AN EXPLORATION OF TACTILE INTERACTION IN OSTEOLOGY AND MATERIAL CULTURE

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ABSTRACT

This paper explores the use of touch in osteology. Though this field is heavily reliant on sight, touching and handling bones provides another aspect of learning and research that complements visual inspection. I show how handling skeletal elements is central to osteological analysis by examining tactility's prevalence in osteological practices, vocabulary and descriptions. I also review how touch as a method of learning has been employed in museum contexts and in biology classes for the blind.

The senses of sight, taste, sound, touch and smell are biological adaptations that provide an individual with necessary data about their surroundings and are also used as a means of learning. Each of the senses gives a better understanding of what is being experienced or examined. For example, when presented with a lit candle, one can see that the candle is burning but can also feel the heat from the flame. By engaging each of the senses, one's potential to learn and understand is multiplied. The senses each receive and correlate information about the external world, and are combined to produce a multisensory experience (Spence 2007:45). This is what makes the senses particularly useful in research that involves

material objects, including osteology, the study of bones. Though this field is heavily reliant on sight, the application of touch provides another avenue for data collection that expands on visual cues.

Touch enhances the impression a person has of the nature of an object, mostly through confirming what cannot be determined by sight alone (Classen 2005:277). Many things including weight, texture and temperature cannot be determined purely by sight or sound. For example when a person lifts an object, thinking it to be heavy, and finds that it is in actuality very light. Touch also gives a person an intimate experience between themselves and the object. For instance, in order for sight to be most effective, a person must put a certain amount of distance between themselves and whatever they are looking at. This results in a detachment between the person and the object; each is its own entity, separate from each other by negative space. However, touch removes this barrier and gives the person a physical connection with the object (Classen 2005:277). There is also a sense of pleasure that touching an object can give. John Hull, a blind professor of religious studies at the University of Birmingham, expressed the satisfaction he receives from handling and interacting with various objects when he stated, "I am developing the art of gazing with my hands. I like to hold and rehold and go on holding a beautiful object, absorbing every aspect of it" (2005:326). For Hull, touching an object is not merely the act of holding something, but it is a process of appreciation, much like when a sighted person spends time gazing at a portrait. This is especially the case for man-made objects, as handling and touching them brings the person closer to not only the object but also what that object represents (Classen 2005:277). In a museum context, this yearning to touch and handle artefacts gives satisfaction through the intimacy that touch creates. For instance, by donning the helmet of a

Roman centurion or holding the sword of a knight, one creates a personal connection not only to the object but also to the person or historical era that it is associated with. By trying on a centurion's helmet, one can appreciate its weight, the feel of it around the head and perhaps even imagine how the original owner would have experienced this object in battle.

TOUCH IN THE MUSEUM: HANDS OFF LEARNING?

At the Enlightenment Gallery in the British Museum, a table is set up every day with different objects that the public is encouraged to handle and examine. The objects include small pieces that vary in their geographic and temporal origins, such as a fragment of Egyptian mummy cloth and a shark's tooth necklace from the Pacific (Candlin 2008:278). Though it is expected that the objects presented are either replicas or small pieces of no real historical significance, visitors find a sort of novelty in being allowed to touch an object within a museum.

For many, the thought of being able to pass one's hand along the face of a painting or feel the fabric of an ancient headdress is taboo as museums are purely a visual experience and the use of touch is prohibited. If an interactive exhibit is offered, it is assumed to be intended for children, as if touch has no relevance to material culture once maturity has been reached (Candlin 2008:279). The practice of inviting museum visitors to touch the artefacts within the collection might appear as if a taboo is being broken, but this was not always the case. In the 17th and 18th centuries touching and handling museum artefacts was socially acceptable (Classen 2005:275). Early museums grew from the private collections of individuals and being able to see the objects within the collection was done only through invitation. Social protocol called for the host to act as curator and

give a guided tour of the collection to their guests, offering up the objects for handling and interaction (Classen 2005:275). The guests on their part were expected to ask questions and handle the objects that were offered to them; "to be invited to peruse a collection of exotic artefacts and *objets d'art* and *not* touch anything would be like being invited to someone's home for dinner and not touching the food" (Classen 2005:275). Furthermore, social protocol established that the reverence of the host would be given to the guests and not the objects within the collection; not allowing the guests to touch the pieces could lead to accusations of incivility (Classen 2005:275-276).

As these collections grew larger and more public, the touching of museum pieces was slowly phased out beginning in the 19th century, partially due to the status the objects were given. Artworks began to be recognized as masterpieces while artefacts from far off lands were becoming irreplaceable treasures; these objects slowly became regarded as sacrosanct (Classen 2005:282). As more people began to visit museums, curators feared that constant handling of the pieces would lead to theft or damage. This was especially the concern for pieces that were centuries old and slowly deteriorating; these precious objects had to be preserved at all costs (Classen 2005:282). The other factor that hastened touch's banishment from museums was the visitors that came to see the collection. When museums were still relatively small and privately owned, the collector would ensure that only those they personally deemed "worthy," namely those not of the uncultured, working class, could handle pieces from the collection. But as the museums became open to a larger public, the quality of the visitors became more varied and curators soon found it difficult to ensure only those deemed acceptable would touch the artefacts on display (Classen 2005:281). Soon after,

museum visitors had to become conditioned to the taboo of touching museum pieces. This was accomplished by establishing that the object was more important than the person viewing it, and touching was thus disrespectful, damaging and dirty. Above all the museums instilled a belief that touch had no value in experiencing or learning (Classen 2005:282). Along with propagating these beliefs the museums employed other techniques to discourage touch that are still seen today, including housing their pieces in display cases and using railings to prevent people from getting to close.

In recent decades there has been a shift from museums being centers for scholarly research and depositories for the world's treasures to more informal resources for learning and social inclusion. Since funding for national museums is correlated with audience statistics including the working class and those from low income, museums can simply not afford to alienate prospective guests (Candlin 2007:89-90). In response, museum displays, including sensory and interactive exhibits are created to be appealing to diverse age groups and non-traditional museum visitors (Candlin 2007:90). For instance, the Nottingham Loans collection offers loan boxes and handling collections for school and community groups with the aim of allowing students to interact with objects linked to the theme of their studies (Trewinnard-Boyle and Tabassi 2007:192).

RESEARCH AND TEACHING AMONG THE BLIND

Helen Keller, the blind and deaf American author and political activist, had once said, "touch brings the blind many sweet certainties which our more fortunate fellows miss, because their sense of touch is uncultivated [...]. No doubt that is one reason why their knowledge is often so vague, inaccurate and useless" (1909:42). Keller's musing illustrates how the blind experience touch and how

they apply it to gathering information and learning. The blind must rely on other senses to accompany their education and their sense of touch must therefore be cultivated and honed to a greater extent than that of the sighted. In this way, better distinctions can be made in regard to differentiating objects as well as recognizing variety in weight, texture and shape.

When tactile sensation replaces visual information, modifications and adaptations are an essential for those in academia. For instance, many books can be made available in braille and there are technologies that allow the blind to effectively use computers. However osteology and paleopathology, the study of ancient diseases, are highly visual disciplines reliant on observation for research and data generation. Since the natural environment is visually perceived in terms of its descriptions and explanations, some teachers assume that the physical aspects of biology are practically impossible to teach to blind students and this attitude has persisted over time (Davis and Redden 1978:177; Supalo 2010:1). However, according to Tombaugh and Tombaugh's (1984) manual for teaching biology to the blind, there are a number of tactile techniques that can be employed. For instance anatomy is best studied through the use of models and raised line drawings (Tombaugh and Tombaugh 1984:8). In regards to osteology, bone structure can be made clear by allowing the student to handle the bone and experience the different shapes, while being given verbal instruction. Bony features such as anatomical landmarks could be learned by guiding the student's hands; other features that cannot be easily felt such as small foramina or holes within the bone can be distinguished by inserting a small piece of wire or pipe cleaner that has a label printed in braille (Tombaugh and Tombaugh 1984:8). Interestingly, Tombaugh and Tombaugh observed that details of bone structure are more evident

to students with good tactile ability (1984:8). Tombaugh also noted that during animal dissections, blind students were able to locate and identify small organs through the use of touch much more easily than the sighted students who relied on finding the organs visually (1972:259). It is very likely that this could be the same for learning bone morphology; touch can be used to not only identify individual bones but also the anatomical features.

USING TOUCH IN OSTEOLOGY

Osteology seeks to learn about the lives of ancient and modern people by examining their physical remains (Sofaer 2012:137). This study reconstructs the life and identity of an individual based on evidence presented in their skeleton and explores a variety of areas of human life, including sex, age, variation, disease, injury, diet, migration, activity patterns, and biological distance between kin groups. This discipline gains its importance from not only its applications in modern forensic contexts, but also in its ability to give a semblance of identity to the unnamed, unknown dead (Sofaer 2012:137). Like other biological sciences, osteology is heavily a visually oriented, descriptive form of study and as such, osteologists may employ the metaphor of needing to be able to 'read the body,' further enforcing the use of visual observation (Sofaer 2012:139). However, despite the emphasis on what is seen by the researcher, much of the work of an osteologist is done with the hands and the sense of touch. Through the use of touch, osteologists produce data by using their tactile abilities to probe and manipulate the bones in a way that would be impossible to accomplish solely through visual methods (Sofaer 2012:140). In its simplest form, employing touch as an osteological method includes rotating the bone to see its various angles and spatial dimensions, as

well as feeling the surface texture of the bone. Though it may sound simplistic, this method gives insight to the osteologist regarding the bone's present condition and clues as to how further analysis should proceed. Yet despite its importance, touch is often relegated as secondary to what is visually seen. For instance, in academic journals, osteologists will frequently describe what was seen on the bones but rarely refer to what was felt (Sofaer 2012:140). Despite this, the use of touch is reflected in the language used to describe what is seen in osteological contexts. Terms such as smooth, rough, granular, porous, sharp, and dull appear frequently in osteological literature to describe skeletal features and pathologies. Such an instruction can be seen in *Standards for Data Collection from Human Skeletal Remains* when looking at the mandible and assessing the pronunciation of the mental eminence: "hold the mandible between the thumbs and index fingers with thumbs on either side of the mental eminence. Move the thumbs medially until they delimit the lateral borders of the mental eminence" (Buikstra and Ubelaker 1994:20). Furthermore, osteology handbooks give instruction on how to properly physically handle bones so as to prevent damaging them. For instance, White and Folkens advise that a skull should be held with both hands and that one should never use the thumb and fingers to grip it by the eye orbits or the zygomatic arches (2005:75). In osteology classes, students are encouraged to not only feel the bones but interact with them as well, learning about their relative size, shape, volume, weight, curvature, depth and other spatial features (Sofaer 2012:141). Students are also encouraged to feel their own bones to help understand how they articulate as well as feeling distinguishable characteristics such as the occipital protuberance of the male skull (Sofaer 2012:143). However, despite the prevalence of touch in osteological practices, vocabulary and

descriptions, there are no specific lectures or tutorials given to students that offer sound instruction on *how* to touch bones or how to *interpret* what is felt. For the most part, this method is largely intuitive and developed individually over the course of years of experience from touching and handling different skeletal elements (Sofaer 2012:141).

When beginning analysis, the osteologist will first arrange the bones in their anatomical position on a table and then pick them up individually for examination and identification. This initial stage allows the researcher to see the bone from various angles as well as gain an impression of the bone's weight and surfaces (Sofaer 2012:140). The next step is to establish the biological profile of the individual by ascertaining the sex, age and ancestry of the skeleton. In the human skeleton sex is best determined by examining the pelvis, as the pelvic girdle is morphologically adapted for child birth in females. To accommodate birthing, the female pelvis is typically wider than the male pelvis, but this generalization is only visually observable when the pelvis is compared to another of known sex (White and Folkens 2005:392). Variation among humans also hampers visual observation. To compensate for this, various techniques using touch are employed. One such method includes examination of the greater sciatic notch, which is generally wider in females and narrower in males. To examine this, some osteologists will hold the os coxae against a diagram or simply place their thumb in the notch itself (Figure 1); if their thumb fits snugly then the bone is more characteristic of a male.

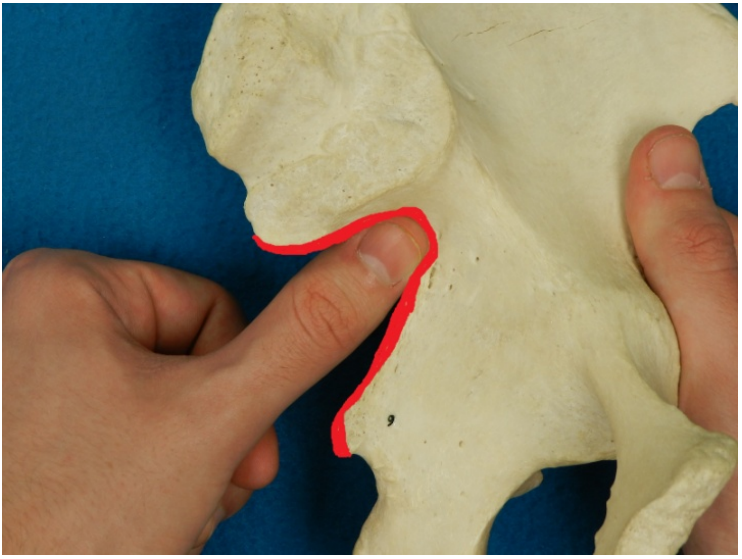

Figure 1. Judging the greater sciatic notch (highlighted in red) with the thumb (Siek 2013a)

Another technique for sex estimation is to recreate the sub-pubic angle of the pelvis. To do this, the osteologist will hold the os coxae and manipulate them so that they articulate as they would in life (Sofaer 2012:140). Doing this recreates the characteristic sub-pubic angle, which is generally wider in females than it is in males, however it can only be accomplished by physically manipulating the individual bones (Figure 2).

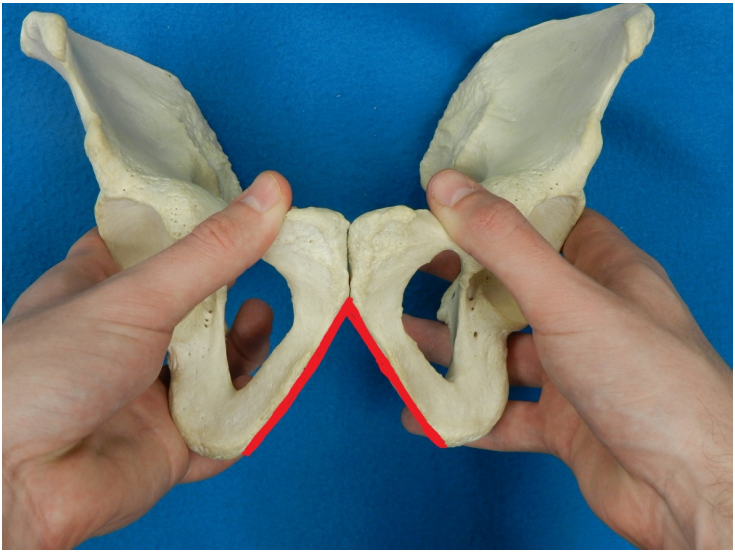

Figure 2. Manipulating the os coxae to recreate the sub-pubic angle (highlighted in red) (Siek 2013b).

The main method for sex estimation with the pelvis that employs the use of touch was developed by Phenice (1969). This method looks at three traits on the pubic bone: the ventral arc, the sub- pubic concavity and the medial aspect of the ischiopubic ramus. The ventral arc is a ridge of bone that is more pronounced in females and when being examined, some osteologists will run their finger over this trait, following its progress along the bone. With the sub-pubic concavity, some osteologists will line up their index finger with the edge of the pubis and see whether a concavity or gap is formed between the bone and their finger; if a concavity is formed then that is another indication that the pelvis possibly belongs to a female (Phenice 1969:300). The last trait, the medial aspect of the ischiopubic ramus, is characterized by a narrow crest of bone and is verified by pinching the trait between the thumb and index finger.

By applying these tactile techniques to the Phenice (1969) method the osteologist is assisted by their sense of touch in confirming the visual appearance of the traits and in determining whether they are significantly pronounced enough to determine the skeleton's biological sex.

The Phenice (1969) method uses language that instructs the eyes as well as the hands (Sofaer 2012:140). For instance, the ventral arc is described in osteological textbooks as being a "ridge of bone which sweeps down the surface of the pubic bone to merge with the border of the inferior pubic ramus" (Mays 2010:40). Likewise, Buikstra and Ubelaker's osteological standards manual states that the medial aspect of the ischiopubic ramus is "broad and flat in males" (1994:17). Both of these descriptions give not only a visual clue as to how to identify these traits but also a contextual reference to shape and dimension that can be confirmed by touch. Apart from the pelvis, the skull is also used in sex determination and tangibly descriptive language is used, such as, "feel the surface of the occipital with your hand and note any surface rugosity, ignoring the contour of the underlying bone" (Buikstra and Ubelaker 1994:19). In this way touch is being used to distinguish between different types of texture, something that would be difficult to accomplish by sight alone. Buikstra and Ubelaker continue by describing the upper edges of the eye orbits when they state, "begin by holding your finger against the margin of the orbit at the lateral aspect of the supraorbital foramen. Then hold the edge of the orbit between your fingers to determine its thickness" (1994:19). In this example osteologists receive instruction on how to properly hold the skull and determine the thickness of the upper eye orbit where thinner margins would suggest a female skull and thicker margins would suggest male.

In determining age, the language used in various osteological methods also encompasses terms that refer to touch and how things should feel; this is clearly seen in the methods developed by Todd (1921) and Lovejoy et al. (1985). To estimate age of a skeleton, Todd (1921) looked at the morphological changes of the pubic symphysis, the space where the two pelvic bones articulate. This method uses 10 distinct phases that allows the osteologist to estimate age up to around fifty years. More importantly, each of these phases employs tactile terms that encourage the researcher to feel the symphyseal face. For example *Phase 1* states that, "[the] symphyseal face [is] rugged, transverse by horizontal ridges separated by well-marked grooves" (Buikstra and Ubelaker 1994:22). In this description terms such as "rugged" and "grooves" invite the researcher to feel the bone. *Phases 3* and *5* mention "sharp lipping" (Buikstra and Ubelaker 1994:22), another feature that can be more easily determined by running one's finger up the side of the bone and feeling if it catches along the lipped edge of the pubic symphysis. Todd's (1921) method was later adapted to become the Suchey-Brooks method based upon the works of Brooks and Suchey (1990) and Suchey and Katz (1986). This system lists six phases that describe the morphological change in the pubic symphysis and also uses a language that emphasizes touch. For example, *Phases 5* and *6* mention the formation of a depression in the symphyseal face (Buikstra and Ubelaker 1994:23) that can only be really noticed by pressing one's finger directly onto to the bone and feeling it. Similar terminology can be seen in Lovejoy et al.'s (1985) use of the auricular surface for age determination. The auricular surface is located on the os coxae where the bone articulates with the sacrum to create the pelvis; much like the pubic symphysis, it too undergoes morphological changes as a person ages (White and Folkens

2005:247; Buikstra and Ubelaker 1994:24). Using eight phases, Lovejoy et al. (1985) apply tactile terminology that helps the researcher to make visual distinctions. For instance, *Phase 1* makes reference to "fine granularity," and *Phase 3* mentions a "coarsening" of the surface until it becomes completely dense by *Phase 6* (Buikstra and Ubelaker 1994:25).

Paleopathological textbooks such as *The Archaeology of Disease* also employ tactile language. For example in referring to individuals who were scalped: "new bone formation eventually occurs if the person survives and the healed surface appears depressed, smooth and variable in thickness" (Roberts and Manchester 2007:117). Another example includes linear enamel hypoplasia, a dental pathology indicating periods of stress during tooth development. This pathology is described as "lines, pits or grooves on the enamel surface" (Roberts and Manchester 2007:75). Due to their sometimes-faint appearance, linear enamel hypoplasia can be difficult to identify solely through a visual observation, and often osteologists will pass a finger along the tooth's surface to feel the grooves to confirm the pathology's presence when technological equipment is unavailable.

CONCLUSION

Touch enables a better understanding of studies involving material objects and acts as a complement to visual observation by verifying and confirming what sight can only estimate such as weight, texture and temperature. As a discipline rooted in material culture, osteology is highly visual and contains a substantial tactile component. Touch provides another avenue for data collection and expands on visual cues in areas including the determination of sex

and age, as well as the recognition and confirmation of skeletal features and pathologies.

In museums, the high seat of material culture, touching collection pieces was originally an expected part of the visitor's experience. Despite this practice being discouraged for both practical and theoretical reasons, such as the risk of damage and the importance and value placed on the object, touch has been re-emerging in museums through interactive exhibits and specialized handling collections. By holding an object a dynamic element is added to the visitor's experience beyond passively looking through a glass case; handling an object creates a personal connection and enables a better understanding the significance of what that object represents. Like museum visitors handling artefacts, osteologists holding and manipulating skeletal remains develop a similar personal connection as they gather information to determine sex, age and other anthropological data. The skeletal remains are given an identity and an understanding of their life as well as the time they lived in.

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