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Touch Without Touching

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1. Introduction

To see a cup on the table is to see a particular individual — *that very cup* — with its various qualities, located in relation to other visual objects and properties. Perceptual experiences like these seem to possess *demonstrative content*; the experiences seem to be about or refer to particular individual objects.

Visual and auditory experiences can be about or refer to objects (or events) even when those objects are located far away from our bodies. In addition, these modalities seem to directly represent distal objects, without representing any intermediary connecting us to them. I see the cup without seeing the light contacting my retina. I experience a distant sound as located far away, not as travelling through the air from its source all the way to my ears. These modalities can be described as *teleosenses*: they can represent distal objects without requiring that we represent something else connecting us to those objects. Both vision and audition represent objects and their features as located at a distance from our bodies, and neither involves direct contact with the objects of our distal experience. Touch is not a teleosense. Whereas we can see an object from across the room, or hear a voice calling out from a distance, touch seems to require direct contact with the objects of our experience. We seem incapable through touch of reaching out beyond the limits of our bodies, of experiencing the world beyond our skin. We find a quarter in our pocket by feeling the contact it makes with our fingers. We turn on the light in the closet by feeling around until our hand makes contact with the switch. Indeed, one meaning of 'touch' is just to have our bodies come into contact with something, even if it does not elicit a perceptual experience.

It might seem obvious, then, that to experience an object through touch requires that we come into direct bodily contact with it. Despite the intuitive appeal of such a view, the claim is implausible. The main argument of this is paper will be that, like the teleosenses of vision and audition, touch often represents objects that are far removed from the surface of the body. Even though distal touch experiences require that

something make contact with our sensory surfaces, it does not follow that the objects of our tactual experiences — those objects or properties to which our tactual experiences refer — themselves need to be in direct contact with our bodies.

What follows is an account of the relation that holds between touch experiences and the objects of those experiences. It is, essentially, an account of perceptual reference in touch. I argue that in touch, as in vision and audition, we can and often do perceive objects and properties even when we are not in direct or even apparent bodily contact with them. Unlike those senses, however, touch experiences require a special kind of mutually interactive connection between our sensory surfaces and the objects of our experience. I call this constraint the *Connection Principle*. In other words, tactual reference to an object requires an appropriate connection to that object, either directly or through some connecting medium. Touch, on this view, is something of an inbetween sense, not a full teleosense, but also not a contact sense. Rather, it is a *connection sense*: we can experience distal objects through touch, but unlike the teleosenses, we can do so only if there is an appropriate exploratory connection between our bodies and the external object.[1] This view has important implications for the proper understanding of touch, and perceptual reference generally. In particular, spelling out the implications of this principle yields a rich and compelling picture of the spatial character of touch.

2. The Contact Thesis

I start with the assumption that perceptual experiences contain some demonstrative referential component.[2] Philosophers have traditionally recognized a distinction between intentional states and phenomenal states. Beliefs are paradigm intentional states; they *point to* or *are about* states of affairs in the world. Such states possess some referential component. Perceptual experiences are paradigm phenomenal states. They involve a particular phenomenal character, or feel. But my assumption is that they also have an intentional component. Perceptual experiences seem completely intentional in Brentano's sense: like beliefs and thoughts, they are about things in the world. When we see a red apple on the table, our experience is representing a certain state of affairs. This is a basic sense of representation that most would agree on. While some philosophers have recently argued that phenomenal states just are intentional states of a certain kind (*e.g.*, Dretske 1997, Tye 1997, Byrne 2001), this is not required for perception to possess a referential character. The view does not, for instance, require an explicit, fully detailed mental representation of the state of affairs, nor does it require that the phenomenal character be fully exhausted by such representational content. In addition, I assume that perceptual experiences ground demonstrative thoughts about objects in the world (Siegel 2002, Campbell 2000) and are assessable for accuracy (Siegel 2010, Schellenberg forthcoming). Using these relatively modest assumptions as a foundation, this paper develops an account of the referential character of typical touch experiences.

The most obvious and initially plausible account of tactual object reference is that it requires direct bodily contact. Call this view of tactual reference the *Contact Thesis*:

> **Contact Thesis (CT)**: Tactual object perception occurs only at the surface or limit of the body; reference to an external object in touch occurs only when the object is in direct contact with the body.

CT seems right. After all, our touch receptors are located on our bodies and do not appear capable of delivering information about distal objects or events. It does seem as though we perceive objects through

1. Of course, even the teleosenses require an appropriate causal or informational connection between our sensory systems and distal objects. As we shall see, the exploratory connection involved in touch turns out to be importantly different than the connection found in either vision or audition.

2. For additional motivation for this view, see Campbell 2002, Campbell and Martin 1997, Siegel 2002, Matthen 2005, and Pylyshyn 2006.

touch only when they come into contact with our bodies. Appearances are deceptive, however. It is relatively easy to find touch experiences that violate CT. Whenever one touches an object while wearing gloves, for instance, one perceives an object that is not in direct contact with the surface of the body. When one picks up a pencil while wearing gloves, one still has a tactual experience of the pencil, not of the glove nor anything beyond. Such examples are not restricted to something as thin as latex gloves (which one might think are barely registered by our tactual receptors). One can feel the surface of the floor through one's socks and shoes, feel the keys in one's pocket by pressing on the outside of the fabric, or feel the movements of a puppy wriggling under a blanket. CT is even more clearly false if we define the limits of our bodies as the limits of our sensory surfaces (the specialized transducers within the glabrous and hairy skin).[3] Most touch receptors lie deep within the dermis, under many layers of dead cells in the epidermis. All touch experiences would thus seem to occur through some mediating material that lies beyond our actual receptors (see *e.g.*, Lumpkin and Caterina 2007, and Moll *et al*. 2005).[4] In addition, there are no transducers in our fingernails, yet we are able to perceive a range of tangible properties through our nails.[5] I have not even mentioned the wide variety of complex touch experiences involving tools and other intermediary objects that would also violate CT.

3. While no recent thinkers have claimed that touch begins at the receptors (rather than the body), that tactual information is reliably transmitted through inert layers of skin, nails, and teeth lends additional intuitive support to the positive view to be defended later.

4. This seems to be the view of Aristotle, cf. *De Anima* bk 2, ch 11.

5. See Lederman and Klatzky 2004 for an excellent study and review of our ability to perceive objects through an intermediary, what they call "remote" touch. Their findings indicate that the loss of texture and other material information when using a rigid probe, for example, negatively impacts our capacity for haptic object-recognition. Even so, we are able to experience distal objects, for instance, through the use of fingernails, also discussed at some length by Katz (1925/1989).

3. The Apparent Contact Thesis

We can find a more plausible version of CT suggested by Michael Martin (1992).[6] Rather than appeal to the actual limits of the body, Martin suggests that we appeal to its apparent limits. Martin appeals to the well-established fact that our body schema is malleable: where our body is felt or experienced to end is not necessarily where it actually ends (1992, 201–2). Thus bodily feeling need not occur within the actual limits of one's body, but only within the apparent limits of the body. This leads to the following modification of CT:

> **Apparent Contact Thesis (ACT)**: Tactual object of perception occurs only at the apparent surface or limit of the body; reference to an external object in touch can occur only when the object is in direct contact with the apparent limits of the body.

Martin argues that bodily sensations are always felt as located on one's body. Thus touch experiences (which plausibly depend on such sensations) must involve an experience of an object in contact with the apparent limits of the body. Any space beyond our body simply could not be a possible location for a bodily sensation: "the apparent limits of the body are the apparent limits of possible sensation" (202). Since we experience objects only when they cause sensations, and these sensations are always located on the body, it would seem to follow that we can experience objects only when they come into contact with the apparent limits of our bodies.

Consider an example. Martin claims that when we grasp the rim of a wine glass with our outstretched fingers, we make contact only with five points on the rim, and thus have only five discrete points of tactile sensation. Since we come to experience the glass as circular, this experience depends upon the sensations at the fingertips: "one comes to be

6. It is unclear if this is Martin's intended view. His focus, after all, is not on the referential character of touch but on distinguishing the spatial character of touch from vision. Still, the referential view attributed to Martin here seems strongly suggested by his paper (cf. Scott, 2001).

aware of the glass by being aware of the parts one touches" (1992, 200). This quote suggests that we are aware of the glass as a whole only in virtue of awareness of the parts being touched. We have no experience of what lies between the fingers or of the glass as a whole; the points of contact are the only locations of which we experience (for these are the only locations of possible bodily sensation). The experience of bodily contact is that which reveals or makes manifest the properties of the impinging object. As Martin says, "One measures the properties of objects in the world around one against one's body. So in having an awareness of one's body, one has a sense of touch" (203).[7] Contrary to this view, I believe that we can and do have tactual experiences of distal objects even when those objects are not in contact with the apparent limits of our bodies. While I think touch does involve some *connection* with external objects, the object of our experience need not be in direct contact with the apparent limits of our bodies.

4. Some Problematic Cases

I am now going to describe two cases that show that we can have touch experiences of objects and properties with which we are not in direct contact and that are not experienced at the apparent limits of the body. These are examples of what I call *tactual projection*. They involve experiences of distal objects and properties through an intervening material or tool. In these cases some mediating element connects the objects we experience and the actual sensory surfaces of the body, and it is not the case that we experience these intermediaries as apparent parts of our bodies. If this is correct, then ACT is false. These cases reveal that the necessity of apparent bodily contact must be wrong, and they lay the foundation for my own positive view to follow.[8]

7. Here I'm assuming a strong reading of "awareness" that involves an explicit, attended experience of the body. As we'll see, I support the view that touch involves an implicit, background bodily awareness. Later I will motivate and develop this distinction in detail.

8. These are not isolated cases, but merely good examples of distal touch. Once one starts looking, cases like the ones I will discuss are easy to find.

I start with the observation that most discussions of touch oversimplify tactual experience. Our theories of touch ought to acknowledge and incorporate the full depth of tactual experience. Touch involves cutaneous stimulation of our fingers and hands, but it also involves surface activations across the entire body, along with proprioception, vestibular information, motor and muscular feedback, and our sense of agency. Prehension and grasping, for instance, are highly complex motor actions that involve the coordination of many distinct subsystems.[9] This means that a range of touch experiences can be produced that violates ACT. Consider the following example:

> **Driving**: You are driving a car. You notice, through your tactual experience alone, that the road changes from smooth asphalt to gravel. You may even think to yourself, "This section of road is rough."

This is a case of a tactual experience — mediated by vibration and pressure on the sensory surfaces of the skin — which represents a property of the road, its being rough.[10] Your experience is *of the road*, it is not an experience of the wheel or the car frame, and certainly not *of the seat*. It is an experience of the road upon which you are driving; the road is the object of your experience. This experience, I would argue, is not a bodily (or even bodily-directed) experience, for instance, of your body vibrating against the seat. It is an experience of the road. The externally directed experience of your back against the seat is a different experience, in both its phenomenology and its content, from the experience of the road. The bodily awareness in such an experience is largely implicit and in the background. That is, we need not assign any intrinsic sensory

9. Jones and Lederman's recent book on the hand (2006) provides a very detailed neuro-psychological account of such interactions in hand-based tactual perception.

10. Of course, the possibility of this sort of experience depends a lot on the car. Cars with very smooth suspensions may make such experiences nearly impossible. For my purposes here, assume a car in which such distal experiences of the road can be reliably generated.

quality directly to the body. The upshot is that that we can have an experience of the road that is not at the same time an experience of our own bodies. We might not notice or experience anything about our own bodies while driving, yet be completely aware of changes in the road.[11]

In such cases, it is the road that is the object of the experience.[12] This is a case of a *projected* tactual experience; we project our tactual experience beyond the proximate stimulus (the vibration of the seat) to the object causing the vibration (the road).[13] Consider another example:

> **Cat Tracking**: Consider the experience of lying on a bed very early in the morning, barely awake, with your eyes closed, when, as happens all too often, your cat leaps onto the foot of the bed, and begins the steady march toward your face.

Even if the cat does not touch your body directly, you have no difficulty following the cat's progress when this happens. You can feel each step,

11. For a similar point see A. D. Smith's discussion of perceptual constancy, (2002, pp. 170ff). The idea there, supported in the empirical literature, is that some perceptions of external objects remain constant throughout changes in subjective sensations. In the present case, our constant experience of the road through changes in our sensations in the seat would be an instance of perceptual constancy. The critical difference, of course, lies in the distal character of the tactual experience.

12. One might worry that this is a mischaracterization of the experience; that rather than an *experience* of the road, driving involves an inference or judgment about the road based on the proximal experience (much as we become aware that we are running out of gas by looking at the gauge). I will address this worry in detail in Section 6.

13. I wish to be cautious in my use of "causal" here. It may not be correct to say that we always represent to ourselves a causal connection in such an experience. Indeed, when driving we may simply experience the road directly, without representing to ourselves the fact that it is the road that is causing our experiences in the seat. Thus it may turn out that tactual projection involves an implicit or automatic extension of experience to a distal object. Still, even if it is not an explicit representation of a causal connection, the experience of a distal object through touch seems best characterized as a projection through our total proximate experience to that which is causally connected to it. I will return to these issues.

and track the cat as it navigates around obstacles and marches on toward your face. The experience of the cat and its location is mediated here entirely by touch, even though the cat is clearly located beyond the range of the body, and also beyond the apparent limits of your body. Such a complex touch experience undermines the plausibility of ACT, for there is no sense in which the apparent limits of the body extend to include the mattress and the bed.

Despite these cases, we can agree with Martin that alterations in body schema do occur. Phantom-limb patients clearly seem to experience sensations in limbs that only apparently exist, and a professional tennis player may experience her racket as a literal extension of her body. We can even agree that such alterations are common. It seems reasonable, for instance, to think that even wearing a hat or a heavy coat alters our perceived sense of bodily space. However, it is incorrect to suppose from such cases that all extended tactual experiences involve a reordering of one's body sense. In the driving example, it is unlikely that I experience the seat or the car itself as an extension of my body. Similar points can be made about cat-tracking. I still have an experience of the limits of my body, and this is an experience of my body as sitting on the seat or the bed, not as continuous with or a part of the seat, or the car frame, axle, or wheels. Outside of the points of contact with the seat, there are no good, principled candidates for the apparent limits of my body that explain my experience of the road. If my body image were to expand to the whole car, for instance, then I ought to experience a passenger as sitting inside the limits of my body. Clearly, this does not happen, and we must conclude that cases like cat-tracking, driving, or even using a pencil to feel the roughness of paper are a variety of distal touch that violates ACT.

A better account for distal touch is required. Instead of expanding our body out to the distal object, we seem to experience the connecting element as a kind of medium through which distal information is transmitted to our sensory surfaces. This is related to an idea discussed by Evans (1982). He argues that direct informational links are a necessary condition of perceptual reference. His idea was that a perceptual

experience refers to a particular object in virtue of the informational links connecting the perceptual state to the object. As Evans correctly notes, such links are not sufficient to ground perceptual reference; however, I think he was correct that some such link is a necessary condition on perceptual reference. This insight allows us to develop a more plausible account of tactual reference.

To see this more clearly, imagine something further removed from our skin than a pencil or gloves. It is unlikely that we would experience a broomstick or a shovel as defining the limits of our bodies, though we can just as easily drag either along the ground to determine its texture and hardness, or probe the walls of a dark room to determine its shape. It is much the same with stilts, bikes, roller skates, or other extensions of our tactual abilities. That we project our experiences to distal objects does not show that we project our body-sense. It is not the case that whenever we touch an object with some mediating object, we incorporate the mediator into our body image. It is far more likely that we experience on our sensory surfaces stimuli that give us consistent information about distal objects, information that is merely transmitted through some intermediary tool or object which is not itself the object of our experience. This initial insight leads us to my positive account.

5. The Connection Principle

We often experience objects through touch that we are not in direct contact with, and that are not in contact with the apparent limits of our bodies. Tactual reference therefore cannot be explained in terms of such (apparent) contact. A plausible means of understanding tactual reference is needed. I begin first by suggesting a principle that can replace ACT and that can account for the wide variety of distal touch experiences. I'll then consider and reject a closely related alternative to this view. Finally, I'll consider the critical question of where distal touch objects are represented as being. The answer to this final question, grounded in the distinction between different levels of spatial representation, will offer a plausible general account of the spatial character of touch.

We started with the observation that touch appears to be a contact sense. Initially, this was understood as the claim that touch, unlike the distal senses, cannot represent objects or properties not in direct contact with our bodies. This claim has now been rejected on the basis of clear counterexamples. Nevertheless, there still seems to be something important in the claim that touch requires contact: touch seems to need *some* connection to the objects we experience. Following Evans (1982), I suggest that tactual reference requires a strong informational link between an object and our sensory surfaces. We cannot have an experience of an object if that object is not connected to us in the appropriate way. One cannot experience a sphere through touch if the sphere (or its properties) is not connected in some appropriate manner to our sensory surfaces:

> **Connection Principle (CP)**: Tactual reference to an object requires an appropriate tactual connection with the object, either directly or through some intermediary.

Anything that transmits information about distal objects, and thereby allows us to have genuine tactual experiences of these objects, counts as a *tangible medium*. This will include various objects, tools, voluminous materials, and even organic substances as fingernails, epidermis, and hair. Touch is a connection sense, but that does not mean that it isn't distal. It can represent objects located some distance from the body, but only if those objects are connected to us in the appropriate ways, through the appropriate channels. Connection to an object is necessary for tactual reference. We'll look at the nature of these links in a moment. First, let me emphasize that the informational connection involved here is not sufficient but only necessary for perceptual reference in touch. We cannot secure reference through a bare causal or informational connection without some experiential component. We need not explicitly experience the connection in order to properly connect the proximal stimulations with the proper external object. Instead, the kinds of informational links that connect us through touch lend themselves to the

right kind of implicit awareness (skillful sensorimotor connections, for instance). In this respect, the CP is in line with the kinds of connections Evans originally envisioned with his notion of informational links, supplemented by appropriate exploratory mechanisms.

What kinds of connections would be appropriate, then? I'm going to start with an idea discussed by Evans (1982). According to him, "demonstrative thoughts take place in the context of a continuing informational link between subject and object" (1982, 146). This information link provides a subject with a governing conception of the object, keeps the subject "in contact" with the object for the purposes of tracking and updating, and allows the subject to locate the object in egocentric and allocentric space (173–4). Evans is clear to emphasize that the link is not sufficient for demonstrative thought, but that it needs to be appropriately associated with our thoughts. There are many positive aspects of this view. The view is temporally extended, allowing the natural incorporation of extended touch experiences. The view is inherently active and exploratory. It accommodates circuitous information links. And finally, it offers a relatively touch-friendly model of spatial representation. Despite these strengths, it also suffers from some weaknesses. For Evans, the information link seems to be unidirectional, with information from objects in the world connected to and updating our thoughts. But the information links in touch seem mutually interactive and bidirectional. When we press and pull against an object we both change the object in various ways and receive updated information from that object. Another worry is that Evans downplays the importance of sensory experience in demonstrative thought, but our account of tactual reference ought to make some reference to the qualitative character of touch experiences in virtue of which they can be about particular objects. And finally, Evans' account of spatial contents can be revised in light of recent empirical evidence to offer a more plausible account of tangible space. With this revision, we can now put forward a detailed account of what an appropriate connection amounts to.

First, let me introduce the notion of *tactual media*. Such media — which include various material objects and tools, and perhaps even organic substances such as fingernail, epidermis, and teeth — reliably transmit tangible information about distal objects and thereby allow us to experience those objects. Slack string, for instance fails this test: it simply cannot transmit the appropriate information to our touch receptors. Pencils, gloves, walking sticks, and a myriad of other tools and objects do reliably transmit tangible information and count as tactual media. These media transmit tangible properties, which include roughness, solidity, weight, elasticity, vibration, and thermal properties, along with many others. Some tangible properties are more easily transmitted through tangible media. These tend to be relatively sparse properties like roughness and smoothness that do not involve precise spatial resolutions. Other tangible properties, like fine texture, exact shape, contours, and part-whole relationships, are more difficult to transmit through tactual media, though some media exist that can transmit such information (thin gloves, for instance). A connection is appropriate for touch, then, if it involves tactual media that can reliably transmit information about distal tangible features.

We can say a bit more about the connection. For many touch experiences, the connection seems to be closely related to exploration and control. Consider a simple case of distal thermal touch. With your eyes closed or blindfolded, you can experience the heat coming from a candle set before you. The exploratory actions you perform relative to the candle — perhaps moving your palm around in front of you, feeling for the heat to increase or decrease — allow you to experience the heat as coming from an external source, located in a particular spot. It is the way in which the experience of the heat changes relative to our movements that secures the distal nature of the experience; we experience the heat as located at a distance from our bodies because our heat experiences are appropriately linked to our movements.

The same is true of distal touch involving tools. When we use a pencil or tongs to touch objects, we are able to move and manipulate the devices in different ways, allowing for coherent and stable representations of objects located away from the body. When we use such a tool, or experience an object through a soft intermediary, it is not in

some random or chaotic manner; rather, we feel stable information *through* the intermediaries. We are, in a sense, able to feel through them to the object on the other side. When we explore through touch, we are able to ground and represent certain properties as located in certain places. The same is true of the use of tools for tactual projection, which occurs when the medium becomes, in a certain constrained sense, transparent.

We can further clarify these points by saying that the information link ought to mesh with our *exploratory procedures* (EPs).[14] Lederman and Klatzky (1987) introduced this notion after discovering that subjects always used a set of stereotypical exploratory movements when touching objects in an unconstrained setting. These EPs include movements, like unsupported holding, pressing, and contour following, that allow a subject to engage directly with objects in order to determine sets of tangible features. The use of tactual media must allow for the smooth incorporation and extension of these exploratory movements. That is, the actions we perform with tools and other tactual media must cohere with the kinds of EPs we would normally use when touching objects: we should be able to press and tap and slide tactual media across a surface, for instance. This explains why we can experience a distal surface with a pencil but not with slack string: we cannot perform any exploratory procedures with such a string.

That touch makes use of a medium should not be particularly controversial. The distal senses all involve stimulations that arrive at the surface of the body through a medium. As Austen Clark (2000, Chapter 1) notes, the appearance of space in general is mysterious. Touch should be no more so. Through touch we are sensitive to pressure waves and vibrations, as well as other similar signals, and these stimuli are capable of travel through media just like light and sound waves. It thus makes sense that our touch receptors could bring us into contact with distal objects or features, especially when there is a strong mutual informational link between the distal object and our bodies supported by our exploratory actions.

14. Some tools might require the development of novel exploratory procedures beyond those used with bare hands alone. This possibility does not undermine the point that useful intermediaries will be those that can most easily be incorporated into our existing stock of exploratory movements.

6. Mediated Contact Thesis

Before developing the consequences and details of the CP account of tactual reference, it will be useful to contrast it with another closely related view. This alternative removes the implausible claim that the objects of tactual experience must be in apparent contact with our body, and it too can invoke a connecting element between our bodies and the distal object of experience. It differs however, in maintaining that we must have a direct, explicit experience of the object that *is* in direct contact with our body. Call this the *Mediated Contact Thesis*:

> **Mediated Contact Thesis (MCT)**: Tactual object perception occurs only in virtue of explicit awareness of an object that is in direct (or apparent) contact with the body.

MCT requires that we be explicitly aware of an object in contact with our bodies in order to experience a distal object through touch. In other words, MCT holds that we experience distal objects through touch only via a mediating, referring experience of some object that *is* in direct contact with our bodies. While one may be able to feel some distal object through a stick, MCT holds that this requires explicit awareness of the proximal end of the stick that *is* in direct contact with the body.

The basic idea is that some experiences *mediate* other experiences. Such mediation is common in the other senses. We cannot see the wind directly, but we can still become aware of the wind by seeing the leaves rustle along the ground. Similarly, we cannot see the moon-landing directly, but we can still experience it by watching a video of it on a television screen. MCT holds that distal touch also has a mediated structure, that our experience of the distal object is mediated by some more proximal experience of an object that is in direct contact

with our bodies. To properly assess this view, however, two distinct kinds of perceptual mediation must be distinguished.

Call the first *inferential mediation*. Such mediation occurs when a perceptual experience allows us to become aware of some state of affairs.[15] Contrast this with *experiential mediation*, which involves a perceptual experience that depends on some other perceptual experience. Among other ways, we can distinguish these two kinds of mediation by how they differ in the assignment of qualitative sensory features. To have an inferentially mediated awareness of x via a perceptual experience of y involves no qualitative awareness of sensory features of x. When we experience the wind by seeing the leaves, we do not experience any sensory features of the wind; when we see that the tank is half full by looking at the gauge, we do not experience any sensory features of the gas in the tank; when we become aware of the fire by seeing its smoke, we do not experience any features of the fire itself. We become aware of these things on the basis of perception, but strictly speaking, we do not perceive them. Rather, we infer x, perhaps even quickly and seamlessly, from the perceptual experience of y.

Cases of experiential mediation are different. In experiential mediation, we perceptually experience the sensory qualities of x by experiencing the sensory features of y. Watching television is a good example. One can see the green grass of Fenway Park by seeing the green pixels on one's television set. Here a qualitative sensory feature — greenness — is being assigned directly to the grass; the color of the field is not simply inferred from our experience of the television pixels, it is perceptually experienced (seeing something on a television is still a kind of seeing). Another example is recorded sound. We can have auditory experiences that refer to a particular voice by experiencing a recording of that voice. In both cases, the experiences are mediated; we have the one experience (of the green grass, of the voice) only because we have some other experience (of the television, of the recording). There is a relation of dependence between the two experiences: one could not have the mediated experience without the mediating one. The mediated qualitative properties we experience depend on those of the mediating one: on different television sets, the Fenway grass may appear more yellow or blue than it actually is. But note: in many of these cases, while the mediating experience is causally necessary for the mediated one, it need not be an explicit, attended experience that does the mediating. The mediating experience can remain implicit, part of the background. For example, one can be fully engrossed in the depicted events of a movie without paying any attention to the changing proximal properties of the screen. We can see *through* the screen directly to the objects and events beyond. Such mediating experiences can thus be quite thin, so far as experiences go.

MCT holds that distal touch experiences have a mediated structure. But which structure? According to MCT, to have a touch experience requires an explicit awareness of the proximal object. This seems to place an implausible constraint on experiential mediation, which typically involves background, implicit mediating experience. For this reason, inferential mediation seems like the most likely candidate relation for MCT. On this view, we become aware of the roughness of the paper indirectly, through an experience of the pencil in contact with our hand. But this structure does not work for distal touch. To experience the gas level in the tank by seeing the gauge requires an attended awareness of the gauge. If I fail to attend to the gas gauge (despite "seeing" it in some weak sense at the periphery, as I check my speed, say), then I cannot experience the level of gas in my tank. Similarly, I cannot experience the wind in the trees if I fail to attend to the movements of the branches. But in touch, I can be aware of the distal features without any awareness of the mediating experience. (More on this point below.) The tangible features I experience are those of the distal objects, not of the proximal object. When I feel the paper through the pencil, or the road through the car, I experience the sensory qualities (roughness, smoothness, texture, solidity, shapes, etc.) of the road and the paper. I do not *infer* the roughness of the paper from what I experience about the pencil; I have a direct, qualitative experience of the sensory features of the distal object,

15. Whether to call the inferred representation an "experience" is a difficult question.

as direct as any experience I might have of objects in contact with my hand.[16] Since sensory features are assigned to objects in distal touch, it seems unlikely that touch involves explicit inferential mediation.

The other option is that touch involves experiential mediation. This is implausible if construed as the view that distal touch is mediated by an explicit, foreground awareness of the mediating experience (as stated in MCT). We can see this by appeal to the close connection between attention and demonstrative thought (and this connection works as well in the inferential case discussed above). If we perceptually attend to an object, then that experience should ground demonstrative thoughts about the object of our attention. For instance, if my visual experience involves explicit awareness of a red box on the table, such an experience should ground a demonstrative thought about "that red box on the table" (cf. Siegel 2002, Campbell and Martin 1997). If distal touch experiences occur in virtue of tactual reference to the proximal object, then any experience of a distal touch object ought to ground reference both to the distal object and to the proximal object. So an experience of the paper through a pencil should ground thoughts about "this pencil" as well as "this paper". But it seems clear that distal touch experiences often involve no proximal experiences that could ground demonstrative thought. I can experience the distal object (the paper) without being in a position to think something about the proximal object (the pencil). This is because even if they are present, the proximal experiences are unattended and remain in the background. While we may have some implicit experience of the proximal points of contact, we almost never attend to such experiences, leaving them unable to ground demonstrative thoughts. For this reason, the claim that distal touch involves attended, explicit awareness of the proximal object (as seems required by MCT) cannot be a necessary condition on distal tactual reference.

16. Of course, subpersonal inferential processes are likely involved in such cases of distal touch, but this is also true for distal visual and auditory experiences, and does not require an explicit awareness of the mediating experience.

The CP account of tactual reference is consistent with a version of MCT in which distal touch experiences require only background or implicit experience of the proximal points of contact. Consider two cases: feeling the roughness of paper with a pencil, and touching a table through gloves. In the first case, we do not experience the paper by attending to the pencil in contact with our fingers (a point discussed earlier). The pencil is a tactual medium that is reliably transmitting tangible information about the paper to our hands. So there is going to be some bodily awareness of our fingers (a kind of background awareness of our fingers, say), but our fingers themselves need not become the direct objects of experience, nor need we attend to them, nor need we be able to have a demonstrative thought about them (all useful tests for distinguishing implicit from explicit awareness). Similarly, we need not attend to the interior of the gloves in order to experience the table. We can simply experience the table, without any more direct proximal awareness.

Before moving on, I want to briefly consider a closely related view that replaces explicit awareness of a proximal object with explicit awareness of our own bodies. Brian O'Shaughnessy (1989) seems to defend such a view, which he calls "tactile representationalism". As he states it:

> What must be emphasized about touch is that it involves no mediating field of sensation… . In touch a body investigates bodies as one body amongst others, for in touch we directly appeal to the tactile properties of our own bodies in investigating the self-same tactile properties of other bodies. [1989, 38]

According to O'Shaughnessy, our experience of external objects through touch always involves a direct awareness of our own bodies, so we can experience objects only when something impinges upon the body and (importantly) when we are aware of that impinging. Vision and the other distal senses involve no mediation through bodily awareness; we can easily see an object located some distance

from our bodies without becoming explicitly aware of some change or impingement on our retina. As O'Shaughnessy remarks, in touch "it remains true that awareness of the external spatial property only occurs though the mediation of a body-awareness with a matching spatial content" (1989, 46).[17]

The same criticisms discussed above apply to this bodily version of MCT. Distal touch experiences do not require an explicit, attended, or referentially grounded experience of the body at the proximal points of contact. When I touch paper through a pencil, I may have no explicit awareness of what is happening to my fingers as I explore the page. While there may be some background experience of the body in such experiences, we do not experience distal objects in virtue of such proximal awareness and certainly not via some explicit inference from our bodily experiences.

7. *Where* Are Distal Touch Objects Located?

The Connection Principle constrains the reference of our tactual experiences. But possessing the appropriate connection is not the whole story, for there remains an important question about the spatial character of distal touch. In particular, we require an account of how the tactual experience represents the distal objects as located some distance from the body, given that our tactual receptors are all located on the body. In this section I will argue that tactual objects are represented as located in a special intermediate spatial frame commonly called *peripersonal space*. This space is defined by the limits of exploratory reach and is thus an ideal candidate for distal touch.

Let's start with the observation that we seem represent space in a number of different ways. While cognitive psychologists differ in their interpretations of the data, there does seem to be ample evidence that humans have distinct levels or frames of spatial representation (*e.g.*, Halligan *et al.* 2003). On most standard accounts, there are (at least) three distinct frames of spatial reference. First, there is *internal* or *personal space*, which is the space occupied by our own bodies. An itch on the arm or a pang of hunger located somewhere in the belly are examples of representations within one's personal space (Halligan *et al.* 2003). The locations involved here are egocentric, relating various body parts with each other without concern for their objective locations in space. In addition to personal space, there is *extrapersonal* or *external* space. Looking out onto a field of flowers involves representing objects in external space. They might be represented relative to other external objects or landmarks, but they are taken to have a stable and objective location "out there". I think that prior views of touch have assumed, incorrectly, that these are the only frames of reference relevant to perception. The distal senses have been taken to operate in external space, representing objects and properties relative to some external frame of reference. Touch, on the other hand, has been relegated to personal space, and it was assumed to represent features only relative to the body (hence the centrality of bodily awareness at the proximal points of contact). Such a view seems to justify a view like ACT. A strong argument might be made for the view on this basis, were it not for the existence of a third level of spatial representation. This level, typically called "peripersonal space" or the "space of action" plays a crucial role in perception, especially touch and vision for action. Peripersonal space is the area immediately surrounding a subject's body, usually defined as the area wherein one can easily reach and actively engage. These three levels of spatial representation are distinct; they can be dissociated from one another and there exist pathologies that leave a subject without the ability to represent only one level of representation through forms of spatial neglect (Mennemeier *et a.l* 1992, Pegna *et al.* 2001). There is ample evidence that it is representations in peripersonal space that mediate many of the tactual experiences (especially tactual reference) that I've discussed in this paper. Tactual projection is typically a projection into peripersonal space; the use of tactual media typically occurs in peripersonal space. In addition, it has

17. O'Shaughnessy may have in mind something weaker, like the causal mediation I described above. If so, then there may be no disagreement between our views. However, he seems to suggest that we experience objects *in virtue of* bodily awareness, which is the view I'm arguing against here.

been shown that while use of tools projects into peripersonal space, only the proximal and distal ends of the tool are ever represented in experience (Holmes *et al.* 2005).

It is obvious that visual experiences represent objects and features in external space. It is also obvious that touch represents objects and features in personal space. The error is thinking that these are the only options. Both touch and vision seem able to represent objects in peripersonal space. I think a careful consideration of the nature of peripersonal space allows us to explain how touch is able to represent objects as located in the space around the body. The coordinates of peripersonal space are defined, after all, by such things as how far we can step or reach in various directions, and these things, being grounded in proprioception and kinesthetic feedback, play a crucial role in genuine tactual experiences. This might offer an explanation for how tactual projection works (one projects into the space where one can reach, manipulate, and so on using a tool or intermediary). Recall that by using particular *exploratory procedures* (EPs; again, this term is introduced by Lederman and Klatzky 1987) to investigate an object, one comes to represent various elements of the object in peripersonal space (by how one's grasp needs to change to feel a certain feature, say). Tactual awareness of complex or large objects might require some implicit awareness that my arm needs to move such and such a distance to explore the far side of the object, etc. And these spatial facts can be grounded in the features of peripersonal space instead of external space, which means we no longer need to default to body awareness to explain tactual experience. When we are haptically engaged with the things around us, these things are all located at specific locations in peripersonal space, and the features of this space are available to (indeed, partially constructed by) touch (cf. Kappers 2007; Klatzky and Lederman 2003b).

The role of peripersonal space also allows us to have a better understanding of the relation between touch and the other senses. This is because peripersonal space is multimodally influenced by the other senses, especially vision. Action-guiding vision, for instance, plays a strong role in determining the extent of our immediately accessible environment. Mohan Matthen (2005) has highlighted the importance of "motion-guiding vision", and the relation between motor actions and the objects of our visual experience. Matthen argues that objects close enough for us to interact with have a special phenomenal character, what he calls a "feeling of presence". The objects that are close enough for active engagement, those with the feeling of presence, are by their natures located in peripersonal space. The coordinates and locations of objects will be subject, not just to the structures and limits of our reach, but also to the influence of motion-guiding vision. There is thus a strong interaction between touch (and closely related actions like reaching and grasping) and motion-guiding vision. A more detailed consideration of peripersonal space will offer many insights into the structure of perceptual experience and its spatial character.

Susanna Millar (2008) had subjects sit in front of a visual-tangible map with marked landmarks for key locations such as the post office or bank. Their task was to memorize the locations of these key points, using either vision or touch, and then perform a location task on the blank map. They might be asked, for instance, to locate the bank on the map. In previous studies, it had been shown that there were marked differences in task performance between subjects who used touch and those who used vision on the task. This suggested that the two senses used different spatial frames. Millar showed that this assumption was incorrect by having each group of subjects make use of different kinds of reference cues. Subjects using vision were asked to locate landmarks relative to egocentric frames (*e.g.*, a little to the right of the body's centerline), while subjects using touch were instructed to use external reference cues (coordinate markers on the sides of the map). What Millar discovered was that the type of reference cue was responsible for task differences between touch and vision. Subjects using vision and egocentric reference cues performed the same as touch subjects in previous studies; touch subjects using external reference cues performed the same as vision subjects in previous studies. The difference between vision and touch, Millar argued, is not a difference

in spatial reference frames but a difference in the reference cues typically used (Millar 2008, Chapter 6).

If this is correct, then the main spatial difference between touch and sight is a relative difference in the types of reference cues that each typically uses. Vision typically makes use of external reference cues, like external objects or landmarks used as anchors for assessing spatial relations between objects. Touch, on the other hand, typically uses body-based reference cues, such as locations relative to the midline of the torso or a small movement of the hand to the left. The different emphasis on these two types of cues is largely responsible for the experimental differences found between the senses. That is, representations of external space typically involve external reference cues, whereas personal space is typically centered on body-based reference cues. Because it makes more consistent use of external reference cues, vision seems to represent objects only in external space (and vice versa for touch and bodily space). But Millar showed that by forcing subjects to use body-based reference cues in vision (and external cues in touch) subjects no longer displayed this striking differential data. When prompted, Millar found, subjects were perfectly able to use external reference cues in tactual perception or body-based cues in vision. It turns out that both types of reference cue can be invoked depending on task demands and context. This discussion reveals that touch most often attains spatial information relative to body-based cues, whereas vision does not. This accounts for the assumption that the spatial content of touch involves only bodily coordinates. In the intermediate range, however, both kinds of cues can be invoked, in both vision and touch, to attain spatial information about the world. In other words, touch and vision share a common space in the external environment. This space involves explicit representations of spatial locations in touch via reference cues that are not located on the surface of the body. This level lines up precisely with what I've been calling peripersonal space, where both types of cues — external and body-based — are present.

Another aspect of touch that has gone largely unnoticed (at least among philosophers) is the fact that spatial information plays a less important role in securing object reference and recognition in touch than in vision. Touch is continually contrasted with vision, and the focus is largely on the fact that both senses involve spatial representation (considerable focus has been on the representation of shape in both senses, for instance). It is easy to assume that touch and vision make similar use of spatial information in securing reference and especially recognition. This is not the case. Spatial information plays a smaller role in tactual object-recognition than it does in vision. Most important in touch are so-called *intensive features* — things like material composition, texture, weight, temperature, and so on.[18] This may translate over to object reference as well. We seem to secure reference to the keys in our pocket through intensive features like *metallic* and *cold* and *small* than we do from the specific shapes of the individual keys. This is actually a surprising fact, but one which was discovered by careful empirical investigation (Klatzky *et al.* 1993, Lederman and Klatzky 1997). Restricting the availability of so-called intensive cues causes our otherwise excellent haptic recognitional capacities to suffer greatly. For instance, Lederman and Klatzky (2003) found that subjects given a range of tangible stimuli shaped like ordinary objects, but made out of the same uniform material, find object-identification tasks more difficult than when they have access to the material composition and heft of the object but not its overall shape. Other studies have shown that non-spatial surface properties are available faster in haptic processing than are spatial features (Lederman and Klatzky 1997). This means that in a typical tactual experience we can be aware of *what* something is — we can identify the object or a range of its most salient features — without knowing *where* exactly the thing is located or its spatial characteristics. This fact helps explain how one can secure tangible reference to an object through a probe or intermediary even when that intermediary supplies only limited spatial information about the object (that is, without specifying its exact shape and location). The reference can be secured via sparse spatial information so

18. Lederman and Klatzky (1997) introduced the term "intensive features" to describe non-spatial features like textures or material composition.

long as there is enough additional information about an object's other salient features (solidity, roughness, weight, etc). The coordinates of peripersonal space are sparse in exactly this sense: they do not specify exact locations or precise geometric relations. Instead they label one's surroundings with limited information about the immediate environment in action-guiding terms. These in turn allow a subject to engage with a distal object via some appropriate intermediary and thereby discover its diagnostic, intensive features.[19]

8. Conclusion

If the proceeding is correct, then we can and do experience objects through touch, even when those objects are not in contact with the apparent limits of our bodies. And we can do so without explicit awareness of the proximal points of contact. Such experiences involve an appropriate informational connection between our bodies and the distal target. The linkage involves the reliable transmission of tangible information, appropriate coordination with our exploratory capacities, and the representation of coordinates supplied by our active engagement with the intermediate frame of peripersonal space. We possess distal touch, not by building up a complex spatial representation with all the object's features, but by grounding our representations in sparse, easily accessible features, such as texture and material composition. This makes the referential character of touch importantly different from that of vision and the other senses. In addition, this account of distal touch ought to be of considerable interest to those working on haptic interfaces and virtual reality technologies. [20]

19. Another critical element is how the various features are assigned together as features of the same object. This coordinated assignment of features — often called feature binding — is thought to play an important role in object perception in the other senses. Feature binding in touch is discussed at some length in Fulkerson 2011.

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