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A multimodal perspective on touch, communication and learning
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Introduction
Two decades ago, the New London Group's seminal paper 'A Pedagogy of Multiliteracies' argued for the need to better connect literacy with the changing social environment facing students and teachers and called for more understanding of the diversity of representational forms available within the communicational environment. A key tenant of the NLG paper is that the social requirements of social and cultural epochs, of which technologies are a part, are intimately connected to the shape, use and design of communicational modes within a community. That is that:

> 'Designing will more or less normatively reproduce, or more or less radically transform, given knowledges, social relations, and identities, depending on the social conditions under which Designing occurs…producing new constructions and representations of reality…. [Through which] people transform their relations with each other, and so transform themselves. (NLG p 12)

As has been evidenced by the immense changes in the digital landscape since the NLG paper was published, the social conditions of design can change rapidly and in significant ways. The once radical call of NLG to focus on the importance of an 'increasing multiplicity and integration of significant modes of meaning making, where the textual is also related to the visual, the audio, the spatial, the behavioral, and so on' (NLG, 1996:2) has now become standard, and accepted against the advanced technologies of the contemporary moment. The primary focus of the NLG on 'linguistic design', 'visual images' and 'written word' and their changing relationships reflected the digital environment of the 1990's, which consisted of 'desktop publishing' and 'mass media, multimedia and electronic hypermedia' and where whole body and touch interfaces were a feature of science fiction books and film. Over the past decade digital advances have freed learners from the desk and the classroom in ways that newly foreground the bodily and spatial aspects of pedagogic interaction, through interactive physical-digital games (Burn, 2014), mobile devices (Sakr, Jewitt, Price, 2015), and tangible technologies (Price and Jewitt, 2013). While the NLG paper mentions 'Gestural Meanings (body language, sensuality)' as a design element in the meaning making process, this was not in focus.

In this chapter I attend to touch as an emergent communicational form that is coming into focus through the effects of changing social requirements on the communicational landscape. Notably, a new wave of digital sensory technologies that draw on touch capacities highlights the need to better understand the role and potential of touch for communication, learning and literacies (Walsh and Simpson, 2014; Crescenzi, Jewitt and Price, 2014; Bezemer and Kress, 2014). I draw on the literature to present a brief sketch of the place of touch in communication and pedagogy. I then focus in to address three questions. First, why does touch matter in the contemporary moment? Second, can touch be thought of as a mode? Third, what is the effect of the digital on touch? Through the chapter I build the argument that touch is an act of communication and a pedagogic resource that digital environments involve a complex exploitation of touch in which touch-response-feel sequence is an aspect of encounters between humans, and the digital. Thinking of touch in this way I bring three interconnected aspects of communication into focus: the production of communicative digital touch artefacts; their interpretation; and their use to engage with others. I conclude the chapter by looking forward to tentatively consider the potential implications of digitally mediated touch for the communicational and pedagogic landscape.

The place of touch in the communicational and pedagogic landscape

Touch is frequently referred to as a neglected sense (Field, 2001). Indeed touch appears to have 'passed under the radar of the academic' (Classen, 2005: 2), and despite it being a 'complex and effective channel [touch] seldom receives any serious attention in accounts of communicating.' (Finnegan, 2014: 197). While a review of the literature shows that touch may not be much spoken about in the fields of communication and pedagogy, it provides people with significant information and experience of the world. Touch is the first sense through which humans apprehend their environment and it is central to our development (Field, 2001); it is crucial for object recognition, manipulation and tool use (Fulkerson, 2014). Although touch is often underestimated, we are able to process large amounts of abstract information through touch, a capability that it has been suggested can reduce the risk of visual and auditory overload (Van ERp and Toet, 2015). While tactile communication is often 'below the level of conscious awareness' and difficult to research (Finnegan, 2014:176), perhaps one reason for its low profile, touch is central to communication: 'Just as we 'do things with words' so, too, we act through touches' (Finnegan, 2014: 208). Indeed knowing how to infer meaning from touch is considered to be the very basis of social being (Dunbar, 1996). Touch can take many social forms in our daily lives such as greetings - shaking hands, and embracing; intimate communication - holding hands, kissing, cuddling, and stroking; and in correction - punishment, restraining, hitting and beating (Linden, 2015). Touch has been shown to be as effective as facial expression and voice at communicating a range of emotions (Field, 2011). In a study in which participants were allowed to touch an unacquainted partner on the whole body to communicate distinct emotions, for example, fine-grained coding documented specific touch behaviours associated with different emotions and the person being touched decoded the intended emotions (anger, fear, disgust, love, sadness, happiness, gratitude, and sympathy) at greater than

chance levels (Hertenstein et al, 2009). Touch has been shown to have a role in communicating complex social messages of trust, receptivity, and affection as well as nurture, dependence, and affiliation (McLinden and McCall, 2002; Field, 2011; Linden, 2015; Given this, it is perhaps unsurprising that touch is an effective means of influencing people's attitudes and creating bonds with people and places (Field, 2011; Krishna, 2010). In clinical and professional situations, for example, interpersonal touch has been shown to improve information flow and to result in a more favourable evaluation of communication partners and to increase compliance. Indeed, Finnegan argues that 'Establishing tactile contact is an act of communication.'(2014: 201).

Touch is largely neglected in pedagogy in comparison to other communicative forms. Touch has received some attention as a 'compensatory mode' with reference to tactile interaction and sign-systems for the visual and hearing impaired. Much of this work is concerned with understanding (and training) learners' exploratory strategies using hand movement, tactile manipulation and touch to communicate and to learn. Such as mapping tactile features (e.g. vibration, texture, shape, hardness/softness, elasticity etc.) and the functions of touch (e.g. to control, to convey information, express emotion, to bond, to protect (McLinden and McCall, 2002). Touch is also recognised as a primary form of interaction for very young children, it forms part of our multi-modal sensory systems and has been shown to be important for child development (Smith and Gasser, 2005). In general, touch has been argued to be important in extending children's understanding and knowledge of the world through its specific sensory functions, for example, experiencing texture, shape, weight as well as contributing to learners' classification skills. Here I focus on how touch has been taken up with museum education to point to some of the more general potentials of touch for pedagogy.

The 'sensory turn' of the past decade together with the activism of blind advocates, has led to some contemporary museum educators rethinking the role of touch for museum learning. This development links with the history of the museum as a cultural space. In the late seventeenth and eighteenth centuries visitors to great museums, such as the Ashmolean and British Museum were allowed to rub, pick up, shake, and even taste the artifacts on display Classen, 2014). This tactile and sensory engagement with museum objects was gradually restricted to museum conservators. Today the museum shop has become the primary space where touch is permitted and, as a result, where visually impaired visitors have commented they have done most of their learning (Levent and McRainey, 2014). The sensory turn to touch has been used as a way to include visually blind communities otherwise excluded from the ocular-centric experience of art galleries and museums. A new focus on directly 'experiencing the properties of things' (Dudley, 2012) has emerged and studies have shown the social and learning benefits that touch can have in the museum for instance in relation to object handling, engagement and aesthetic tactile pleasure, understanding through the tactile acquisition of knowledge, and information retention and recall (levent and 2014). Some museums are newly driven by the idea that 'feeling' is linked with 'feelings' (Chatterjee, 2008) and that touch establishes an essential connection. This has prompted the

establishment of touch rooms and artefacts such as the 'Hands on' project at the British Museum (London) and the Touch Gallery at the Lourve Museum (Paris) and the Please Touch Museums in the USA that allow visitors to handle touchable artefacts from their collection. While other galleries incorporate touch into exhibits, the Treasures Gallery in London's Natural History Museum, for example, presents a series of treasures exhibited in glass cabinets alongside 3D digitally printed replicas that can be touched by visitors.

Why does touch matter in the contemporary moment?

The centrality of touch to legal, work, religious, medical, and family in earlier societies, e.g. in the European Middle Age (Classen, 2012), is well recorded. As is the lessening role of touch in the late nineteenth century due to a complex set of social, political, economic and technological changes including changing relationships to distance and travel, kin-ship relations, the rise of the notion of the individual, health related 'tactophobia' and the 'contamination' of touch against a backdrop of the plague and other epidemics, changing religious rituals, and the emergence of optic and print technologies. By the beginning of the twentieth century touch had been 'ousted' by the visual, as 'vision become an evermore important sensory avenue for acquiring knowledge about the world' (Classen, 2012).

Over the past two decades the possibilities for touch communication realized by the portability, connectivity, and power of the digital and their effects on communication is again changing the communicative and pedagogic role of touch. This can be understood as a response to changing societal interests and needs. The design of touch technologies has emerged in response to the need to manage shifts in how social relations, both personal and work-related, are conducted. For example technologies that support touch connection at a distance to enable people to newly connect and reconnect with one another, objects and environments. The digital is increasingly creating new sensory devices and experiences, interfaces, and environments that push at, and remake, the boundaries of touch. The digital can be seen to support emergent and evolving touch forms, enhance touch practices of share-ability, access to information, and extend sensory interaction.

Today, touch is at the center of a re-imagining of digital sensory communication. There is a new wave of technologies and devices that rely on touch sensation interfaces and use touch to create the illusion of shape and textures that enable users to feel a variety of virtual objects and control remote manipulators (e.g. the haptic Phantom). The rise of touch has been accompanied by growing interest in re-evaluating the roles of all senses within education studies, and the social sciences more generally and a desire to move beyond a vision-centric approach (Howes and Classen, 2014). From a multimodal perspective modes and semiotics resources are shaped by the social functions they are used to realise, they are fluid and changing in character rather than fixed. It follows that as the social usage of touch changes, so does its function in the production of knowledge, social relations, and identities, and people themselves change. Touch matters *now* as contemporary social requirements appear to be changing the place of

touch in the communicational landscape. There is an ever-closer relationship between the semiotics of touch, technology and communication. As society and technology turn to touch so must multimodal researchers. Multimodal work on touch is at a very early stage. At a time of significant social and technological change in which touch is becoming ever-more central to communication, understanding what touch is and might be is essential.

Can touch be thought of as a mode?

The NLG paper reference to 'Gestural Meanings (body language, sensuality)' as a design element in the meaning making process is indicative of the exploratory character of multiliteracies project and its ability to set a new agenda. It also provides some insight on subsequent developments, debates, theorisation within multimodality: and the move away from the terminology of 'languages' to modes; the rethinking of 'body language' as discreet but interconnected modes of gesture, movement, gaze, posture in a theory of learning (Bezemer and Kress, 2016); and distinctions between concepts of mode, sense, and affect (see Kress, 2014). For my purpose in this chapter two relevant questions are prompted – can we distinguish between gesture and touch and can touch be thought of as a mode.

I argue that we can distinguish between the modes of gesture and touch, and that it is useful to do so to get at the granularity and specifics of interaction. I understand gesture to refer to integrated 'non contact' sets of movements of hands, fingers, arms, and facial expression and is received through sight (Bezemer, 2013). While I take touch to rely on the contact of the maker of the sign – usually through hands or fingers (and the mouth in the case of very young learners) - with 'another' (I will expand on this 'another' later in this section).

For something to count as a mode it needs have a set of semiotic resources and organizing principles that are recognized within a community as realizing meaning. For example, the resources of gesture have been semiotically shaped into communicative modes to serve a diverse range of communities (e.g. hearing-impaired communities, visually and hearing impaired people, ballet dancers). For a particular set of semiotic resources for making meaning to be considered a mode, it needs to meet the requirements of Halliday's theory of meaning. He developed three Metafunctions to describe the functions of language: the 'ideational' (subject matter), the 'interpersonal' (to enact social relations and create a stance to the world) and the 'textual' (to organize and create coherence). The metafunctional principles are adopted to understand the functionalities and underlying organization of semiotic resources and to investigate the ways in which semiotic choices interact to create meaning in multimodal texts and interaction. One 'test' for whether a set of resources 'counts' as a mode is that the three Hallidayan 'metafunctions' (Halliday, 1978) are realized. Definitions of mode continue to be refined and developed. However, it is important to note that what a mode is

continues to be subject to debate. One response to this is that definitions of mode are dependent on what are counted as well-acknowledged regularities within any one community. Using these criteria it is clear that touch is already a mode for certain social groups: people who use the 'tactile sign' system are likely to have a secure grasp of the range and potentialities of touch, whereas this might not qualify as a mode amongst others who may not have access to and knowledge of these resources and their 'affordances'.

Using Halliday's concept of mode, Bezemer and Kress (2014) suggest that for touch to become effective as a mode it needs to meet the following three conditions:

> (a) Touch communicates something (e.g. tapping on a person's shoulder may mean 'well done' or 'can I have your attention please'): this meets Halliday's ideational metafunction
>
> (b) Touch is designed for one or more specific others and someone is addressed (e.g. a handshake): this meets Halliday's interpersonal metafunction
>
> (c) Touch is coherent with signs made in the same and other modes in forming a complete semiotic entity, an interaction (e.g. a handshake accompanied by saying 'nice to see you again'): this meets Halliday's (inter)textual function.

This does not require touch to have the same realizational features as other modes, rather the expectation is that for touch to be considered a mode it should be able to realise meanings in the three metafunctions. Bezemer and Kress suggest:

> 'We can distinguish between communities in which touch is weakly developed, has limited semiotic reach or 'communication radius' and communities in which touch has been developed into a mode which is highly articulated, with extensive reach.'

The concept of communication is essential to the NLG manifesto, and here I turn to the question of whether or not it is possible to discuss touch as a form of communication. Bezemer and Kress suggest that in order for touch to be considered a communicative mode it needs to be 'designed as a message', 'addressed' to a community, and to be 'treated as having meaning' to be 'interpreted': suggesting that this is touch that happens between people. For Bezemer and Kress (2014) touch as mode *always* involves tactile means of addressing another human:

> Where two or more participants are involved, touch often relies on a dual materiality: visible and tactile. Each of these materialities has distinctly different potential. When both materialities are 'exploited' to communicate, as in shaking hands, or when only the tactile materiality is 'exploited', as in tactile signing,

touch can develop into mode. (Bezemer and Kress, 2014)

Other commentators within multimodality, however, work with a broader conception of mode and touch communication and suggest that meaning is communicated through 'our tactile interaction with other beings and objects in our world' (Cranny Francis, 2011: 465). Norris (2012), for example, includes the potential of touch communication with people, objects and animals. In a multimodal ethnographic study of horse riding she observes lessons in which a rider communicates with a horse primarily through the mode of touch. A key aspect of learning to ride is to learn how to touch the horse and how to feel the horse's response to the rider's touch. Norris explores touch via a focus on foot leg and hand movement within the broader multimodal frame of interaction in the horse-ridding lesson. This highlights that touch is a mode that can involve the whole body. She shows a sequence in which the riding instructor demonstrates both the incorrect and the correct 'touch-response-feel' expected. Norris distinguishes between acts of 'touch', 'response' and 'feel'. She notes that a sequence of touch-response-feel happens between two social actors, and she suggests that a social actor may be either another human or an object. I want to argue here that it is not the object that is 'acting' rather it is the social intentions of the object's designer imbued in the object. The programming of digital touch technologies raises questions for what interaction is and how an object can 'act'. For example, some digital clothing or devices vibrate to give a player physical feedback in specific contexts. The idea of 'responsive objects' is a feature of Cranny-Francis's work on technology and touch (2013). She suggests that meanings are 'potentially activated when we touch [objects or others], although the nature of the particular interaction determines which meanings are deployed and to what ends.' She goes onto suggest that 'by exploring those meanings we are able to map the potentials that are available in every tactile encounter and how they might be mobilized to create the most effective and/or rich interaction.' (ibid). This notion connects with the multimodal understanding of artefacts as material traces of the work of those who made them. That is the object itself is not seen as agentive, but rather full of meaning potentials that can be activated via interaction.

This exploration of touch as a mode connects with the NLG paper and other early multimodal explorations that set out to map the modal qualities, materiality and semiotic potential of emergent modes, and to investigate whether, and under what conditions, they fulfilled the criteria of being a mode. In the case of sound (van Leeuwen, 1999) and colour (Kress and van Leeuwen, 2001) the answer was in some social contexts of usage colour and sound were fully articulate modes; in others they exhibited 'mode-like' qualities and potentials when used in combination with other modes. More recently the resources of sound and colour have been extended and used in some new ways, particularly in combination with digital mediation. The same appears to be the case for touch, at least at the moment of writing.

Touch can be a mode, an act of communication and a pedagogic resource. Touch can refer to contact that is human-to-human, human-to-animal, and human-to-

object/digital. Touch in digital environments involves a complex exploitation of touch including the potential for digital touch feedback that leads to felt responses: suggesting in other words that a touch-response-feel sequence is an aspect of encounters between humans, human and animals, and human to digital. Thinking of touch in this way brings three interconnected aspects of communication into focus:

1. The production of communicative digital touch artefacts: the process of producing the device itself is understood as a communicative one, the device is seen as designed with an imagination of its communicative context and user, and the traces of the designers work are embedded in the design of devices as a set of meaning potentials - that are a part of shaping communication.

2. Their interpretation: the ways in which people *interpret* these digital touch devices, what it is possible and not possible to communicate via them is an aspect of communication

3. The use of a device to engage with others: that is, how a user's engagement with a touch device is constrained/shaped though not determined by its design, by their user's interests and purpose, and its the context of use.

Key developments in the digital mediation of touch and its effects on touch

Touch is being drawn into and mediated by a wide range of technologies including tangible, haptic, wearable and material technologies. In this section I provide a brief overview of key developments in the terrain of touch as it is digitally mediated with a focus on communication and pedagogy in the broadest sense. The examples below are presented to help point to some of the varieties of interaction and texts that touch technologies will enable and in the style of NLG raises some questions, as yet unanswered, perhaps an agenda, for what might these mean for literacy and the negotiation of a multiplicity of discourses. The touch developments outlined below make new dimensions and designs of meaning newly available, and can be exploited for pedagogy, in the context of NLG's concern with changing working lives, public lives and private lives.

Haptic technologies rely on sensory or motor activity based on touch and kinaesthetic sensation to create the illusion of shape and textures. These blur the boundaries between people, objects and environments: shifting communication from co-present human-to-human interaction to activating surfaces that provide tactile feedback. For instance, the use of Vibro-tactile technologies, 'tixels' (or tactile pixels) can create new felt sensations, textures and differently intense tactile experiences (Hoggan, 2013). It has also been used to create interactive museum display cases in which users can feel an object's texture without actually touching them by sliding their finger on the glass. In other words the digital can be used to supplement a lack of touch or to heighten touch. The investigation of sensory engagement and authenticity in the provision of touch

experiences in museums has been a feature of research on the design and use of digital technologies. Notably the potential of digital touch technologies to extend and enhance sensory engagement within a museum using touch experiences. This shifts the learner from a passive visitor to an active participant and has the potential to re-configure their emotional and physical distance from museum artefacts, which in turn raises new potentials for visitors to encounter tactile experiences of the material qualities of the past as well as questions of authenticity and experience (Hurcombe, Dima and Wright, 2014).

Tangible technologies are 'graspable' technologies that depend on the physical manipulation of physical objects embedded with computational power and wirelessly linked to various forms of digital representation (Price, 2013: 307). Tangible technologies can extend or reconfigure the semiotic features of touch, deploying touch for new communicative purposes, where people and technologies are co-located. Tangible technologies can also be used to supplement and extend remote (i.e. at a distance) digital touch communication. The *inFORM* device is a shared tangible surface that three-dimensionally changes shape (Leithinger et al, 2014). It enables learners to interact with digital content in 'space', to manipulate, tweak or radically transform objects virtually across distance, even experience the sensation of holding hands with a person hundreds of miles away. The role of physical actions in learning has fostered enthusiasm for developing novel learning representations using emerging technologies such as tangibles. The ability to integrate technology into physical objects makes the importance of understanding how or even if these materials help children learn and understanding of how different forms of touch interaction will affect children's conceptual development (Manches and Price, 2011).

Advancements in material and wearable technologies draw the skin, the body's largest organ and the sensory receptor for touch into the realm of communication and learning. Textile sensors can be designed to supplement the loss of touch. The Touch Glove (Seeley, 2011) integrates a textile pressure sensor into a glove for people who have lost their tactile sensation to enable differences in pressure to be made visible by being 'translated' into light patterns embedded at the wrist of the glove. Wearable devices can also heighten touch and extend it into new domains, such as *Buzzwear* (Lee and Starner, 2010) a tactile display worn on the wrist that can transmit different tactile patterns that users can accurately identify. Such technologies can extend touch to communicate connection across distance. Such devices make use of existing face-to-face touch practices *and* herald new digital touch practices and semiotic affordances.

Technologies such as those outlined above draw different tactile resources and capacities into play and intensify how the sensorium itself is utilized and mediated (Jones, 2007:5). Just as the NLG called for us to understand the technological and organisational changes brought about by the visual, this chapter calls for a focus on the potentials of touch as it is digitally mediated for communication and pedagogy.

Looking forward

Building on the arguments of NLG I have argued that the changing social environment means that touch matters newly in the contemporary moment. I have shown that these changing conditions provide a basis from which to suggest that, at least some times, touch can be thought of as a mode. I have also shown that new digital developments are serving to supplement, heighten, extend and reconfigure the resources and practices of touch. Using the NLG concepts of materiality, modal affordance, and semiotic resource we can ask how are the sensory, material and physiological aspects of touch drawn into, shaped, and given social meaning. That is we can use multimodality to explore the boundary of the physiological, the semiotic and the social. In other words, how the physical is drawn into a social system of signifiers. Multimodality can help us to explore the effects this reimagining and remaking of touch in digital environments might have on the semiotic resources of touch. To explore the new potentials for who touches, what and how people touch, against a backdrop of digital globalized social relations. At a time of significant social and technological change and digital touch is becoming ever-more central to communication, an investigation of digital touch, what it is and might be, how it may newly constitute our experience of communication with close and distant others is timely and essential. Multimodality has the potential to bring a much-needed socially oriented analysis to examine the impact of digital touch on communication.

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