signs) to form words and sentences which carry meanings.

The English 'drawing' takes its form from the action of pulling, which is characteristic of so much drawing activity, but a similar etymological link can be seen in the words sign and design (Ashwin 1984). Observational drawing (and in particular the combination of cross-contour and gesture drawing) makes use of a series of marks (signs) to re-present objective reality. As in the formation of letters of the alphabet from marks, a series of marks are assembled in specific

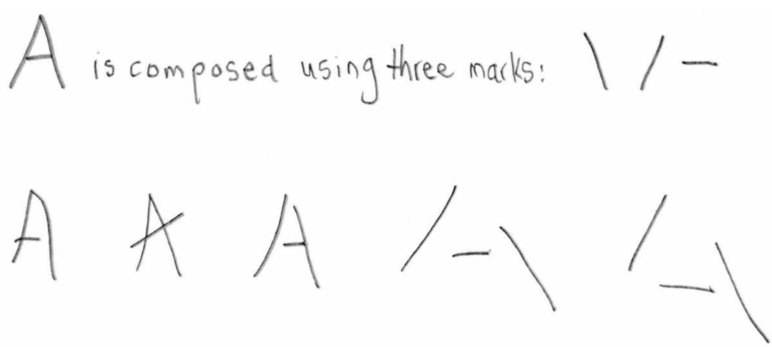


Figure 7.7 Marks, writing and letters by the author, Leonard Shapiro.

configurations to denote the 3D form of an object and so describe the object to the viewer by means of these marks. The extent to which the configuration of marks (the signs) reflects the 3D form of the object (and becomes a signifier of the 3D form of the object for the viewer) is the extent to which the configuration of marks can be said to have a *c*ohesive descriptive value (cohesive semiotic value) which is close enough to reflect the descriptive value of the 3D form of the object that it describes, and can consequently be successfully read (interpreted) by the viewer.

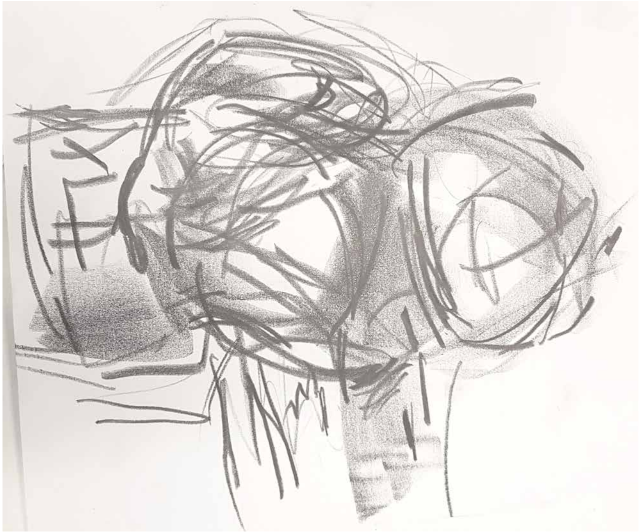
In a similar way that the three lines (marks) are configured closely enough within the parameters such that they sign/denote the letter A (and that what is signified by the formation of these three lines does not exceed these parameters and become impossible to be read), the combination of marks in a drawing that act as signs that signify the various aspects of an object will either succeed or fail. They will succeed if their signing (the marks) closely enough re-present the form of the object that is being observed. In an iterative feedback loop, the marks that are made reinforces for the observer-drawer what has been observed more accurately and less accurately, thereby directing the HVOD practitioner to re-explore those parts of the object that were less accurately observed.

Marks made using HVOD have descriptive value

With the HVOD method, we employ touch via the EPs to observe and understand 3D form, and we simultaneously employ marks on paper that follow and reflect the hand gestures made by our EPs. The marks that result from our gestural exploration of an object's shape contain a descriptive value singularly and in combination (Figures 7.8a and 7.8b), which provides a visual description of the 3D form or global shape of the object.

In a similar way that marks are used to form the letter A to denote its sign and signification (its semiotic value), a drawing of a hammer is constructed from a series of marks which create a sign with the signification viz. hammer. In constructing this 'sign' using graphite, each mark follows from and reflects haptic and visual observation, denoting the trajectory that the hand (and eye) took in observing the hammer.

In the process of observing and drawing the object, the observer-drawer constantly (and at speed) shifts their haptic and visual observation from the object to the paper as they compare what they have just observed with the marks that they have just put onto the paper: a close observation and drawing dialogue is taking place. When there is a mismatch (non-correlation) between what is observed and what is marked down on paper, the observer-drawer



Figures 7.8a Drawing of hammer by Dr Willem Strydom.

Figure 7.8b Portrait by Leonard Shapiro.

returns to observing that part of the object that they detected to be less well-observed and re-observe and re-draw that part of the object, such that there is a 'close enough' correlation between what is observed and what is rendered in marks, and the marks begin to read as a convincing semiotic description of the object (Brew n.d.). This iterative technique of observing and drawing is applied from the beginning until the end of the observation process.

Erasers are not to be used at all. The use of an eraser would be counterproductive to the iterative nature of the observation process. As already discussed, the descriptive value of the marks made during the observation process inform the observer-drawer of the need to revisit and re-observe the object. While doing this, the observer-drawer refines the descriptive value of the marks made by drawing over specific lines and areas of the drawing, such that the new marks better reflect and describe the object. This process is akin to an author refining a handwritten piece of writing through editing, where words are scratched out and other words are selected and inserted to reflect the author's thoughts more precisely. While the result on the page may look 'messy', the writing will still be able to be read and understood by the author. In effect, the author has clarified her thoughts through a process of thinking and writing and reworks her writing until what appears on the page is an accurate reflection of her thoughts. A piece of writing is a visible reflection of an author's thoughts, and similarly, a drawing is a visible reflection of an object that has been observed.

HVOD-based exercises designed to address 3D spatial awareness challenges in clinical practice

Based on the principles underpinning the HVOD method, exercises have been designed that address specific challenges in medical education and clinical practice. Improved 3D spatial awareness leads to improved 3D spatial skills, such as improved laparoscopic instrument use, improved radiation oncology planning, improved surgical planning and performance (Branson et al. 2021), and improved observation and diagnosis of patients through palpation.

In laparoscopic instrument use, the cognitive embodiment and understanding of the length of the instrument through a guided exercise involving active haptic and visual exploration, greatly improves both the surgeon's accurate navigation through space and engagement with tissue using the instrument's terminal end.

It is important for medical students and clinicians to understand the 3D volume of the body cavities and the relationship of anatomical parts within these cavities. A 'Box Exercise' is specifically designed to improve 3D spatial awareness; the exercise imparts an embodied, cognitive understanding of what 3D space is. In this exercise, the inside empty space (volume) within a cardboard

Figure 7.9 3D space inside a shoe-size box. Drawing by Leonard Shapiro.

box (Figure 7.9) is haptically explored. As one hand is moved within the box, the other hand simultaneously traces its trajectory on paper with a piece of graphite. By doing this, 3D space was expressed and mapped as a 2D image and the awareness of the location of a mark on paper represented the location within the volume of the box. The result is that 3D space is understood cognitively, rather than only as a mathematical set of linear x, y and z coordinates.

This exercise was initially designed for radiation oncology planners who needed to improve their cognitive understanding of 3D space, also called 3D spatial awareness. Improved 3D spatial awareness is an important cognitive function which leads to improved spatial skills (Branson et al. 2021), such as selecting specific x, y and z coordinates which correlate with tumours. In the case of brain tumours, it is especially important that healthy tissue is not destroyed by radiation, while diseased tissue is. Radiation oncology planners typically study a series of 2D computerized tomography (CT) image slices on a 2D screen and need to extrapolate the position of these slices within the 3D volume of the anatomical part from which these image slices are derived. The Box Exercise is also useful for understanding any of the body cavities, such as the chambers and large vessels of the heart. In order to achieve this understanding, the empty spaces of a dissected wet specimen of the heart is observed and drawn using the HVOD method.

Evoking humanistic values

Medical humanities is recognized for the important role that it plays in medical education, patient care and clinical practice (Cole 2015). In this regard, the generation of a dialogue around humanistic values is important in helping to prepare medical students to integrate these values into their engagements with their patients during clinical practice. To this end a two-part, teacher-supervised session is described. It is carried out over two consecutive days and is designed to facilitate conversation, thinking and insight amongst students around values such as empathy, compassion, health, wellbeing and existential concepts such as life, death, what it means to be human, the transitory nature of existence and the awe and wonder of existence and an appreciation for the brilliance of the engineering of the human body. This two-part session is an entirely optional adjunct which may follow the two-day HVOD workshop. It is recommended that students who participate in these sessions have already engaged in the dissection of body donors. In addition, students need to choose whether they want to attend or not, and then elect to attend either or both sessions.

The exercise begins in the dissection room with the observation and drawing of a body donor over a two-hour period. Up to fifteen students stand or sit in a circle around the body donor with clipboards and A4 or A3 paper. The students observe and draw while doing so. Each student will choose to what extent they wish to engage haptically with the body donor, and some may not wish to engage haptically at all. At some point, they are encouraged to walk around the body donor and draw from multiple positions to comprehend the body from different perspectives, as well as to better understand its 3D nature. Note that the face of the body donor is not drawn, nor are any other identifying features, such as tattoos or scars. This is to protect the identity of the body donor. Of course, photographing within dissection rooms at universities is strictly prohibited. Note that the above are guidelines and naturally the teacher may suggest additional helpful exercises. The students may also suggest helpful exercises.

The following day, again over a two-hour period, the students and teacher meet in a venue at their university in which there are no body donors. Here, they observe and draw a living, nude human model. The format is very similar to that of a typical life drawing art class. Note that although this is an adjunct to a HVOD workshop, the students do not touch the living model. At the beginning of this session, the living model stands and turns very slowly through 360 degrees while the students observe and draw her or him continuously as they turn.

The model then stands alongside a bone (not plastic) teaching skeleton. One reason for this is so that the students can see all the types of bones that lie beneath the soft tissue of the living model: there is visible 3D information about what lies beneath the soft tissue of the model. This information is useful to them as they notice the protuberance of the model's bony structures. Another reason for the positioning of a skeleton alongside of a living human is a conceptual one. It is to suggest to each student that this bony structure is within the living model and in each of them. As obvious as this is on an intellectual level, it is often not fully grasped as an existential reality and students are often surprised once they realize this. To encourage this realization, and with the live model still standing next to the skeleton, the students are invited to draw the skeleton only. Following this, they are invited to draw the living model only. They are then encouraged to draw both the skeleton and living model together. The teacher may contribute to this realization by, for example, asking the students to notice the model's bony protuberances showing beneath their skin and inviting them to correlate these with the bones of the skeleton.

During both days, conversations around the above-mentioned values and existential concepts continue at various junctures. It is interesting (but not altogether surprising) that these activities in themselves stimulate these understandings in the observer-drawers, in addition to prompting spontaneous student discussion without the need for prompting by the teacher.

Conclusion

The HVOD method employs a combination of touch and drawing, primarily as an aid to the closer observation of anatomical parts and improved 3D spatial awareness, both of which have important implications for anatomy study and clinical practice. Decades of published research into haptics by Klatzky and Lederman (Klatzky et al. 1987; Lederman and Klatzky 1987) supports its use in the observation of 3D form. Employing the hand to observe couples a complementary set of information about the 3D form of the object with the sense of sight. The exploratory procedures (EPs) of contour following and enclosure (Klatzky and Lederman 1987) closely approximate the drawing approaches of cross-contour drawing (Nicolaïdes 1941) and gesture drawing. Employed in combination, the EP gestures and corresponding gesture drawing and cross-contour drawing gestures support closer observation. In addition, during the observation and drawing process, the reading of the descriptive value of the marks made serves as a visible indication to the observer-drawer which aspects of the object need to be revisited for further observation and drawing. Based on the HVOD method a number of tailored exercises have been developed to address and improve observation and spatial challenges in specific areas of anatomy study and clinical practice.

An online course entitled 'Exploring 3D Anatomy', which includes numerous video-recorded exercises, was designed in response to a need by both medical students and clinicians to improve their 3D spatial awareness. This course was created between 2020 and 2022, by lead educators Shapiro and Professor Iain Keenan who is a Professor of Anatomical Education at Newcastle University School of Medicine in the UK. Keenan and Shapiro demonstrate the exercises which are easy to follow and practice. Exploring 3D Anatomy also includes a video in which Shapiro demonstrates the steps to be followed and practised in order to learn the HVOD method. This online course is a collaboration between

Figure 7.10 Exploring 3D Anatomy online course QR code.

the University of Cape Town and Newcastle University. The course is free and aimed at medical students and clinicians globally. Exploring 3D Anatomy can be accessed via the QR code (Figure 7.10). Shapiro and Keenan have an ongoing and fruitful collaboration in art-based methods in anatomy education.

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