Canadian Journal of Family and Youth, 10(1), 2018, pp 205-234
ISSN 1718-9748 © University of Alberta
http://ejournals.library.ualberta.ca/index/php/cjfy

Harlow's Famous Monkey Study: The Historical and Contemporary Significance of the Nature of Love

Phillip Radetzki

Abstract

If you were to contemplate what it meant to be *loved* or what exactly makes you *love* another individual, the brunt of your conceptualization may very well stem back to Harry Harlow's famous 1958 study, "The Nature of Love." At a time that approached love as a child's need to reduce primary drives via his/her mother, Harlow aimed to identify other variables that could explain the underlying affection of an infant-mother bond – such as contact comfort. To do this, Harlow conducted a series of investigations as part of a novel experimental design that used infant rhesus monkeys and a set of inanimate surrogate mothers. Not only did he propose a new social paradigm for family life, the role of mothers and fathers, and what it meant to be a *loving* parent in the process, Harlow distinguished himself as one of the most controversial experimental researchers in the history of psychology. The present paper explores the context of Harlow's academic career and the zeitgeists that marked his time while also providing an in-depth analysis of his landmark 1958 study, how his work has been interpreted for over a half-century, and factors contributing to his overall legacy.

Philip Radetzki will graduate this spring with an honours degree in psychology after five years of study at MacEwan University. His research interests are in the area of cognition and psychopathology and how concepts and methods from cognitive psychology can be used to refine cognitive-behavioural treatments for depression and anxiety disorders. As such, Philip plans to pursue further training in a clinical psychology graduate program. Meanwhile, as an undergraduate, Phillip has published a book review and is currently preparing a second manuscript for submission which discusses the approaches to assessment and treatment for Generalized Anxiety Disorder in children, adolescent, and adult populations.

Acknowledgements
The author would like to thank Dr. Nancy Digdon for agreeing to oversee this project. In addition to making the completion of this paper possible, Dr. Digdon's insightful revisions and suggestions proved to be invaluable in my development as an academic.

Introduction

Nearly every field has its handful of giants. For instance, Aristotle and Socrates shaped philosophy, Archimedes set the foundation for mathematics and engineering, Albert Einstein and Isaac Newton revolutionized physics, and Galileo and Copernicus led the way in astronomy. Most recently, one may very well hold Steve Jobs and Bill Gates to similar standards in terms of being the titans of modern technology. The field of psychology is no different. With William James' and Wilhelm Wundt's fundamental contributions to establish psychology as a science, Sigmund Freud's founding of psychoanalysis, and B.F. Skinner's radical behaviourism, many psychologists have undoubtedly left their mark on the field. Harry Harlow is another prominent figure whose accomplishments and lifelong dedication to psychology warrant him such regard. More generally though, it was Harlow's groundbreaking 1958 "The Nature of Love" study with infant monkeys and fake mothers that made him a household name.

Harlow (1905-1981) was an American psychologist born in Fairfield, Iowa. Perhaps like most students, Harlow first entered university with sights at a career completely different than the one he would ultimately have a fundamental impact on. However, Harlow's initial pursuit toward an English degree was quickly extinguished after he received a particularly poor grade. Although unsuccessful in English courses, Harlow nevertheless always displayed a passion for poetry and artistic writing (Blum, 2002). In fact, Harlow even included whimsical poems and sketches regarding the hippopotamus, rhinoceros, snake, elephant, and crocodile in his landmark paper, "The Nature of Love."

While not progressing in his English classes as well as he anticipated, Harlow excelled in his introductory psychology classes, which inspired his passion for psychology – a passion that would lead to a Bachelor of Art's degree in that field in 1927. Afterwards, Harlow did graduate studies in psychology at Stanford University. There, he held a teaching assistantship in social psychology and research assistantships in behavioural studies on rats. These positions served as the basis for Harlow's training as an experimental psychologist, as exemplified by his Ph.D. thesis on social facilitation and eating behaviours in rats.

Thereafter, Harlow accepted a position at the University of Wisconsin as an assistant professor, where he would quickly gain a reputation as not only one of the most effective and popular lecturers on campus, but also one of the most sought-after speakers in all of psychology (Sidowski & Lindsley, 1989). In addition to lecturing, Harlow conducted research as a comparative animal psychologist. Ironically, though, despite Harlow's glowing reputation, the university refused to provide him a research laboratory or research funding. This put Harlow is a very peculiar spot as an experimental researcher, as biographer Deborah Blum (2002) notes:

> He was a researcher with nothing to study. He was an animal psychologist without rats. At that moment, he could be compared to an astronomer without a telescope, a marine biologist with only a jar of distilled water to study (p. 68).

As a result, Harlow turned to the local Vilas Park Zoo in Wisconsin as a venue for his research, which, as we will later discuss, proved to be the perfect place to stimulate the very idea that would inspire one of the most famous studies in the history of psychology. Working from the local zoo, however, meant having to transport tables, trays, puzzles, and blocks for testing back-and-forth from the campus – a one-mile trek.

Naturally, Harlow outgrew the local zoo after two years and created his own primate lab in which he could keep his own animals and control his experiments in a convenient and much more *serious* manner. At this point, the university offered Harlow the old abandoned forest service property across campus (Blum, 2002). With such, Harlow recruited students and personally crafted a place not only to conduct research, but also one of the most famous studies in psychology. Thus, what would quickly become a premiere, cutting-edge primate laboratory started off with the humblest of beginnings.

After establishing his primate lab, Harlow became increasingly intrigued with the role of contact comfort in the development of an infant's affection for his/her mother. To objectively test the value of such contact, Harlow employed neonatal and infant macaque monkeys as subjects of analysis. Interestingly, when explaining why infant monkeys were selected instead of human infants, Harlow cites that "the monkey is more mature at birth and grows more rapidly; but the basic responses relating to affection, including nursing, contact, clinging, and even visual and auditory exploration, exhibit no fundamental differences" (p. 43). Accordingly, Harlow would create two inanimate surrogate mothers – one padded with cloth and the other comprised of bare wire-mesh. Both surrogate mothers, though, were heated, had faces intended to mimic real monkeys, and provided postural support, thus making the *quality* of contact the only way they differed. These artificial surrogate mothers were used as key instruments throughout a series of five investigations, which I will discuss in more detail later. In all, Harlow (1958) challenged the assumptions of the time that basic human needs are limited to aggression, defecation, food and water, oxygen, sex, and sleep (Seymour, 1963). Further, Harlow refuted the belief that the fulfilment of such needs is the basis of love between a

child and his/her mother. With such, he proposed a new social paradigm for family life, the role of mothers and fathers, and what it meant to be a *loving* parent. Notably, Harlow began his research under the recent shadow of World War II and the countless American men who had been sent away from home to fight. This left many American cities with vacancies in important factory positions, editorial jobs, and managerial roles that had been held by the men, while also giving women unprecedented access to non-combat military jobs. Consequently, as historian Emily Yellin (2004) describes, "…women all over this country from every walk of life learned they could accomplish things they had never been allowed or asked to try before" (p. xiv). Thus, as America experienced a taste of life beyond the traditional nuclear family model, Harlow became all the more determined to demonstrate that fathers, too, could effectively care for infants.

Today, Harlow's landmark 1958 paper can sometimes be regarded as a catch-22, taking a significant step forward within behavioural research while simultaneously taking a significant step backward within ethics. For instance, while summarizing Harlow's paper, Scientific American blogger Melanie Tannenbaum admits that even though what Harlow did to test his hypothesis was arguably ingenious, it was also inarguably cruel (2013). And this sentiment aligns with many academics, too. Singer (1975) was cited as calling Harlow's 1958 paper a "classic case example of exploitive, painful, and unjustified research," while Midgley (1981) used the powerful phrase "ethically thoughtless." In fact, Harraway (1989) concluded that Harlow's work should be classified as that of a sadist rather than that of a genius (as cited in Gluck, 1997, p. 150).

However, in Harlow's perspective, his research reflects a symbiotic advantage that improves infant monkeys' quality of life while also producing invaluable

experimental data. So overall, two completely opposite perspectives take form: one that perceives Harlow as an *evil* scientist and another as a more *responsible* genius. So, which view is *right* – was Harlow's work with monkeys an ethical debacle or an exemplary case of ethics in groundbreaking science? Similarly, what is Harlow's final legacy after 40 years of teaching, conducting research, and maintaining multiple sought-after positions on boards, committees, and journals? To answer these questions, we examine Harlow's personal history, his rise as a distinguished scholar of psychology, the experiences of his many former students, and the social and cultural factors that defined his time.

The Predominant Beliefs of the Time

Sigmund Freud's idea of basic human motives remained prominent among researchers decades after his death in 1939. With such, developmental psychologists of the 1950s explained the nature of affection as a series of learned affectional responses that generalized from the initial and intimate relationship between a child and his/her mother (e.g., Benedek, 1946; McKinney, 1949; Heathers, 1955; Gluck, 1997; Shaver & Mikulincer, 2006). More specifically, the affection between a child and a mother was believed to be exclusively dependent upon a reduction of primary drives – that is, the child initially experienced affection towards his/her mother as the direct result of being fed, hydrated, and relieved of pain. Furthermore, while popular rhetoric among scientists included the use of more obscure and technical language, Harlow employed terminology grounded in real-world, everyday experiences. For instance, de Waal (1989) notes a particularly interesting encounter between Harlow and a psychiatrist:

> Harlow used the term *love*, at which the psychiatrist present countered with the word *proximity*. Harlow then shifted to the word *affection*, with the psychiatrist again countering with *proximity*. Harlow started to

> simmer, but relented when he realized that the closest the psychiatrist had probably ever come to love was proximity (p. 14).

Unsatisfied with a lack of experimental research to support (or to refute, for that matter) the predominant assumptions of the nature of affection, Harlow sought to identify other variables that could explain the affection between a child and mother. For instance, why does child-mother affection persist throughout the child's life when the mother no longer reduces the child's primary drives? How does a father's affection for his child compare to the affection that a mother has for her child? Further, why do individuals continue to care for their parents once they have attained degrees of financial, emotional, and other independence? Harlow identified the need for sound experimental evidence to solve real-world concerns; he balanced the tough-mindedness needed for scientific rigor with the softmindedness needed to assess the state of society.

A Closer Look at the Study

Harlow's studies on contact-comfort and maternal-attachment took place at the Vilas Park Zoo with an initial focus on cortical lesions and delayed response tasks in rhesus monkeys (Harry F. Harlow: American Psychological Foundation Gold Medal Award, 1974). The zoo would separate baby rhesus monkeys from their mothers soon after their birth in effort to minimize disease upon the introduction of a new breeding program. Once separated, these orphan monkeys would cling to the pads in their cages, demonstrating aggressive and helpless behaviors whenever the pads were removed for cleaning purposes (see TheSassl, 2012, for original video footage). What's more, the infant monkeys placed in cages without padding would often struggle to survive past the first week of life (Harry F. Harlow: American Psychological Foundation Gold Medal Award, 1974). These disturbing observations led Harlow to engineer two different

surrogate monkey mothers – one of wire and one of cloth – with the intention of studying affectional responses to contact comfort. This would become the basis for the study that would later become a classic.

As previously mentioned, Harlow was intrigued with the role that contact comfort may play in the development of an infant's affection to his/her mother. More specifically, Harlow (1958) investigated the role of contact comfort as it relates to conflicts of: (1) dual-mother surrogate conditions; (2) measuring affectional bonds; (3) mothers as a source of security; (4) measuring the strength of affectional responsiveness; and (5) critical periods for the development of maternally directed affection.

In the first area of investigation, the conflict of a dual-mother surrogate condition, Harlow placed both a cloth mother and a wire mother in different sections of an infant monkey's cage. In one condition, only the cloth mother lactated, whereas only the wire mother lactated in a second condition. The conflict of a dual-mother surrogate condition compares the value of contact comfort and nursing comfort. To measure the strength of affectional responsiveness, Harlow observed the tendency of neonatal and infant monkeys to cling to the surrogate mother in situations deemed stressful, ambiguous, or dangerous. According to Harlow, the urgency an infant displayed to find his/her mother in such circumstances could be measured and subsequently used to identify the intensity of the affection the infant has for his/her mother. To investigate mothers as a source of security, Harlow conducted an *open-field test*, in which infants were placed in a room with various stimuli that would elicit curiosity, exploratory behaviours, or manipulation. In this experiment, Harlow observed whether or not the presence of a mother would influence the infant's degree of curiosity and exploratory behaviors. Moreover, Harlow

also used the open-field test to measure affectional retention, or the strength of affectional responsiveness. Here, Harlow tested if the initial affection an infant had for its surrogate mother would endure a 30-day absence. In other words, would an infant monkey *forget the love* it initially held for his/her mother, ultimately demonstrating the same behavior in the open-field with and without *her* presence? Lastly, Harlow tested whether there was a critical period during development for an infant to form an affectional bond to his/her mother. To test this, Harlow raised a group of orphan monkeys who had never been exposed to any surrogate mother. Once these monkeys reached 250 days of age, each monkey was presented one type of mother. Harlow observed how these monkeys interacted with the new mother figures and compared such behaviors to those of monkeys who had been raised with a surrogate mother from birth.

Most generally, the results demonstrated that infant monkeys have an overwhelming preference for physical contact with the cloth mothers over the wired mothers. For instance, when presented with a non-lactating cloth mother and a lactating wire mother, Harlow's infant monkeys showed greater attraction to the cloth mother, despite the wire mother's ability to reduce primary drives (i.e., provide milk). This was the case for both the orphan monkeys and those raised with surrogate mothers since birth. Similarly, when presented with fear-producing stimuli, a toy bear in this case, the infant monkeys demonstrated a significant preference to cling upon a cloth mother over a wire mother. This intense preference for a cloth mother even impacted the infants' curiosity. When placed in an open room with various curiosity-provoking stimuli, the absence of a cloth mother resulted in either immobile or frantic behaviour in the infants, while her presence stimulated the exploration of the room's outskirts and the subsequent

manipulation of any stimuli obtained. Now while contact comfort may indeed act as a variable of significant relevance in affection between an infant and a mother, Harlow also found that affectional responsiveness persisted over time despite any deprivation the infant may undergo. In fact, as Harlow reported, deprivation can even prolong bodily contact upon the infant's reunion with his/her mother. This was illustrated by an open-field test characterized by the cloth mother's absence in 30-day intervals. When finally reunited with their surrogate mother, the infants often ran to embrace them, play on them, and rarely left their side. Moreover, this *love* was demonstrated when the monkeys were allowed to see but not touch their surrogate mother. Consistent with Harlow's predictions, the maternal bond was not experimentally extinguished by separation but was in fact enhanced by it. Lastly, despite noting an initial state of significant discomfort, Harlow observed that infants deprived of any interaction with a mother early in life were nevertheless able to develop affectionate responses with time. Harlow observed that these orphan monkeys were initially fearful and angry toward their new surrogate mothers, but soon became dependent on their cloth for security and safety reassurance. Interestingly, even though the *adopted* monkey's affection for the surrogate mother increased with time, it remained less than that of the monkeys raised with surrogates from birth. Altogether, Harlow's findings in his 1958 study with infant rhesus monkey were groundbreaking and pioneering, a reputation which continues today (e.g., Lanius, Vermetten, & Pain, 2010; Schmidt, Sterlemann, & Müller, 2008). Furthermore, this series of investigations also illustrates Harlow's ingenuity in designing experiments and in creating clear operational definitions of 'fuzzy' hypothetical constructs.

How is Harlow's Study Regarded in Terms of Ethics?

Harlow's experimental work with monkeys acts a driving force in both scientific contribution and ethical debate. In fact, despite achieving exceptional success across many domains of psychology, such as serving key roles on various boards, committees, and associations, the *nature* of his work with primates dominates his legacy (Blum, 2002).

Harlow's work has been heavily criticized and often the flashpoint of controversy in the ethical debate of use of animals in research (Gluck, 1997). John Gluck's 1997 paper, "Ethical Paradox," illustrates the distaste that many academics hold toward Harlow's work with monkeys. On one hand, Gluck summarized one half of Harlow's reputation as being ethically thoughtless, a sadistic experimentalist, self-absorbed, and a man accused of conducting cruel, inhumane, and unjustifiable research. Interestingly, William Mason, one of Harlow's former students, also espoused this opinion, "He kept going to the point where it was clear to many people that the work was really violating ordinary sensibilities, and that anybody with respect for life or people would fine this offensive" (Blum, 1994, p. 96.). Martin Stephens, a biologist and vice president for laboratory animal issues at the U.S. Humane Society is a harsh critic of Harlow's work. Stephens, as Blum describes in her 1994 book, *Monkey Wars*, has analyzed Harlow's work to a nearly exhaustive degree and argued that:

> …when you look around at scientists with fame, it's been essentially at the cost of integrity. They overgeneralize; they over interpret; they have almost an megalomaniac sense of their own importance. Harry Harlow is a good example of that (Stephens as quoted in Blum, 1994, p. 97).

Moreover, Stephens concludes his report on Harlow's work by labelling it cruel, without any results beneficial to people, and redundant in nature with torturous dynamics.

Others in the animal community echoed such remarks, asserting that "we simply should not experiment on animals so smart, so emotionally connected, so closely related to ourselves" (Blum, 2002, p. xi).

Now, on the other hand, Gluck (1997) summarizes the second half of Harlow's reputation as being an animal husbandry advocate, a creative innovator in the pursuit of concrete answers to real-world problems, a generous person, and the ultimate pioneer in revealing ingrained similarities between nonhuman and human primates. Harlow (1958) himself touched on the ethics of his 1958 study within his manuscript in a similar vein:

> The infant mortality was only a small fraction of what would have obtained had we let the monkey mothers raise their infants. Our bottle-fed babies were healthier and heavier than monkey-mother-reared infants. We know that we are better monkey mothers than are real monkey mothers thanks to synthetic diets, vitamins, iron extracts, penicillin, chloromycetin, 5% glucose, and constant, tender, loving care (p. 44).

Clearly, Harlow maintained a completely different perspective than his negative critics in terms of the ethics behind his work with monkeys – and this is not entirely surprising either. See, while present-day students (and even researchers) might be quick to label Harlow's work along the same accord as the academics mentioned above, such thinking would be an example of *presentism* – that is, an attitude toward the past that is predominately shaped by contemporary attitudes, experiences, and knowledge (Merriam-Webster, n.d.). Indeed, while such a study involving infant monkeys would be unlikely to be approved by today's standards of research ethics, such was not the case in Harlow's time. Rather, Harlow (1958) was published eight years before the Laboratory Animal Welfare Act was passed in 1966, an act which would set a standard for how animals could be treated in experiment settings. Accordingly, Harlow's work was received with

instant success by both the science community and the public (Vicedo, 2009). Harlow was showered with accolades from his colleagues, including Edward Tolman, a highly respected psychologist in his own right: "It was absolutely superb: The substance, the wit and the delivery. More power to you" (as quoted in Vicedo, 2009, p. 200). Harlow (1958) was even picked up by various news networks and legendary newspaper companies, such as the *New York Times*, who reported his groundbreaking methods and results to millions and even published the whimsical poems from his manuscript. Though Harlow had already established a notable reputation within academic circles, Vicedo (2009) asserts that it was the blockbuster-like reception of "The Nature of Love" that fired the imagination of the public and made Harlow a popular culture icon.

Ultimately, there may be no way to firmly conclude whether Harlow's work with monkeys was ethically *right* or *wrong*. Instead, we must acknowledge the context of the times in which it was conducted and set aside contemporary ethical standards. From this standpoint, we may very well generate two conflicting perceptions of Harlow's study: (1) an innovative study of groundbreaking implication; or (2) a barbaric and irresponsible case example of antiquated science. Author Duane Rumbaugh (1997), however, offers a more integrative and sweeping perspective: "Harry [Harlow's] legacy, if not destiny, as it is here argued, was to lead psychologists to new approaches in the study of behaviour" (p. 200). In his opinion, Harlow's work is appreciated for its overall contributions – both explicitly and implicitly – to academia, experimental psychology, and the movement toward more rigorous ethical standards.

Academics' Responses to Harlow's Research

Many psychiatric studies of the 1940s and early 50s looked at the consequences of being deprived of love (Seymour, 1963). This includes work by Bowlby (e.g., 1944; 1951; 1956; 1958a; 1958b; 1960), who had led the way in research regarding the impact of the quality of mother-child relationships. Such work surely influenced Harlow's interest in contact comfort. In fact, two quotes from "The Biosocial Nature of Man" (Montagu, 1956) capture the novelty in the idea that love and contact comfort are necessities for a healthy child:

> It is now known that children lacking such experience of love tend, usually, to grow up as 'affectionless characters,' suffering from affect-hunger, exhibiting the effects of the privation of love which they have suffered in their own inability to love (p. 52).

> The evidence is today overwhelming that in order to become an adequate, healthy, cooperative, loving human being it is necessary to be loved. No child is born hostile or aggressive. It becomes so only when its desires to be loved and to love and frustrated, that is, when its expected satisfactions are thwarted – and the thwarting of an expected satisfaction is the definition of frustration (p. 53).

Indeed, many scholars embraced Harlow's findings on love and contact comfort. For instance, McCall (1963) applauded Harlow's clever decision to use rhesus monkey subjects instead of human infants. McCall stressed similarities between rhesus monkey and human infants, including similar levels of visual curiosity, which Harlow had noted, as well as similarities Harlow did not mention, including the infants' natural tendencies of frustration, fear, and temper when their cloth blanket is taken away from them. Further, only three years after the publication of Harlow's 1958 paper, William Kessen and George Mandler (1961) published an article titled "Anxiety, pain, and the inhibition of distress," in which they claimed that existing theories of anxiety were too narrow and focused exclusively on trauma and inadequate flight responses. Kessen and Mandler

asserted that such theories provide no objective understandings of human and animal distress. To demonstrate this point, Kessen and Mandler cite Harlow's finding that infants cling to a cloth mother instead of a wire mother after being exposed to fear-producing stimuli. Kessen and Mandler give minimal detail about Harlow's study, perhaps assuming that Harlow's work would be well-known among their academic readership. In addition, and more fundamentally so, Kessen and Mandler already recognized Harlow's findings, despite being rather "provocative," as providing an empirical procedure for testing the reduction of stress and anxiety that is "beyond doubt" (p. 401).

Harlow's pioneer findings continue to impact academics throughout the decades (see Appendix A for a Web of Science citation analysis report). Indeed, academics have continued to cite Harlow (1958) in many different contexts and ways. For instance, while some academics report the details and finding of Harlow's study with great accuracy and detail, other academics convey brief and inaccurate representations.

A study by Howard Hoffman and Alan Ratner (1973) exemplifies the impact of Harlow's study on later research related to affection and socialization. Hoffman and Ratner (1973) argued that the phenomenon of *imprinting* is comprised of innate affectionate behaviour upon exposure to certain characteristics of the object, animal, or stimuli imprinted upon – thereby making such characteristics primary reinforcers – and the developed familiarity with the characteristics of the imprinted object, animal, or stimuli through the associated classical conditioning. After citing more recent research, Hoffman and Ratner nevertheless consider Harlow's (1958) work as particularly noteworthy. However, unlike Kessen and Mandler's (1961) extensive description of Harlow's work, Hoffman and Ratner's description is a single sentence, acting almost like

a simple nod of appreciation toward a study whose findings have become the benchmark for all subsequent research in the field.

In contrast to studies that use Harlow's 1958 findings as empirical refutation of various theories of anxiety (e.g., Kessen & Mandler, 1961) or as the historical foundation for research on affection and socialization (e.g., Hoffman & Ratner, 1973), William Mason and Gershon Berkson (1974) use it as the impetus for research on the effects of maternal variability on infants. In doing so, Mason and Berkson begin their paper by immediately introducing Harlow's initial and critical findings, that is, that rhesus monkeys showed a significant preference for a cloth mother over a wire mother. Though the description of Harlow's 1958 findings is brief, the researchers use his work to set the stage, so to speak, for the subsequent presentation of more recent research in the field of infant-mother relationships conducted with monkey subjects. In addition, Mason and Berkson built upon Harlow's discovery of the value of a contact comfort variable in the infant-mother relationship and investigated whether aspects of contact, such as the mother's rocking back-and-forth, had any effect on the development of the infant. With this, the significance of Harlow's initial work becomes reinforced once again as researchers attempt to further expand on his nature of love more than 15 years after the fact.

While brief, it can be reasonably argued that the series of studies mentioned above successfully inform their reader of the underlying nature and findings of Harlow's classic study. However, it is also quite common for descriptions of classic studies to perpetuate error and myth – and perhaps understandably so. As decades pass after the publication of a monumental study, such as Harlow's "The Nature of Love," authors may become

increasingly reliant on their memory of the study or on descriptions of it in secondary sources rather than re-reading the original paper, often times marked by outdated phraseology. For instance, certain studies (e.g., Mineka & Suomi, 1978; Drescher, Whitehead, Morrill-Corbin, & Cataldo, 1985) have reported Harlow's 1958 study in ways that are inaccurate, subject to misinterpretation, or otherwise poorly presented. We can contrast Mason and Berkson's (1975) accurate description: "In Harlow's initial experiments with artificial mothers, rhesus monkeys developed a strong and abiding attachment to a cloth-covered cylinder, similar in many respects to the attachment formed to the natural mother" (p. 197) with Mineka and Suomi's (1978) faulty description: "Infant monkeys are quite capable of forming strong attachment relationships with objects other than their mothers, for example, surrogates" (p. 1382). While in essence true, such a report oversimplifies Harlow's findings and overlooks the underlying purpose of the study – to investigate the value of contact comfort in the formation of affection between an infant and a mother. In addition, Harlow (1958) stated that the surrogate mothers were engineered to be superior monkey-mothers. Though perhaps more troubling, after finding a connection between depression and developmental arrest in children who had been excluded from physical contact, Drescher et al. (1985) report their results to be similar to those found by Harlow (1958). However, Harlow never reported depression or developmental arrest. In fact, Harlow reported that monkeys only exhibited fits of panic-stricken and desperate behaviour in the first 48 hours of being introduced to a mother figure (i.e., surrogate). Whether or not it can be argued that the behaviours Harlow described can constitute as being *similar* to those mentioned, the

authors are embellishing the validity of their study by grouping their findings to those of Harlow's via use of vague descriptions of his work.

Papers published after 2000 tend to reference Harlow's work with more direct quotes, biographical elements, or the addition of personal insight compared to earlier papers that cite Harlow's work. For instance, while one study (Webb & Peck, 2015) directly quotes Harlow's thesis in "The Nature of Love," a second study (Crofton, Zhang, & Green, 2005) describes both Harlow's 1958 paper and Harlow's eventual shift in focus toward studying the effect of isolation. Ruth Feldman (2015) is particularly noteworthy because she manages to incorporate an accurate description of Harlow's classic work as well as his later studies on the effects of peers. Even more, Feldman also includes a quote from Harlow (1958) that is pertinent to contemporary research interest in the neurobiology of fatherhood.

How Contemporary Media Portrays Harlow's Work

A simple YouTube search of "Harlow's Monkeys" generates over 10 pages of videos which include college students reenacting the experiment (e.g., Biel, 2014), educational drawings (e.g., Bourassa, 2010), and comparisons of real life footage (e.g., Upcycle, 2011). One video, titled "Rock-A-Bye Baby," (see Upcycle, 2011) juxtaposed footage from Harlow's experiments with James Prescott's 1970 film of primates at the Hazleton laboratories in Falls Church Virginia and with footage of human infants raised in institutions. This compilation of clips accentuates cross-species comparison, and perhaps viewers will form their own appreciation of the importance and implications of Harlow's work.

Harlow's classic study has also become a common topic of non-academic articles – such as blogs and podcasts. The overwhelming popularity of blogs in this contemporary digital age provides an opportunity to gain insight into how individuals across the world – ranging in culture, life experiences, and personal values – interpret and present Harlow's "The Nature of Love." One concern with blogs and podcasts, however, is that they are not peer-reviewed and accuracy can be highly variable. Possible implications of the contemporary blogging culture include increased second-and-third hand reporting and decreased writer accountability, both of which may result in inaccurate or biased articles. For instance, one blog (Raab, 2011) misattributes Harlow as to believing the very developmental perspective of the nature of love that he was in fact aiming to disprove. Further, Raab omits essential details of Harlow's initial study. For example, while the infant monkeys did indeed show significant preference for the cloth mother instead of the wire mother, they did so despite the fact that only the latter was equipped with a nursing bottle – a detail of critical importance that Raab omitted.

Overall, Harlow (1958) continues to influence and provide a foundation for studies on social attachment, child rearing, and touch, as exemplified by these recent statements about Harlow's findings: "Physical touch provides the basis of attachment" (MacDonald & Leary, 2005, p. 205); "A central part of building a sense of belongingness and attachment is touch" (Gentsch, Panagiotopoulou, & Fotopoulou, 2015, p. 2392); and "Maternal emotional warmth and comfort is necessary for healthy child development" (Algoe & Way, 2013, p. 1855).

Harlow's Legacy Within and Beyond Psychology

The impact of Harlow's work has extended well beyond psychology (see Appendix A for a Web of Science citation analysis report). An in-depth analysis of all the fields that cite Harlow is beyond the scope of my paper. Instead, I highlight only how Harlow's work stimulated research in two fields that are generally quite independent from one another: neurobiology (e.g, Gordon, Zagoory-Sharon, Leckman, & Feldman, 2010) and dermatology (e.g., Lloyd, McGlone, & Yosipovitch, 2015).

More than a half century after Harlow (1958), research on parent-infant bonding has a neurochemical focus, such as on the role of oxytocin (OT) in forming and perpetuating this bond processes (Gordon et al., 2010). OT is believed to affect various aspects of social bonding, interpersonal closeness, and social and emotional behaviours. While some studies have shown that an infant's increased responsiveness to a mother may be explained by the mother's excess OT at birth and during associated states like breastfeeding (e.g., Carter, 1998), more recent research has found that there are no differences in OT between mothers and fathers (e.g., Gordon et al., 2010). This recent finding aligns with Harlow's suggestion that fathers and mothers are both equally capable in developing love relationships with infants. In addition to contributing to current research in neurobiology, Harlow's work is being cited in dermatology – the medical specialty caring for illnesses relating to the skin, hair, and nails (Twomey, 2003). For instance, a 2015 study by Donna Lloyd, Francis McGlone, and Gil Yosipovitch describes how a new class of touch receptors – i.e., C-fibres that code for pleasure properties – can be targeted in clinical treatments such as massage therapy, thereby potentially treating psychophysical aspects of chronic skin conditions without the use medication. Lloyd and colleagues reference Harlow's classic study as demonstrating the value of interpersonal

touch and its importance for physical and cognitive development. This linkage to Harlow is particularly interesting because Harlow's study did not specifically test for human (or even monkey) touch. Rather, and most fundamentally, Harlow showed that contact comfort can be provided by something as simple as a non-living cloth mother. Overall, this article presents Harlow's findings as accurately as do many of the more psychology-based studies discussed throughout the present paper.

Now, all of Harlow's contributions within and beyond psychology discussed thus far have also been applauded with dozens of ceremonial events and prestigious awards. Harlow received virtually every available prize for scientific achievement – including the Gold Medal from the American Psychological Association, the National Medal of Science from Lyndon Johnson, the Kittay Award from the Psychiatric profession, and honourable mention from the Nobel Committee. In addition, Harlow was granted membership in the American Philosophical Society and was the first psychologist to be elected a member of the National Academy of Sciences (Gluck, 1997). But Harlow's importance as a researcher has also been appreciated in even more overt ways, such as at a symposium held by the American Society of Primatologists in 1996 dedicated in his honor, for instance.

In addition to his numerous accolades and awards, Harlow's legacy as a colleague and supervisor is also noteworthy. In her 2008 article, "Harry Harlow: From the other side of the desk," Helen LeRoy reminiscences about her time helping Harlow keep track of his day-to-day engagements:

> He was an extremely busy man, with an almost surreal out-of-town travel schedule, combined with multiple local obligations. He ran a major primate research laboratory… he was a professor… he was heavily recruited as a speaker [at other colleges, universities, and professional

> societies]… he was an NIH consultant, GRE/Educational Testing Service consultant, American Institutes of Research consultant, on the editorial board of *Science*… the Editor of the *Journal of Comparative and Physiological Psychology*… and to top all that off, Harlow was President of the American Psychological Association (p. 348).

Now, despite all of Harlow's immense academic success, especially upon the publication of "The Nature of Love," LeRoy emphasizes that Harlow's personality never changed:

> He often had early morning coffee with the janitors… He never let his fame get in the way of his dealings with those around him. There was not a trace of superiority nor dictatorship in Harlow's management of laboratory personnel. He allowed his graduate students, post-docs, and staff enough latitude to blossom on their own, to try out their own ideas… [he had an] uncanny ability to bring together some of the greatest people I could ever hope to know (p. 350).

In addition, LeRoy also mentions that Harlow would always *bend over backwards* to help his students obtain the best job possible upon attaining their doctorate, which may have ultimately helped propel some of his students toward reputations as prominent scientists of their respective fields. And indeed, at a 1996 meeting of the American Society of Primatologists, a handful of Harlow's former students comprised a group of celebrated scientists invited to speak about Harlow's history of achievement. Here, his former students emphatically credited Harlow with establishing the fundamental grounds for behavioural development and attachment, the neurobiology of cognition, the assessment of animal intelligence, the promotion of proper animal husbandry techniques, the treatment of psychopathology in humans and non-human primates, and the general fostering of the cognitive revolution in the 1960s (Gluck, 1997).

Clearly, Harlow's impressive academic career has left roots that stretch beyond the field of experimental psychology. As a supervisor, Harlow helped produce some the

most noteworthy researchers of the past few decades, such as Gene Sackett, William Mason, Stephen Suomi, Leonard Rosenlum, and Abraham Maslow. Meanwhile, as a colleague, he inspired kindness in the competitive atmosphere of academia and was the glue for many longstanding relationships.

Conclusions

Most elegantly stated, "love is an emotion that does not need to be bottle-or-spoon fed..." (Harlow, 1958, p.49). Harlow debunked the popular beliefs of the time regarding affection as being the result of the reduced primary drives the child experiences through a mother. Utilizing an experimental paradigm, Harlow demonstrated that infants preferred a non-lactating padded mother over a lactating wire one. This provided evidence for the importance of contact comfort and helped disarm a 1950s attitude that was fueled by influential voices such as John B. Watson's, who asserted:

> When you are tempted to pet your child, remember that mother love is a dangerous instrument. An instrument which may inflict a never-ending wound, a wound which may make infancy unhappy, adolescence a nightmare, an instrument which may wreck your adult son or daughter's vocational future and their chances for marital happiness (as cited in Parini, 2011, p. 275).

Instead, Harlow's findings revealed that a mother was more than a source of nourishment for her child and that love was not to be feared or denied. Harlow (1958) further argued, in paradigm-shifting fashion, that fathers and mothers are both equally capable in developing child-parent relationships characterized by love. This was a significant implication of the time, with more mothers joining the workforce in order to fulfill increasing socio-economic demands resulting from WWII or, in many cases, to pursue personal desires.

The results of Harlow's (1958) study also served as the foundation for future studies that focused on love, touch, and depression. This is illustrated in citation records from 1958 to 2017 (see Appendix A for a Web of Science citation analysis report), to which Harlow (1958) has been cited over 31,200 times in six different languages, with over 655 publications in the Web of Science database as of 2017. And, with the number of citations following a consistent and upward trend each year, the implications of Harlow's work continues to draw the interest of contemporary audiences even a half century after its initial burst into popular culture. This increasing trend in citation activity can simply be explained by the article's own title – *the nature of love*. Simply put, the *nature* of love is human nature. As an undeniable and surrounding force that encapsulates us all upon the moment of our birth, behaviours motivated by love may be the most pronounced and of the utmost importance. Harlow is the first to demonstrate this in his classic study by identifying that the value of contact comfort outweighs that of a mere reduction of primary drives. Though Harlow (1958) himself admitted that contact comfort is just one variable of love, "The Nature of Love" has nevertheless served to be the first piece of the puzzle toward identifying what can one day be considered to be the core of humanity. While Harlow's legacy may very well forever include a debate over his integrity, one thing is certain: "it is a journey with one very complicated scientist, one who spent most of his life trying to understand the role of relationships in monkey societies and by extension human ones" (Blum, 2002, p. xii).

Appendix A

Citation Analysis Report of Harlow's "The Nature of Love"

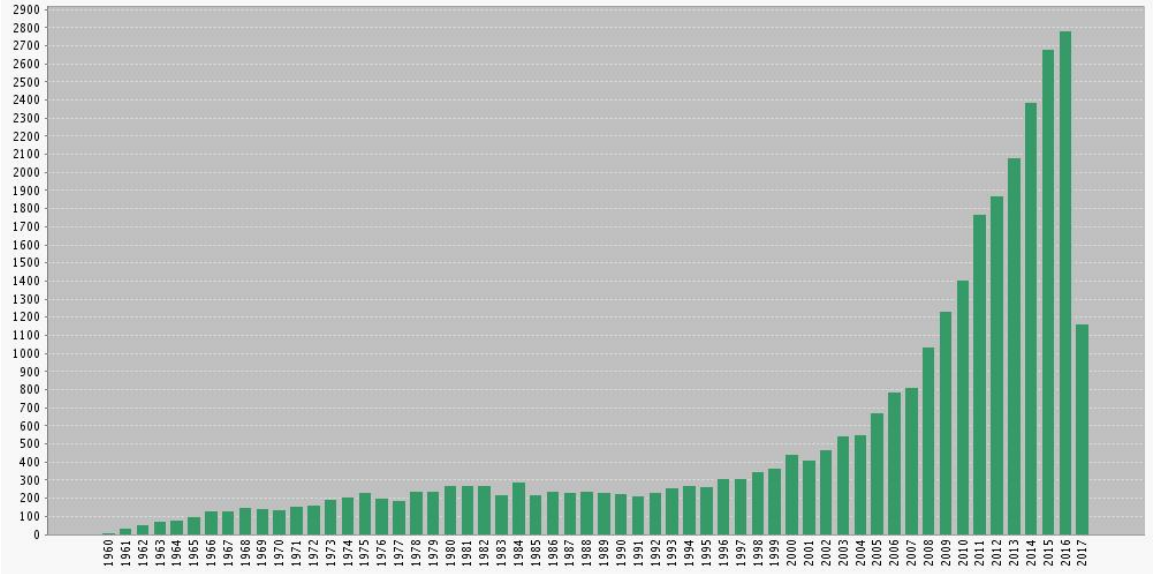

Figure 1. This chart illustrates the number of citations to Harlow (1958), as indexed by Web of Science on June 12, 2017. Note the relatively modest numbers of annual citations up until 1991compared to the much starker upward trend in later years.

Field: Research Areas	Record Count	% of 640	Bar Chart
PSYCHOLOGY	382	59.688 %	
PSYCHIATRY	94	14.687 %	
NEUROSCIENCES NEUROLOGY	52	8.125 %	
BEHAVIORAL SCIENCES	40	6.250 %	
EDUCATION EDUCATIONAL RESEARCH	29	4.531 %	
SCIENCE TECHNOLOGY OTHER TOPICS	26	4.063 %	
ZOOLOGY	25	3.906 %	
FAMILY STUDIES	20	3.125 %	
PEDIATRICS	20	3.125 %	
SOCIAL SCIENCES OTHER TOPICS	15	2.344 %	
DEVELOPMENTAL BIOLOGY	12	1.875 %	
NURSING	12	1.875 %	
REHABILITATION	11	1.719 %	
SOCIAL WORK	10	1.563 %	
SOCIOLOGY	10	1.563 %	
VETERINARY SCIENCES	10	1.563 %	
GENERAL INTERNAL MEDICINE	9	1.406 %	
ANTHROPOLOGY	8	1.250 %	
HISTORY PHILOSOPHY OF SCIENCE	7	1.094 %	
BUSINESS ECONOMICS	6	0.938 %	
ENDOCRINOLOGY METABOLISM	6	0.938 %	
GENETICS HEREDITY	6	0.938 %	
PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH	6	0.938 %	
BIOMEDICAL SOCIAL SCIENCES	5	0.781 %	
PHARMACOLOGY PHARMACY	5	0.781 %	

Figure 2. This chart illustrates the number of citations for Harlow (1958) in different research areas. It shows Harlow's broad impact on fields other than psychology, therein supporting the distinguished status often associated with his study.

References

Algoe, S. B., & Way, B. M. (2013). Evidence for a role of the oxytocin system, indexed by genetic variation in CD38, in the social bonding effects of expressed gratitude. *Oxford Journals, 9,* 1855-1861. doi:10.1093/scan/nst182

Benedek, T. (1946). Development to love. In *Insight and personality adjustment: A study of the psychological effects of war* (pp. 9-27). New York, NY, US: Ronald Press Company. doi:10.1037/10669-001

Biel, M. (February 19, 2014). Harry Harlow's monkey love experiment. [video file]. Retrieved from: https://www.youtube.com/watch?v=7q9DOw5qeG8

Blum, D. (2002). *Love at Goon Park: Harry Harlow and the science of affection*. Cambridge, MA: Perseus Publishing

Blum, D. (1994). *Monkey wars.* New York, NY: Oxford University Press.

Bourassa, P. (December 4, 2010). Harlow's monkeys. [video file]. Retrieved from: https://www.youtube.com/watch?v=GR5PBL-pquw

Bowlby, J. (1944). Forty-four juvenile thieves: Their characters and home life. *International Journal of Psychoanalysis, 25,* 19–53.

Bowlby, J. (1951). *Maternal care and mental health*. Geneva: World Health Organization Monograph Series.

Bowlby, J., Ainsworth, M., Boston, M., & Rosenbluth, D. (1956). The effects of mother-child separation: A follow-up study. *British Journal of Medical Psychology*, *29*(3-4), 211-247. doi:10.1111/j.2044-8341.1956.tb00915.x

Bowlby, J. (1958a). The nature of the child's tie to his mother. *International Journal of Psychoanalysis*, *39*(5), 350–373.

Bowlby, J. (1958b). A note on mother-child separation as a mental health hazard. *The British Journal of Medical Psychology,* 31(3-4), 247-248. doi:10.1111/j.2044-8341.1958.tb01971.x

Bowlby, J. (1960). Separation anxiety: A critical review of literature. *International Journal of Psychoanalysis, 41,* 89-113. doi:10.1111/j.1469-7610.1960.tb01999.x

Carter, S.C. (1998). Neuroendocrine perspectives on social attachment and love. *Psychoneuroendocrinology, 23*(8), 779-818. doi:10.1016/S0306-4530(98)00055-9

Crofton, E., Zhang, Y., & Green, T. (2014). Inoculation stress hypothesis of environmental enrichment. *Neuroscience and Biobehavioural Reviews, 49,* 19-31. doi:10.1016/j.neubiorev.2014.11.017

de Waal, F. (1989). False dichotomies. In *Peacemaking among primates* (pp. 9-33). Cambridge, MA: Harvard University Press.

Drescher, V., Whitehead, W., Morill-Corbin, E., & Cataldo, M. (1985). Physiological and subjective reactions to being touched. *Psychophysiology, 22,* 96-100. doi:10.1111/j.1469-8986.1985.tb01565.x

Feldman, R. (2015). Sensitive periods in human social development: New insights from research on oxytocin, synchrony, and high-risk parenting. *Development and Psychology, 27,* 369-395. doi:10.1017/S0954579415000048

Gentsch, A., Panagiotopoulou, E., & Fotopoulou, A. (2015). Active interpersonal touch gives rise to the social softness illusion. *Current Biology, 25,* 2392-2397. doi:10.1016/j.cub.2015.07.049.

Gluck, J. (1997). Harry F. Harlow and animal research: Reflection on the ethical paradox. *Ethics & Behaviour, 7*(2), 149-161. doi:10.1207/s15327019eb0702_6

Gordon, I., Zagoory-Sharon, O., Leckman, J., Feldman, R. (2010). Oxytocin and the development of parenting in humans. *Biological Psychiatry, 68,* 377-382. doi:10.1016/j.biopsych.2010.02.005

Harlow, H.F. (1958). The nature of love. American Psychologist, 13, 673-685. doi:10.1037/h0047884

Harry F. Harlow: American Psychological Foundation Gold Medal Award. (1974). *American Psychologist, 29*(1), 48-50. doi:10.1037/h0020149

Heathers, G. (1955). Acquiring dependence and independence: A theoretical orientation. *The Journal of Geriatric Psychology, 87*(2), 277-291. doi:10.1080/00221325.1955.10532940

Hoffman, H., & Ratner, A. (1973). A reinforcement model of imprinting: Implications for socialization in monkeys and men. *Psychological Review, 80,* 527-544. doi:10.1037/h0035533

Kessen, W., & Mandler, G. (1961). Anxiety, pain, and the inhibition of distress. *Psychological Review, 68,* 396-404. doi:10.1037/h0039704

Lanius, R.A., Vermetten, E., & Pain, C. (2010). *The impact of early life trauma on health and disease: The hidden epidemic.* Cambridge, MA: Cambridge University Press. doi:10.1017/CBO9780511777042

LeRoy, H. (2008). Harry Harlow: From the other side of the desk. *Integrative Psychological & Behavioural Science, 42*(4), 348-353. doi:10.1007/s12124-008-9070-y

Lloyd, D., McGlone, F., & Yosipovitch, G. (2015). Somatosensory pleasure circuit: From skin to brain and back. *Experimental Dermatology*, *25*, 321-324. doi:10.1111/exd.12639

MacDonald, G., & Leary, M. R. (2005). Why does social exclusion hurt? The relationship between social and physical pain. *Psychological Bulletin, 131*(2), 202-223. doi:10.1037/0033-2909.131.2.202.

Mason, W., & Berkson, G. (1974). Effects of maternal mobility on the development of rocking and other behaviours in Rhesus monkeys: A study with artificial mothers. *Developmental Psychology*, *8*, 197-211. doi:10.1002/dev.420080305

McCall, R.J. (1963). Invested self-expression: A principle of human motivation. *Psychological Review, 70*(4), 289-303. doi:10.1037/h0045485

McKinney, F. (1949). Affections and conventions. In *Psychology of personal adjustment: Students' introduction to mental hygiene*, (pp. 471-526). Hoboken, NJ, US: John Wiley & Sons Inc. doi:10.1037/13250-012

Mineka, S., & Suomi, S. (1978). Social separation in monkeys. *Psychological Bulletin*, *85*, 1376-1400. doi:10.1037/0033-2909.85.6.1376

Montagu, A. (1956). *The biosocial nature of man*. New York: Grove Press. doi:10.1037/14539-000

Parini, J. (2011) *Promised land: Thirteen books that changed America*. New York, NY: Doubleday.

Presentism. (n.d.). In *Merriam-Webster* online. Retrieved from http://www.merriam-webster.com/dictionary/presentism

Raab, D. (2011, February 14). The nature of love. [Blog]. Retrieved from http://dianaraab.com/blog/author-blog/the-nature-of-love/

Rumbaugh, D.M. (1997). The psychology of Harry F. Harlow: A bridge from radical to rational behaviorism. *Philosophical Psychology*, *10*(2), 197-210. doi:10.1080/09515089708573215

Schmidt, M.V., Sterlemann, V., & Müller, M.B. (2008). Chronic stress and individual vulnerability. *Annals of the New York Academy of Sciences*, *1148*, 174-183. doi: 10.1196/annals.1410.017

Seymour, H. L. (1963). The impact of professional dishonesty on behavior of disturbed adolescents. *Social Work*, *8*(2), 48-55. doi:10.1093/sw/8.2.48

Sidowski, J., & Lindsley, D. (1989). *Harry Frederick Harlow*. Washington, D.C.: National Academy of Sciences.

Shaver, P.R., & Mikulincer, M. (2006). A behavioural systems approach to romantic love relationships: Attachment, caregiving, and sex. In R.J. Sternberg & K. Wies, *The new psychology of love* (pp. 35-65). London: Yale University Press.

Tannenbaum, M. (2013, May 12). The incredible importance of mom [Blog]. Retrieved from http://blogs.scientificamerican.com/psysociety/mothers-day-2013/

TheSasss1. (September 17, 2012). Harlow's monkeys [video file]. Retrieved from: https://www.youtube.com/watch?v=_O60TYAIgC4

Twomey, C. (2003). Report of the committee on dermatology services. *Lenus: The Irish health repository*. Retrieved from a PDF on http://hdl.handle.net/10147/44733

Upcycle. (November 19, 2011). Rock-A-Bye Baby – Harry Harlow baby monkey experiments. [video file]. Retrieved from: https://www.youtube.com/watch?v=uRI8VKApgsU&feature=youtu.be

Vicedo, M. (2009). Mothers, machines, and morals: Harry Harlow's work on primate love from lab to legend. *Journal of the History of the Behavioral Sciences, 45*(3), 193–218. doi:10.1002/jhbs.20378

Webb, A., & Peck, J. (2015). Individual differences in interpersonal touch: On the development, validation, and use of the "comfort with interpersonal touch" (CIT) scale. *Journal of Consumer Psychology, 25*, 60-77. doi:10.1016/j.jcps.2014.07.002

Yellin, E. (2004). *Our mothers' war: American women at home and at the front during World War II*. New York, NY: Free Press.