

As modern humans, we sleep on cushioned beds at night, wear shoes and multiple layers of clothing during the day, and communicate with far away friends and family via text messages. Our ancient ancestors on the other hand slept on the ground, felt the sun on their shoulders, walked barefoot across the earth, and talked, hugged, and “LOL’d” with friends and family face to face and body to body. While the differences between these two scenarios are multitude, there is one aspect of our physiology that spans the entirety of these interactions as well as approximately 22 square feet of our body surface: our skin and the tactile sense that it embodies. While early humans first began the process of covering their skin with good intentions, wearing the furs and skins of other animals conferred an adaptive advantage that allowed human populations to spread far beyond the ancestral homeland of prehistoric Africa, eventually our inventions took on a life of their own and it is only recently that we have begun to understand the unforeseen consequences of disconnecting our tactile sense from the world around it. In my talk, I first address the question: What is the structure and function of the tactile sense in the human organism? Next, I explore the historical and evolutionary significance of touch in human social interactions. I then discuss the various factors that have led to us becoming out of touch and the very real health consequences of this evolutionary mismatch. I then close my presentation with an exploration of the various methods by which we can reconnect to our tactile sense, and in doing so, improve our health and vitality.

What is the structure and function of the tactile sense in the human organism?

Touch, along with sight, hearing, smell, and taste, is one of the five classic senses, but unlike the other senses whose function is mediated through a localized concentration of receptors in a specific organ (the eyes or tongue for example), the sense of touch is a distributed system, with multi-sensory receptors embedded throughout the entirety of the human body [1]. In a given square inch of epidermis you may, on average, find 50 heat receptors, 8 cold receptors, 100 touch receptors, and 800 pain receptors all of which contribute to the subjective bodily sensations associated with touch. Additional touch receptors in the joints and connective tissues respond to stretching and tension and allow for the perception of our body’s location in space [2].

When a touch receptor is stimulated, afferents nerves send a signal first to the spine, where reflex pathways can be initiated via interneurons, and then along to the area of the brain known as the cerebral cortex [3] [4]. If you were to map the cerebral cortex areas devoted to processing the sense of touch in various body parts, you would see that the face, hands, and feet are overly represented versus the rest of the body[5]. Visual representations of this model of the human sensory experience are described as homunculi, Latin for “little man” [6].

Through haptic exploration, the perception of touch gives us direct access to the outside world [7]. With an awareness of where our body is, and where it is not, we are able to interact with other people, places, and things.

What is the evolutionary and historical significance of touch?

Scientific studies of microscopic worms, rats, and higher organisms, up to and including humans, show that regular touch between our bodies and others is essential for proper development [8]. A lack of touch impairs the normal growth and functioning of infants, and as we mature and enter adulthood, touch remains important. Researchers at DePauw University and University of California Berkeley found that touch is able to communicate six distinct emotions; anger, fear, disgust, love, gratitude, and sympathy [9]. Touch was also found to amplify the emotions expressed on the faces of study participants [10].

Human social touch evolved out of primate grooming behaviour, and although vocal communication features more prominently in our species than it does in other primates, the social structure of the tribe would have involved a high degree of interpersonal contact [11]. Studies of !Kung child rearing show that infants had near constant skin to skin contact with their mothers and weaning would not occur until four years of age [12]. !Kung children were also in regular contact with fellow tribe members. Positioned on their mother's hip, they had regular eye contact and face to face interactions with adolescent girls and were even passed around the fire, bounced, sung to, and held by everyone in the tribe [13]. Contrast this scenario to a modern infant who experiences the world strapped into a rolling baby carrier, and the insidious depletion of interpersonal touch and tactile sensation begins coming into view.

How did modern humans get “out of touch” and become disconnected from their tactile sense?

Going beyond baby strollers, there are numerous other ways that our tactile experience has been compromised by technology. In stark contrast to our hunter-gatherer ancestors whose social communication were conducted via analog methods like touch, voice, and physical presence, most of our modern social interactions are communicated digitally. Roughly 49% of American teens say text messaging is the most common way they get in touch with their closest friends and 57% of teens report that the internet is where they primarily make new friends [14]. While physical touch releases the bonding hormone oxytocin, digital interactions drive spikes of the reward hormone dopamine.[15] [16]. Seeking ever greater surges of dopamine, heavy social media users can become addicted to the “likes” and “follows” found online. Some studies have even shown that social media users can experience withdrawal symptoms when they attempt to stop interacting online [17]. By trading oxytocin for dopamine, the modern human experiences social interaction an evolutionarily novel way, biochemically short circuiting the feelings of connection and bonding that we are meant to feel and replacing them with compulsive taps on a touch screen.

In another break from our Paleolithic past, advances in building construction have allowed us to spend increasing amounts of time indoors. It is estimated that the average American is almost always inside, so much so that hypovitaminosis D, a vitamin D deficiency exacerbated by a lack of direct sun exposure, is reaching epidemic levels [18] [19]. In addition to excessive amounts of indoor time, modern humans are also more likely to live in abodes that are physically distant from one another, with members of the same family often residing many thousands of miles apart. A full 18 percent of senior citizens report living alone, a far cry from the tribe of close and

extended family that would have supported our ancestral elders. This extreme physical separateness from one's close family, is likely to be one factor in the feelings of loneliness that plague many young and old alike [20].

Approximately 170,000 years ago, after billions of years spent naked, human beings became the first animal, perhaps excepting the hermit crab, to take on the skins of another animal in order to protect itself from the environment at large [21]. With this newfound ability, our ancestors migrated out of temperate Africa and into colder climates, eventually establishing a global population that managed to thrive in all but the most inhospitable climates. As society evolved, so did our apparel, and from humble pelts and homespun garments, a \$1.7 billion dollar industry emerged. In the past 100 years alone, natural fibers have been replaced with fabrics made from synthetic polymers, and despite the versatility and utility of synthetics, there is evidence that suggests that the friction, heat/moisture retention, and chemicals in modern clothes can irritate the skin, disrupt bacterial populations, and may increase the likelihood of developing skin conditions like dermatitis [22] [23].

Finally, societal inhibitions around social touch have led to the rise of “touch-phobia”, a fear of public displays of platonic, physical affection [24]. Western culture in particular is touch-phobic. In many parts of Asia and the Middle East men will hold the hand of a friend while taking a walk or engaged in conversation. In the West however, fears of being seen as homo-sexual create an environment where all forms of physical contact between men are viewed with suspicion [25]. As mentioned previously, physical touch releases the bonding hormone oxytocin, so this cultural prohibition against physical touch between men is literally changing the biochemistry of their interpersonal interactions. Of course, men are not exclusively impacted by “touch-phobia”, women too are impacted by prohibitions against physical contact, but it may manifest in different forms. In tribal societies, breastfeeding is practiced openly, in full view of other tribe members, and often continues until early childhood. In perhaps the most egregious example of an “out of touch” society, in 21 U.S. states it is still possible for a woman to be ticketed if she breastfeeds in public [26].

Reconnecting with the tactile sense through massage, barefoot walking, and other methods.

Despite having the technological, geographical, economic, and societal odds stacked against us, it is possible for us modern humans to enhance our tactile experience, bond more deeply with our “tribe”, and experience the health benefits of physical touch.

As little as 10 minutes of noontime sun exposure can boost vitamin D levels in the body, providing an important source of the essential vitamin that persists in the body nearly twice as long ingested forms of vitamin D [27] [28]. Improved vitamin D status is protective against cancer, heart disease, hypertension, obesity, diabetes, depression, and other disease states [29]. In Japan, a practice called shinrin-yoku (“forest bathing”) has emerged with trained practitioners leading participants through mindful wilderness experiences [30]. Studies of the

method have shown that a session of shinrin-yoku can decrease levels of the hormone cortisol and lower blood pressure [31].

Massage is another easily accessible way to increase the quantity, and quality of physical touch. Although the study of massage as a clinical intervention is complicated by the difficulty of establishing double-blind controls, preliminary research has shown that massage not only decreases cortisol and increases the bonding hormone oxytocin, it can also be an effective treatment for chronic low back pain [32] [33]. Other research has shown that the giving of a massage also provides health benefits. Even among professional massage therapists, subjective levels of anxiety and stress were reduced after the delivery of a massage therapy session [34].

Like massage, barefoot walking is a practice that can easily be incorporated into one's daily routine. All that barefoot walking requires is to take off one's shoes and to explore their immediate surroundings unshod. Dense with nerve endings, the feet will automatically respond and react to the surfaces they are exposed to, and, as the barefoot walker becomes more comfortable, with the practice, they can start to transition into barefoot jogging and running. Compared to habitually shod runners, barefoot runners experience reduced collision forces with the ground and over time, this could translate into increased orthopedic longevity and a reduction in the incidence of running related injuries [35].

Conclusion

The human body evolved in an environment rich in tactile sensations. From infancy to old age, we were held, stroked, cradled, and hugged. These haptic interactions kept us awash in bonding hormones, boosted our immune systems, and helped us heal. Despite the fact that many of us live in technologically advanced, but touch deficient societies, we can actively work to increase the quality and quantity of touch in our lives. Whether it is taking a barefoot walk, getting a massage, or holding hands with a beloved friend, closing this tactile gap on a daily basis will give your body the tactile enrichment it needs in order to provide you with a healthy, vibrant, and connected life.

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