

**UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION**

TODD ASHKER, et al.,

Plaintiffs,

v.

GOVERNOR OF THE STATE OF
CALIFORNIA, et. al.,

Defendants.

Case No.: 4:09-cv-05796-CW

CLASS ACTION

Judge: Honorable Claudia Wilken

EXPERT REPORT OF DR. DACHER KELTNER, Ph.D.

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I. PROFESSIONAL BACKGROUND

1. I am the Thomas and Ruth Ann Hornaday Chair in Positive Psychology at the University of California Berkeley, director of the Berkeley Social Interaction Lab (<http://socrates.berkeley.edu/~keltner/>), and Faculty Director of the Greater Good Science Center (<http://greatergood.berkeley.edu>). My full *curriculum vitae* can be found in the Appendix to this Report.

2. I received my BA in Psychology from the University of California, Santa Barbara in 1984 and a PhD in Psychology from Stanford University in 1989. After a 3-year NIMH-funded post-doctoral fellowship at the University of California, San Francisco, in 1992 I took my first academic job, at the University of Wisconsin-Madison, and joined the Department of Psychology at the University of California, Berkeley in 1996, where I am a full professor.

3. My research focuses on the biological and evolutionary origins of emotion, emotional communication, and social hierarchy. I study the mechanisms of social interactions – touch, facial expression, and human voice – and how these mechanisms contribute to the individual's social adjustment and mental and physical health. I have published over 190 scientific articles and chapters, many of which are in the premiere journals of the field (e.g., *Proceedings of the National Academy of Sciences*, *Journal of Personality and Social Psychology*, *Psychological Bulletin*, *Psychological Review*) and have been cited hundreds, and on a few occasions, thousands, of times in the scientific literature. I have received three national awards for my research, three awards for my teaching and mentoring, and over \$10,000,000 in grant support from several foundations to fund the Berkeley Social Interaction Laboratory. In the field, I served as an editor for two journals. About 20 of my former students are now professors at

colleges and universities around the world. I have authored over 35 specific articles on the human voice, facial expression, and touch, and taught this science to over ten thousand health care providers. The “Science of Happiness” Massive Online Open Course (MOOC), which I co-taught and hosted on EdX, has had over 175,000 people enroll worldwide to this date. I am also the co-author of two textbooks, as well as *Born to Be Good: The Science of a Meaningful Life*, and *The Compassionate Instinct*, and have written for the *New York Times Magazine*, *The New York Times*, *The London Times*, *The Wall Street Journal*, and *Slate*. A complete list of all my publications from the last ten years is included in my curriculum vitae.

4. I have been retained by counsel for the Plaintiffs in *Ashker et. al. v. Governor of California* to provide an expert opinion on the science of touch and, in particular, the deprivation of touch as an aspect of social isolation. My opinion on these topics is based on a number of sources. In addition to my own publications and lab work, I have reviewed the extensive published literature that addresses the importance of touch and the effects of its deprivation. In addition, I have been provided with a set of documents that pertain to the use of solitary confinement at the Pelican Bay SHU. These include: the depositions of Clark Ducart (esp. pp. 108-110, 155), Tracy Puget (esp. pp. 142-145), and Greg Lewis (esp. pp. 52-53, 105), Plaintiffs' Second Amended Complaint (Docket No. 136), Defendants' Answer to Plaintiffs' Complaint (Docket No. 194) (esp. paras. 48 and 66), CDCR Operational Procedure No. 222 (Exhibit 4 to Ducart Depo.) (esp. pages 17-21 re showering), SHU Inmate Orientation Handbook (Exhibit 8 to Ducart Depo.) (esp. page 13), COMPSTAT DAI Statistical Report (esp. pp. 129-130), California Code of Regulations, Title 15, p. 95, subsection (f), p. 102, section

3177(b)(1)(B)(2), and p. 170, section 3343(f).

5. My rate of compensation for all work on this case is \$150 per hour.
6. I have never been an expert witness or consultant in a lawsuit before.

II. THE SCIENCE OF TOUCH

7. From the first moment of life, touch – the most well-developed sensory modality at birth – is a form of communication that enables individuals to relate to one another, form social ties, and integrate into groups and communities.¹ At its core, touch communicates social support to others. Human relations, health, and well-being depend critically upon the quality of touch an individual experiences in everyday social interactions.

8. Some species of nonhuman primates spend upwards of 10 to 15% of their waking hours grooming one another. In humans, touch is just as fundamental a form of communication, and often so elemental that we can fail to notice its centrality to social interaction. Scientific studies, though, have documented universal patterns of social touch, in which one individual intentionally touches another.² Specific patterns of touch that commonly occur throughout the day are a foundation of parent-child attachments: soothing, tickling, skin-to-skin contact, rough-and-tumble-play, and reassuring contact are building blocks of close ties between parents and children. Social touch is essential to the strength of sibling relations, for it is a basic element of play routines, conciliatory behavior following conflicts, and expressions of affection. Friends rely on tactile contact to create cooperative alliances and a sense of trust and good will. Touch is a language in

¹ Linden, D. J. (2015). *Touch*. New York: Penguin Press.

² Eibl-Eibesfeldt, I. (1989). *Human Ethology*. New York: Aldine de Gruyter.

which we build strong relations with one another. To touch and be touched by others is perhaps the most basic way in which humans recognize the dignity of one another.

A. The Tactile System: From Hand to Skin to Brain to the Neurophysiology of Health and Well-being

9. Social touch involves a complex system that has been shaped by mammalian evolution. The human hand, more dexterous than that of our primate relatives, is remarkably suited to many kinds of touch with its flexible digits (chimpanzee hands have much shorter, less adroit fingers). When the hand touches the skin, it is making contact with the heaviest organ in the human body, weighing upwards of 6 to 8 pounds, which includes tens of millions of cells organized in three different layers.³ Underneath the surface of the skin are immunological cells, which are a first line of defense against toxins, as well as cells that encode information about the location, pressure, and speed of different forms of tactile contact. Tactile contact to the skin is processed in a large region of the cortex known as the somatosensory cortex, which represents the area on the body that has been touched. Tactile contact then triggers activation in regions of the peripheral nervous system, which is the system of neurochemical networks below the midbrain that include the vagus nerve and the hypothalamic-pituitary-adrenal axis, which regulate the human stress response, fight-or-flight behaviors, digestion, and immune system function.

B. The Sophisticated Language of Tactile Contact

10. Social touch involves a complex language of tactile behaviors that structures social interactions frequently throughout the typical day. For example, studies from our Berkeley Social Interaction Laboratory find that with half-second touches to a

³ Jablonski, N. (2006). *Skin: A Natural History*. Berkeley, CA: UC Press.

stranger's forearm -- who is positioned on the other side of curtain -- an individual can communicate anger, fear, disgust, gratitude, compassion, and love.⁴ This study documented over 20 kinds of tactile behavior people intuitively use to communicate emotion, with variation in pressure, timing, location, and duration. Tactile contact involves hundreds of specific behaviors, which are critical to social processes such as greeting, consolation, play, calming, soothing, encouragement, and support.

C. Tactile Contact Provides Social Support within Social Interactions

11. Touch is a fundamental aspect of social interaction, which is a fundamental human need.⁵ Social touch serves three vital functions within human interaction, which together provide the recipient of touch with the sense of social support and social integration.⁶ First, social touch calms the recipient of the touch during stressful experiences. For example, in one study infants' heels were surgically cut by medical doctors.⁷ In one condition, infants were held by their mothers; in the other, they underwent the procedure while being swaddled in a crib. The infants who were touched during the procedure cried 82% less than the comparison infants, they grimaced 65%

⁴ Hertenstein, M. J., Keltner, D., App, B., Bulleit, B. A., & Jaskolka, A. R. (2006). Touch communicates distinct emotions. *Emotion*, 6, 528-533.

⁵ Baumeister, R.F. & Leary, M.R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117, 497-529.

⁶ Hertenstein, M., Verkamp, J.M., Kerestes, A.M., & Holmes, R.M. (2006). The communicative functions of touch in humans, nonhuman primates, and rats: A review and synthesis of empirical research. *Genetic, Social, and General Psychology Monographs*, 132, 5-94.

⁷ Keltner, D. (2009). *Born To Be Good: The Science of A Meaningful Life*. New York, NY: W.W. Norton & Company.

less, and they had lower heart-rate.⁸ In nonhuman primates, grooming reduces heart rate and displacement activities related to stress, such as striking others.⁹ Social touch reduces stress through its effects upon specific branches of the nervous system. Studies find that friendly tactile contact can reduce activation in threat-related regions of the brain. In one relevant study, participants anticipated experiencing a stressful stimulus (electric shock), which activated threat-related regions of the brain, except in participants being touched on the hand by someone close to them.¹⁰ Social touch can influence activation in the stress pathway in the nervous system, reducing levels of the stress hormones: Rat pups who are handled extensively by their mothers show reduced activity of the hypothalamic, pituitary adrenal axis, which is involved in stress responses, and reduced corticosterone, a stress-related hormone, both immediately and when they are mature.¹¹

12. Alongside its soothing function, a second function of touch is to signal safety, that others in the environment are supportive and not threatening. This critical function of touch paves the way for exploration, cooperation, and ultimately, better health and well-being. Touch is a primary means by which parents signal to infants people or

⁸ Gray, L. (2000). Skin-to-skin contact is analgesic in healthy, new-borns. *Pediatrics*, 105, 14-20.

⁹ Aureli, F., Preston, S., & de Waal, F.B.M. (1999). Heart rate responses to social interactions in free-moving Rhesus Macaques (*Macaca Mulatta*): A pilot study. *Journal of Comparative Psychology*, 113, 59-65.

¹⁰ Coan, J. A., Schaefer, H. S., & Davidson, R. J. (2006). Lending a hand: Social regulation of the neural response to threat. *Psychological Science*, 17, 1032-1039.

¹¹ Francis, D. & Meaney, M.J. (1999), Maternal care and the development of stress responses, *Development* 9, 128-34.

contexts that are safe and those that pose peril, and even more fundamentally, a means by which parents develop strong attachments to their offspring. Outside of the familial context, one finds ample evidence of the means by which social touch signals safety, and elicits more collaborative behavior. For example, one study found that the right kind of supportive, social touch – e.g., a pat on the shoulder – from a teacher led students to be more likely to try work on problems, when compared to students in appropriate control conditions.¹²

13. Once again, we can understand these safety-signaling effects of social touch by turning to scientific studies of the neurophysiological effects of touch. Supportive social touch can activate the vagus nerve, the largest bundle of nerves in the human body. The vagus nerve originates in the brain stem and wanders through the body, connecting with muscles in the throat and head, reducing cardiovascular arousal, and regulating digestive and immune processes. The vagus nerve – a focus in scientific inquiry in the Berkeley Social Interaction Laboratory – enables communication, trust, cooperation, sharing, and strong social connections.¹³ When friendly social touch activates the vagus nerve, the individual is predisposed to feel calm, supported, and engaged in the social environment.

¹² Gueguen, N. (2004). Nonverbal encouragement of participation in a course: The effect of touching. *Social Psychology of Education*, 7, 89-98.

¹³ Keltner, D., & Lerner, J. (2010). Emotion. In *The Handbook of Social Psychology* (pp. 312-347). S. Fiske & D. Gilbert Eds. New York, NY: McGraw Hill Publishers. Keltner, D., Kogan, A., Piff, P., & Saturn, S. (2014). The Sociocultural Appraisal, Values, and Emotions (SAVE) Model of Prosociality: Core Processes from Gene to Meme. *Annual Review of Psychology*, 65, 425-460.

14. There are many studies establishing a third function of positive touch, that it increases cooperation. This thesis was first explored in studies of grooming in nonhuman primates, which various species do throughout the day and with surprising regularity. Nonhuman primates groom to facilitate cooperation. For example, chimpanzees are more likely to share food with other chimpanzees who groomed them earlier in the day, suggesting that touch is a medium in which chimpanzees, and other primates, form relationships defined by reciprocal assistance.¹⁴ The same is true of humans: the right kind of social touch increases cooperation.¹⁵ In one study, participants were asked to sign a petition in support of a particular issue of importance locally.¹⁶ Those participants who were touched when asked to sign were much more likely to comply (81%) than participants who were not touched during the request (55%).

15. Once again we can understand these benefits of touch – increasing levels of cooperation – by considering the neurophysiological effects of tactile contact. Pleasing social touch increases activation in the orbitofrontal cortex, a region of the frontal lobes that is involved in the experience of social rewards (e.g., being esteemed by others), and that helps coordinate social behavior with others.¹⁷ Pleasing social touch has been found to stimulate the release of oxytocin, a neuropeptide produced in the

¹⁴ de Waal, F. B. M. (1996). *Good Natured: The Origins of Right and Wrong in Humans and Other Animals*. Cambridge, MA: Harvard University Press.

¹⁵ Kurzban, R. (2001) The social psychophysics of cooperation: Nonverbal communication in a public goods game, *Journal of Nonverbal Behavior*, 25, 241-259.

¹⁶ Willis, F.N.& Hamm, H.K. (1980) The use of interpersonal touch in securing compliance, *Journal of Nonverbal Behavior* 5, no. 1, 49-55.

¹⁷ Rolls, E. (2005). *Emotions Explained*. Oxford: Oxford University Press.

hypothalamus and that is distributed through the brain and peripheral nervous system.¹⁸ Elevated levels of oxytocin are associated with increased trust, cooperative behavior, sharing with strangers, the more effective reading of others' emotions, and more constructive conflict resolution.¹⁹ Social touch – the right kind, i.e. supportive human touch – shifts the neurophysiology of the individual in profound ways, and in ways that make for stronger and more trusting social ties, and the enduring sense that one is supported by others.

D. Touch Interventions Improve Physical Health

16. Given how central social touch is to human relations and the direct effects touch has upon the HPA axis, the vagus nerve, and the release of oxytocin, touch interventions have been developed and tested within several settings.²⁰ Dozens of studies have now systematically assessed the benefits of massage therapies for preterm babies. Premature birth is accompanied by lower birth weight, which is one of the most significant predictors of long-term health problems, and a multi-billion dollar problem for the United States. Premature birth is often accompanied by little social touch with the mother, which in part accounts for its influences upon poor health. Studies comparing massage therapies for preterm babies to appropriate controls have found that massage leads to significant gains in weight (47% in an early study), increased insulin, better

¹⁸ Morberg, K.U. (2003). *The Oxytocin Factor*. Cambridge, MA: Cambridge University Press.

¹⁹ Keltner, D., Kogan, A., Piff, P., & Saturn, S. (2014). The Sociocultural Appraisal, Values, and Emotions (SAVE) Model of Prosociality: Core Processes from Gene to Meme. *Annual Review of Psychology*, 65, 425-460.

²⁰ Field, T. (2001). *Touch*. Cambridge, MA: Cambridge University Press.

gastric motility, increases in activation of the vagus nerve, and observations that the preterm baby is more attentive and less fussy.²¹

17. Touch interventions are being used with pregnant women, who are vulnerable to forms of chronic pain and higher rates of depression. These studies have yielded impressive results. Studies find that compared to appropriate controls, massage therapy leads to less depression, anxiety, and back pain in preterm women, and across studies, a 31% drop in the stress hormone cortisol.²²

18. More generally, touch interventions are increasingly being used to respond to different health complications, including immune problems, asthma, and various kinds of cancer. The results of the studies are consistent and robust: Touch therapies for people enduring different diseases have been found to lead to reduced pain, migraines, fibromyalgia, and inflammation markers, and increases in natural killer cells, a critical part of the immune response.²³ Supportive, caring social touch is a direct contributor to the physical and mental health of the individual.

E. Touch Deprivation Strips People of Social Support and Causes Significant Harm

19. Social touch is a physical manifestation of social support, which refers to the perception that one is cared for, has assistance available from other people, and is

²¹ Hertenstein, M. & Weiss, S (2011). *The Handbook of Touch: Neuroscience, Behavioral, and Applied Perspectives*. New York: Springer Publications.

²² Field, T. (2011). Massage therapy: A review of recent research. In M. Hertenstein & S. Weiss Eds (2011). *The handbook of touch: Neuroscience, Behavioral, and Applied Perspectives*. New York: Springer Publications.

²³ Field, T. (2011). Massage therapy: A review of recent research. In M. Hertenstein & S. Weiss Eds (2011). *The Handbook of touch: Neuroscience, Behavioral, and Applied Perspectives*. New York: Springer Publications.

integrated into a social network. Through social touch people communicate in the most basic way that they support other individuals. The absence of social support has been found to be a primary trigger of chronic stress, which produces hypertension, chronic pain, hopelessness, the sense of little control, depression and anxiety, diabetes, the acceleration of the effects of disease, weight gain, sleep disruption, digestive problems, and the premature aging of DNA.²⁴ The absence of social support amplifies the problematic effects of isolation and rejection, which include increased body pain, aggression, compromised intellectual function, reduced self-esteem, feelings of humiliation, and increased likelihood of mortality.²⁵ Given these patterns of findings, social touch, the physical manifestation of support, has been found to yield benefits for physical and mental health. These benefits of social touch are readily understood in terms of the neurophysiological effects of touch considered earlier in this report. The extreme deprivation of social touch, it follows, will reliably produce marked physical and mental health problems.

²⁴ Dickerson, S.S., & Kemeny, M.E. (2004). Acute stressors and cortisol response: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, 130, 355-391. Coriell, M., & Adler, N.E. (2001). Social ordering and health. In B. S. McEwen (Volume Editor) and H.H. Goodman (Section Editor), *Handbook of Physiology: Section 7: The Endocrine Section* (pp. 533-546). New York: American Physiological Society and Oxford University Press. Dickerson, S.S., Gruenewald, T.L., & Kemeny, M.E. (2011). Physiological Effects of Social Threat: Implications for Health. In J. Cacioppo & J. Decety (Eds.), *Handbook of Social Neuroscience*, 787-803. New York: Oxford University Press. Epel ES, Lithgow GJ. (2014). Stress biology and aging mechanisms: toward understanding the deep connection between adaptation to stress and longevity. *Journal of Gerontology and Biological Science*, 69:S10-6.

²⁵ Williams, K.D. (2007). Ostracism. *Annual Review of Psychology*, 58, 425-452. Pantell M, Rehkopf D, Jutte D, Syme SL, Balmes J, Adler N. (2013). Social isolation: a predictor of mortality comparable to traditional clinical risk factors. *American Journal of Public Health*. 103(11):2056-62.

20. Studies do indeed find that when individuals from infancy through old age experience a notable lack of social touch, they are vulnerable to various physical and mental problems. An early study found, for example, that babies raised in an orphanage and lacking in human contact compared to those raised in a prison nursery who were regularly held by their mothers lagged significantly behind in basic development – they had difficulties with language, walking, and social engagement, and showed less robust physical health.²⁶ Harry Harlow’s studies shortly thereafter found that monkeys raised in social isolation developed in profoundly abnormal ways, unable to interact with peer monkeys when given the chance.²⁷ More recent studies of orphans who were raised in touch-deprived, isolated conditions in Romanian orphanages are finding that those orphans are disturbingly vulnerable to stunted physical maturation, troubles with language, social dysfunction and a lack of ability to engage with others, and, in some cases, reduced development of the frontal lobes.²⁸

21. In other institutions, where touch has been stripped away, the experience lacks social support and is disorienting, isolating, and damaging. For example, it has been recognized that elderly adults living in nursing homes can often be touch-deprived, and health practitioners have made the case that this touch deprivation contributes to the

²⁶ Spitz, R. (1945). Hospitalism. *Psychoanalytic Study of the Child*, 1, 53-74.

²⁷ Harlow, H.F. (1959). Love in infant monkeys. *Scientific American*, 200.

²⁸ Chugani, H.T., Behen, M.E., Muzik, O., Juhasz, C., Nagy, F., Chugani, D.C. (2001). Local brain functional activity following early deprivation: A study of post-institutionalized Romanian orphans. *Neuroimage*, 14, 1290-1301.

mental and physical health problems that can be pervasive in these institutions.²⁹ As a result, touch interventions are now increasingly part of everyday care in many hospitals and nursing homes, and other forms of touch that occur in normal socializing can produce the same improvements.³⁰ In addition, there are numerous studies that have examined the efficacy of touch interventions in people suffering from dementia in institutionalized settings.³¹ This work finds that brief forms of tactile contact can reduce the agitation and negative emotion associated with dementia. These therapies have also been found to improve cognitive function and reduce biomarkers of stress.

22. Additional recent studies highlight the problems associated with touch deprivation, even of a less severe kind than the nearly absolute touch deprivation that characterizes certain institutions. Children who are touched less by their parents tend to show patterns of insecure attachment, showing less confidence in their ties to their parents, which in turn is associated with an increase likelihood of anxiety, depression, aggression, and vulnerability to drug abuse and antisocial behavior.³² Studies with

²⁹ Gleeson, M., & Timmons, F. (2004). The use of touch to enhance nursing care of older person in long-term mental health care facilities. *Journal of Psychiatric Mental Health Care Nursing*, 11, 541-545.

³⁰ Field, T. (2001). *Touch*. Cambridge, MA: Cambridge University Press. Field, T. (2011). Massage therapy: A review of recent research. In M. Hertenstein & S. Weiss Eds (2011). *The Handbook of Touch: Neuroscience, Behavioral, and Applied Perspectives*. New York: Springer Publications.

³¹ Suzuki, M., Tatsumi, A., Otsuka, T., Kikuchi, K., Mizuta, A., Makino, K., Kimoto, A., Fujiwara, K., Abe, T., Nakagomi, T., Hayashi, T., & Saruhara, T. (2010). Physical and psychological effects of 6-week tactile massage on elderly patients with severe dementia. *American Journal of Alzheimer's Disease and Other Dementias*, 25(8), 680-686.

³² Feldman, R. (2011). Maternal touch and the developing infant. In M. Hertenstein & S. Weiss Eds (2011). *The Handbook of Touch: Neuroscience, Behavioral, and Applied Perspectives*. New York: Springer Publications. Main, M., & Stadtman, J.

nonhuman species find that touch-deprived rats show reduced growth hormone and are disrupted in their social relations with conspecifics.³³ Adolescent experiences with impoverished touch are associated with increased aggression and antisocial behavior later in life as adults.³⁴ Without healthy levels of supportive touch, humans and nonhumans are more vulnerable to problems in social adjustment and physical and mental health.

F. Summary and Conclusion

23. This robust science of touch now numbers in the hundreds of rigorous, peer-reviewed studies. It spans different ages, cultures, class backgrounds, ethnicities, and mammalian species, and has assessed psychological functioning at multiple levels of analysis, from self-reports to biomarkers of stress, immune system strength, and brain response. This literature converges on the general claim that through influences upon the nervous system, touch soothes during stress, signals safety, and is a trigger of social cooperation. Touch is a medium of strong relationships, and as a direct physical manifestation of social support, promotes health and well-being.

(1981). Infant response to rejection of physical contact by the mother. *Journal of the American Academy of Child Psychiatry*, 20, 292-307. Mikulincer, M., & Shaver, P. (2007). *Attachment in adulthood: Structure, Dynamics, and Change*. New York: Guilford Press.

³³ Cascio, C.J. (2011). Tactile dysfunction in neurodevelopmental disorders. In M. Hertenstein & S. Weiss Eds (2011). *The Handbook of Touch: Neuroscience, Behavioral, and Applied Perspectives*. New York: Springer Publications.

³⁴ Field, T. (2004). Touch deprivation and aggression against self among adolescents. In D. M. Stoff & E. Susman (Eds.), *Developmental Psychology of Aggression* (pp. 117-140). Bethesda, MD: National Institute of Mental Health. Field, T., *Violence and Touch Deprivation in Adolescents*, *Adolescence*, 37, 735-749 (2002); Field, T., (2005) *Deprivation and Aggression Against Self Among Adolescents*, in D. Stoff & E. Susman(Eds.), *Developmental Psychobiology of Aggression* (pp. 117-140). New York: Cambridge.

24. The science is clear: depriving humans of the ability to touch another human being denies them a basic form of social interaction critical to the functions of soothing in response to stress, creating a sense of safety, and fostering cooperation. Denying people the opportunity for caring touch deprives them of one of the most ennobling sources of purpose and meaning in human social life – contact and affection with family and community. Deprivation of this essential bonding opportunity strips individuals of their sense of social support, setting in motion patterns of chronic stress and distrust, which in turn often directly contribute to greater ill will and hostility. These cumulative effects of touch deprivation – the physical manifestation of social support – will contribute to chronically high levels of stress and cortisol, which have well-established links to the acceleration of multiple health problems and disease, as well as mental health difficulties.³⁵ Touch deprivation only amplifies the pronounced problems of social isolation.

Respectfully submitted,

March 11, 2015



Dacher Keltner, Ph.D.

³⁵ Sapolsky, R. M. (2004). *Why Zebras Don't Get Ulcers. 3rd Edition*. New York: Holt Publishing.

APPENDIX