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Journal

Psychoanalytic Psychology, 24(4)

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Publication Date

2007-10-01

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A NEUROBIOLOGICAL MODEL OF PERCEPTION

Considerations for Transference

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Transference is a key concept in psychoanalysis, distinguishing the analytic treatment from other forms of psychotherapy. In this essay, the authors place transference into the context of a general psychology of human functioning and link it to the neurobiology of perception. The authors briefly review the literature within and outside of psychoanalysis, define transference through the lens of perception, and propose that it is ubiquitous in humans. When not impaired, transference is an adaptive ego function that emerges, along with countertransference, in the context of any interpersonal situation of significant emotional import. The authors draw on W. Freeman's (2003, 2004) research on olfaction, which has since been replicated in other sensory modalities, for a neurodynamic basis for their model of perception and describe how transference may be thought of as an evolved form of it. The authors' view is that transference is a hierarchically integrated perceptual modality of a higher order, although it depends on the same neurodynamic processes as those found in each sensory modality.

Keywords: transference, perception, neurobiology, expectancy

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Transference, in my view, is a very special mental quality that has never been satisfactorily explained. (Bird, 1972, p. 267)

Transference remains a cornerstone of all psychoanalytic theory and practice. Psychoanalysts know it well, and although they may define it differently, all view it as a key to understanding their patients' problems and as a crucial tool in helping their patients to become better.¹ Neuroscientists may be less familiar with the term, although one can generally think of it as a critical factor in how the past carries forward into the present in human relationships and situational expectancies, whether that carrying forward is adaptive or not. As such, transference has obvious connections to learning, memory, emotion, attachment, and perception.

In this article, we assert two fundamental points: (a) the value of appreciating transference from the standpoint of a perceptual cycle of acting into one's world as one predicts, discovers, creates, and transforms it and oneself and (b) the utility of having a neurobiological platform from which to view (albeit at a much more complex level) transferential processes. We argue that transference can best be understood as a special kind of action–perception cycle that is distinctively human, although we trace this form of human perception to its evolutionary beginnings in other species. We limit ourselves to these perspectives on transference and, by way of disclaimer, do not begin to address the complexity and richness of the concept and the phenomenon in the clinical situation.

Our road map is as follows: (a) Frame the psychoanalytic definitional debates regarding transference along three core axes; (b) briefly address more recent efforts to bridge analytic conceptualizations with other disciplines; (c) consider the context in which Freud's early notions about transference were informed not only by his clinical work but also by the existing physiological and philosophical models of perception and epistemology; (d) define expectancy in terms of intentionality and relate it to transference; and (e) present our conceptual and neurobiological arguments for why transference can be viewed efficaciously from the standpoint of the action–perception cycle.

Psychoanalytic Definitional Debates About Transference

The definition of transference has been a topic of significant study and disagreement over the past 100 years. Despite the centrality of transference to the psychoanalytic enterprise, however, Freud wrote quite sparsely about it. For the purpose of clarification, we group the analytic literature over the past many years along three definitional axes: (a) transference as pathological versus transference as intrinsic to human mental functioning, (b) transference as a purely clinical phenomenon versus transference as a ubiquitous component of all human relationships, and (c) transference as becoming conscious through insight versus transference as being inherently unconscious in the moment of experience. One can easily imagine other axes, and there are surely many axes to grind, but we use these three as they provide the most meaningful signposts for our arguments. We have our own distinct perspective as to just where we take up residence on these axes, and we ask that the reader be patient with us as we explicate our viewpoint.

¹ We regard transference and countertransference as features of an embedded involvement between patient and therapist. The reader may assume that each reference to transference can be applied to countertransference as well.

Bridging Analytic Conceptualizations With Those of Other Disciplines

Transference has been linked to complexity theory (Palombo, 1999), right brain laterality (Watt, 2003), connectionism (Westen & Gabbard, 2002), dynamic systems theory (Miller, 2004; Thelen & Smith, 1994), and learning theory (Cooper, 1992; Dollard & Miller, 1950; Schwartz, 1987, 1990; Wachtel, 1977, 1981). Weingartner, Miller, and Murphy (1977) viewed transference as a form of state-dependent learning; Lundh, Wikstrom, Westerlund, and Ost (1999) have focused on an unconscious, preattentive bias; and Luborsky (1965) found attentional and memory bias in people with differing defensive styles. McKenna (1994) discussed transference in terms of traumatic fixation, possibly with neurobiological involvement, and Kolb (1987) and van der Kolk (2004) focused on the implications of trauma on later transferences. This theme has also been elaborated on by Schore (1994, 1999), although the “trauma” in his model is a developmental one, whereby disordered attachment patterns lead to a sequelae of structural changes in the brain.

Post (2002; Post & Kopanda, 1967; Post & Weiss, 1992) connected the notion of kindling in neurobiology to psychiatry, and transference might be viewed from within this model. Sensitization (Antelman, Eichler, Black, & Kocan, 1980; Kalivas, 1992) may also be thought of in terms of critical periods, a tendency to use early “other” prototypes to define future anticipations of self and other.

Andersen (Andersen & Berk, 1998; Andersen, Chen, & Miranda, 2002), describing transference in terms of social cognition, has demonstrated that the properties of a significant other in one’s life are unconsciously attributed to new people in everyday experience and that the “self-with-significant-other complex” helps to unconsciously shape a new person into assuming properties of that historical other and that previous relationship.

The nature and quality of early attachments can be robustly predictive of future attachment patterns in later life (Main, Kaplan, & Cassidy, 1985), whether they have more pathology or are viewed as more flexible and healthy. Early bonds and constructions of self, other, and self-with-other are presumed to be internalized and then to dominate future expectations and adaptations.

Past learning is surely involved and has a role in orientation toward the future. Regarding transference, memory is a helpful descriptor, but *the active process of bringing the past into the texture of the present* is closer to the mark. Emotional attachments are also a component, but in construing transference as a specific form of perception, we are referring to an active, unconscious “reaching into” the moment and shaping how we “find” the other (and ourselves). Finally, preattentive bias, although describing an unconscious referencing and lingering with emotionally salient stimuli, conceptually seems more of a cognitive filtering mechanism and does not include the active shaping of an organized percept (a self-and-other percept, in the case of transference), with the orientation and aims that accompany it. Luborsky’s (1965) related (although more complex) notion that defenses shape percepts is closer to our emphasis, and Andersen’s (Andersen & Berk, 1998; Andersen, Chen, & Miranda, 2002) work is helpful, as it experimentally confirms the unconscious attributional process and the actual shaping of a new other to fit the mold of historically significant relationships.

The Conceptual Dawning of Transference

Freud's early writing from the late 1880s through the early 1900s can be viewed as a conceptual laboratory from which his notions of transference emerged.² Although we must acknowledge the effects of Kant on both Freud and his forebears in physiology, the era was notable for the coexistence of realism and passive associational models of mind and brain. The Kantian notion that reality is "constructed" from within and the passive associational viewpoint are conflicting in many respects, and this ambivalence, we feel, runs through Freud's conceptualizations of transference, and those of many other authors, continuing up to the present day.

Freud's early clinical work with hypnosis and his allegiance to the seduction theory provided a model of a mind susceptible to the designs and influences of the external world (realism). Although he learned the philosophy of Kant (a priori categories and not knowing the "noumena" of the external world), he nevertheless, in the seduction theory, adopted a model of the "outside" pressing on and becoming transcribed or internalized as a percept of the experience. The memory of the experience in the form of retranscription (*nachtraglichkeit*) provides for the meaning and ongoing traumatic effects for the individual. Freud's model, at this point in his thinking, had a primarily passive first stage and an active second stage, a passive taking in and, secondarily, an active reconstruction (for the sake of the discussion in this section, we are referring to the passive aspects of the first stage, and as the reader will later see, a passive first phase of perception cannot exist). This passive model of how the outside gets inside reminds us, in its extreme form, of the Aristotelian view that there is a total identity between the object in the external world and the internal representation, a so-called "immaculate perception."

By the time *Studies on Hysteria* (1895) had been published, the term *auto-suggestion* had been left behind and replaced with *false connections*. And it is in this article in which transference makes its first appearance. Freud's 1895 position, regardless of the terminology, is that "true" connections do exist, in two distinct, if implicit, forms: (a) True connections are not dissociated, and reside within the general associational matrix of the ego, and, presumably, (b) true connections and the knowing of external things and reasons is possible, as opposed to the false constructions that could be built according to the needs of the subject, presumably suffering from a pathological condition. According to this viewpoint, "realistic" and rational apprehension is possible in healthy individuals, and therefore simple realism as an epistemological position remains intact. The passive, associational model survives in large measure at this time for Freud, even though he moves simultaneously in a different direction in viewing perceptions as being unconsciously built by the perceiver. The ambivalence between passive (realism) and active constructivist models has often taken residence in a conceptual conflation between the process of sensation (where the world is sampled) and perception (whereby sensations are integrated with previous history and meaning). In this confusion, some may view the world as "internalized" and then digested and recreated according to one's own meaning. Our model is different in that we do not accept a simple realism that is an importation of the outside world, which is then modified according to the individual's predispositions.

² Makari, (1992, 1994, 1997) has written a series of exceptional articles reconstructing this historical context. We are indebted to his scholarship in articulating the philosophical and scientific environment for Freud's evolving thought. Our own position is that the "birthing" of transference paradoxically trampled on and obscured its rich interdisciplinary "parents," although space does not allow us to explicate our argument here.

Our position is supported by Freeman's (1991) neurobiological research: In olfaction, as in other sensory modalities, sensations enter only the outermost layer of the synaptic bulb. The world never "gets in." Given that this is the case, our ability to navigate in the external world is a tribute to the brain's exquisite evolutionary attunement to the contours and workings of that external world. Otherwise, our internal models would be all too out of step and psychotic-like.

In the *Project for a Scientific Psychology*, Freud (1900–1901/1953c) believed that perception requires an unlimited receptive capacity and that memory is a fixed store—therefore, perception and memory are mutually exclusive. Freud returned to this idea in his paper "A Note Upon the Mystic Writing Pad" (1923–1925/1961b), in which he speculated that the perceptual surface of consciousness needs to be constantly refreshed by deletion—and that "unlimited receptive capacity and memory are mutually exclusive" (p. 230). In this conclusion we now know that Freud was mistaken, as we know that perception and memory are dynamically related. What Freud attributed to perception could be clarified into a distinction between perception and sensation, and it is sensation, at the level of receptor arrays, that needs to be "wiped clean" after receiving data from the environment. This slight revision to the *Project* allows us to argue that perception and memory are dynamically intertwined, and with this revision, we are able to make Freud's contribution neurobiologically more plausible. Both perception and memory, forever affected by previous experience and forever refreshed, can be viewed as integral, and sensation itself, by being refreshed, retains a separate, ever-renewed status, but anchored in the present surrounding environment, not in the inner images of the past. Making this distinction, and fast forwarding 100 or so years, Walter Freeman (1991, 2000) has observed that during olfactory sensation, receptor cells in the noses of rabbits and other mammals continue to respond to whatever chemicals are present in the inhaled air, but the neurons in the brain to which they transmit are "wiped clean" after each inhalation. Perception occurs via a synthesized construction that is constituted by previous experience (this is the memorial component), and this history "leans on" the current stimulus. Perception occurs "behind" the receptor cells and beyond the level of the olfactory bulb, and it is here that the brain begins to construct its meaning. Perception is always context dependent, forever shaped by memories of both phylogenetic derivation and individual experience.

It is relevant for a neurobiology of transference that Freud's (1900–1901/1953c) depiction in the *Project* was that memory and sensation (whether it be from within or without), in combination, could be described as motives. Freud later attributed these motivational properties to instincts, but in the *Project*, motives are an amalgam of sensation (the new) and memory (the old). In our model, we distinguish perception from sensation and suggest that the meeting point of memory (relatively long term) and sensation (short term, always awash in new stimuli) occurs at the intersection or creation known as perception, where the memory of a past emotionally charged experience is elicited by the current stimulus, so that a meaningful percept is created (it should be noted that the conflation of sensation and perception continues in psychology and neuroscience to the present day). All this occurs in a neurodynamic interplay and is in stark contrast to computational theories of information processing.

In Freud's early clinical world, most models of hypnotism and hysteria relied on this passive, associational viewpoint, whether it was Bernheim's Nancy school or Charcot's Salpêtrière orientation. Freud came to Paris in 1885 in the middle of the "hypnosis wars" between these two schools and eventually aligned himself more with Charcot's notion that

the causal factor in the hypnotizability of hysterics was their own internal vulnerability to autosuggestions.

The seduction theory rose and fell within the next few years, and along with it an externally generated etiology for the psychoneuroses. The assumption of a world imprinted and absorbed into the largely passive mind gives way, during these years in Freud's model building, to a more active and even fantastical mind, with a much more complex relationship to external reality. This shift toward a more constructive, creating mind did not negate the influence of external traumata; it merely added internal conflict, wishfulness, and intrapsychic illusion to the etiological mix. Here, as in *The Interpretation of Dreams* (Freud, 1900–1901/1953b, 1900–1901/1953c), Freud articulated the notion of a *motivated* basis for misknowing. It is the motivated nature that makes the Freudian contribution unique to the field of perception.

Freud made a huge step toward seeing transference as a crucial and ongoing function in *An Autobiographical Study* (Freud, 1925–1926/1961a), concluding,

For an analysis without transference is impossibility. It must not be supposed, however, that transference is created by analysis and does not occur apart from it. Transference is merely uncovered and isolated by analysis. It is a universal phenomenon of the human mind . . . and in fact dominates the whole of each person's relations to his human environment. We can easily recognize it as the same dynamic factor which the hypnotists have named "suggestibility." (p. 42)

Bird (1972), who has significantly influenced our own ideas, noted,

In these few words Freud again made the point, and in declarative fashion, that transference is a mental structure of the greatest magnitude. . . . I even suspect it of being one of the mind's main agencies for giving birth to new ideas, and new life to old ones. In these several respects, transference would seem to me to assume the characteristics of a major ego function. (p. 267)

It is clear that the concept of transference remained central to the clinical and metapsychological corpus of Freud's enterprise, although its meaning continued to evolve. Freud's travel to Paris and his eventual affiliation more in the direction of Charcot's empirical scientific culture can in part be explained by the influence of his training in neurology and by the German physiologists. But we also see from his comments in *An Autobiographical Study* (Freud, 1925–1926/1961a) that he never leaves Bernheim entirely behind. He eventually embraces and goes beyond him, stating that transference, a conceptual cousin of Bernheim's "suggestion," "is a universal phenomenon of the human mind . . . and in fact dominates the whole of each person's relations to his human environment" (p. 42). But what do we make of the German influence on Freud's thought?

Freud was deeply influenced by his physiological forebears, the so-called German "bio-physics program," initiated by Johannes Müller and carried forward by Herman von Helmholtz, Ernst Brücke, Carl Ludwig, and Emil du Bois Reymond. Their goal was to banish vitalism and romanticism from the biological sciences, including spirits in the mind. A common reading of their project held that their goal was to eviscerate mind from biology and create a simple material–reductionist model. Material, biological reality was its charge; spirits and romance were its outcasts, although a more careful reading suggests that minds were neither obliterated nor epistemologically avoided by these thoughtful 19th-century scientists. The current enthusiasm for the naïve reductionism of much biological psychiatry may, in contrast, deserve such a criticism.

As Makari (1994) pointed out, Helmholtz began reading the philosopher Immanuel Kant as a teenager. He was influenced by the latter's a priori categories, by virtue of which the mind structures experience, and by Kant's epistemological position that we can never know the "quantities" or noumena of the external world. Kant's a prioris created a constructivist model of perception that replaced the Aristotelian notion of immaculate perception. Furthermore, Helmholtz departed from the Kantian universal a priori categories and created a developmentally oriented evolving mind, in that individual experience and memory must come into play in the construction of a percept. The process that memory and experience play in the construction of a percept, Helmholtz labeled *unconscious inference*.

Just after Freud's 1895 publications, in which transference remained a misknowing by hysterics, Freud acknowledges in an 1896 letter to Fleiss³ his debt to Hippolyte Taine, a French philosopher who was also influenced by Helmholtz and who also was a neo-Kantian. Taine had critiqued the notion of perception as emanating merely from a priori categories and instead described the mind's perceptual constructions as "an acquired disposition, instituted in us by experience" (Taine, as cited in Makari, 1994, p. 565). In addition, in another letter to Fleiss in 1898, Freud expressed his debt to Theodor Lipps, who articulated his own neo-Kantian perceptual theory in which the transfer of previously built-up experience onto newly encountered objects is organized according to *relationship dispositions*. Lipps called the transferring process *ubertragung*, or transference.

It is clear that the neo-Kantian influence of Helmholtz, Taine, and Lipps very much affected Freud's elaboration of the psychoanalytic meaning of transference. It is also clear that viewing transference through the lens of a general theory of perception was available in Freud's thinking (especially by the time of Freud's 1925–1926/1961a paper), although he never explicitly developed the point. Instead, the meaning of transference languished in the consulting room, viewed as an artifact of patient's productions in the analytic procedure. In its residence there, it has been deprived of adoption by other disciplines, definitionally shifting back and forth between positions that highlight either constructivism or naïve realism.

We have reviewed this somewhat oversimplified history for two reasons. First, we want the reader to know that Freud had within his reach a means of profoundly extending the concept of transference to all forms of perception. Second, in highlighting the positions of naïve realism and constructivism, we hope to acquaint the reader with a better context for understanding Freeman's seminal work (1991, 1995, 2000).

A Neurobiological Platform to Support an Understanding of Transference

Generalization [stimulus equivalence] is one of the primitive basic functions of organized nervous tissue. . . . Here is the dilemma. Nerve impulses are transmitted from cell to cell through definite intercellular connections. Yet all behavior seems to be determined by masses of excitation. . . . What sort of nervous organization might be capable of responding to a pattern of excitation without limited specialized paths of conduction? The problem is almost universal in the activities of the nervous system. (Lashley, 1942, p. 306)

When Freud (1925–1926/1961a, p. 42) stated in *An Autobiographical Study* that transference "is merely uncovered and isolated by analysis . . . it is a universal phenom-

³ Makari (1994, pp. 564–566) found the references to Taine and Lipps in letters unearthed by Masson (1985) during the latter's access to Freud's archives. The 1896 and 1898 letters are in.

enon of the human mind . . . and in fact dominates the whole of each person's relations to his human environment," he was referring to an ongoing process by which we situate ourselves in our perceived present, an entirely unconscious process influenced by our historical expectations and histories. Transference is a means of situating our developmental histories with ourselves and others, a mixing and transforming of the current context. Although this reading of Freud has been more popular in the past 2 decades of analytic writing in which analytic thirds, enactments, intersubjectivities, and emergent processes of all kinds are acknowledged (although the adaptive and universal features of transference are not spoken about nearly as much), it is not easily found in the literature, and more important, it is rarely found in neurobiological studies of perception. In many neurobiological and cognitive science approaches (and phenomenological approaches; Merleau-Ponty, 1966), sensation is often conflated with perception, and naïve realism operates to the point of viewing the brain as an information-processing machine "taking in" the external world and almost instantly revising the information according to personal history and meaning. Contrarily, we argue that the surrounding world is merely sensed and does not get past the first synaptic layer of the sensing organ and that the construction of a percept is an unconscious, memory-laden, and meaning-filled process. In this article, we focus on the sensory modality of olfaction, as it is the simplest to articulate and was the first modality studied by Freeman. Transference is a multimodal sensory process involving the construction and integration of percepts and the transformative action of metaphor and language.

We have experimentally observed that during sensation, receptor cells in the nose (see Figure 1) continue to respond to whatever chemicals are present in the inhaled air, but the neurons in the brain to which they transmit are *independent of input* after each inhalation at the level of the olfactory bulb, thus resulting in an unlimited adaptive capacity. Between these receptors in the nose and the output layer of the bulb lies the boundary where sensation ends and perception begins. It is in the population dynamics of the bulb that we

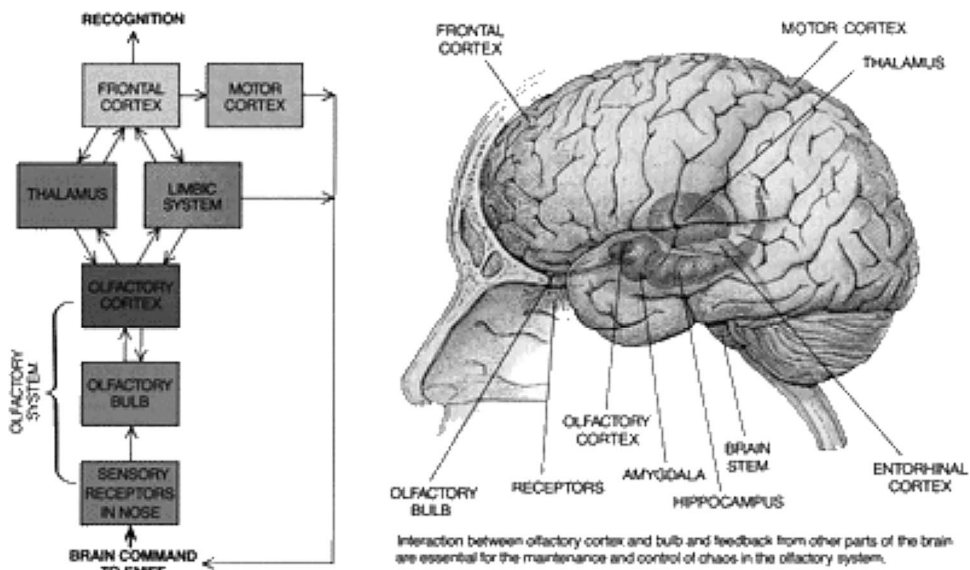


Figure 1. Basic flow of olfactory information in the brain.

found the organized patterns of activity. Meaning is created by these population dynamics within the brain and by the dynamic interactions one has with other intentional beings.

Olfaction is the most primitive of the sensory–perceptual modalities, and there is evidence that the mechanisms and dynamics of the intentional process that underlie transference first emerged in the olfactory system. The other sensory modalities co-opted this same “operating system,” in which some of the details have changed but the basic core of the dynamics have remained the same (Barrie, Freeman, & Lenhart, 1996).⁴ The study of olfaction allows us to generalize about more broadly integrative processes, of which, of course, transference is but one. Furthermore, olfaction is unique among all sensory domains in that its receptor neurons have direct access to the cerebral cortex. Freeman (2000, p. 20) noted that “this explains why odors of smoke, putrid flesh, coffee, tobacco, perfume, body odors and so on are so much more emotionally compelling than the visual and auditory sensations that accompany them.”

Olfaction is also an easy modality to illustrate the disjunction between the content of a sensory stimulus and its meaning for the person. A commonplace example is known by women during pregnancy. They frequently report, especially during the profound hormone shifts of the first trimester, that certain smells suddenly carry profoundly alien meanings, despite remaining recognizable odors. Aromas of coffee, bacon, and even chicken soup that were previously pleasing can abruptly be interpreted as noxious, toxic, and nauseating. Still, those smells are clearly registered as coffee, bacon, and chicken soup—an interesting combination of the sensorily “real” and the constructed.

Freeman (2000) surgically implanted a 4 mm × 4 mm 64-lead epidural electrode array to study the dynamics of the olfactory bulb in rabbits and cats. The 64 separate, very closely situated EEG recordings provided the opportunity to observe neuronal population behavior. We found that no patterns could be detected at the level of the sensory arrays in the nose, although they could be discerned at the level of the olfactory bulb, where populations of neurons self-organize in a bulbarwide fashion. Furthermore,

this gives a very different picture of the transition from sensation to perception from the one generally advanced by materialists and cognitivists, who hold that the information from an odorant is focused by the bulb into just a handful of neurons. Instead, my research shows that the brain generalizes by forming a macroscopic pattern of activity . . . the patterns are therefore created by the neurons within the bulbar population, not imposed by the outside. (p. 73)

The shift toward a macroscopic ensemble is what distinguishes perception from sensation, and in the case of olfaction, an invariant pattern is generated across the entire olfactory bulb. Several characteristics of the bulbar pattern are noteworthy:

1. Background activity is irregular and unpredictable.
2. The whole population takes over in a way that limits the input from other sources, whether they are from the cortex or from the stimulus itself.
3. A repeating, bulbar waveform oscillates, occurring in the gamma frequency and ranging between 20 and 80 Hz (cycles per second).
4. An inhalation waveform emerges over the entire bulb for a short period of oscillation that we describe as a burst; the burst will only carry a pattern if the odorant has a previously learned meaning for the creature.

⁴ The same dynamics have been found in other cortices, and in our own species. Freeman et al. (2003) observed them using scalp EEGs.

5. This burst forms a spatial pattern of amplitude modulations by the 64 micro-EEG.
6. Each amplitude modulation pattern is distinctive and individualized for each rabbit, like a unique signature, despite the fact that many rabbits sniff the same odorant. This suggests that the pattern of amplitude modulation is unique for each rabbit, meaningfully constructed according to the individual history of each animal.

The structured neuronal population activity occurs only if the odorant has a historical meaning and each animal's "take" of the same external stimulus is unique. Thus, our data support a constructivist model of perception, as history helps to create a uniquely experienced present.

The Construction of a Percept: A Forever Evolving Story

You could not step twice in the same rivers; for other and yet other waters are ever flowing on (Nahm, 1964).

A good example of the constructive, always changing nature of perception can be found in the serial exposure to different odorants, all of which have been learned and therefore have a meaning to the animal (Freeman, 1991). We presented the first odorant (sawdust) to rabbits and observed a distinctive pattern, as shown in Figure 2, which can be viewed as a topographical map of the amplitude modulation patterns noted earlier.

The contour plot at the left emerged consistently from bulbar EEGs of a rabbit that had been conditioned to associate the scent of sawdust with a particular reinforcement. After the animal learned to recognize the smell of banana (middle), reexposure to sawdust led to the emergence of a new sawdust plot. The amplitude modulation pattern of the reexposure to sawdust was different from the first, as it was changed by the intervening experience. We concluded that every new meaningful experience alters all others, and there are no fixed stores or representations. Bartlett (1932) was prescient in stating, "Some widely held views [of memory] have to be completely discarded, and none more completely than that which treats recall as the reexcitement in some way of fixed and changeless 'traces'" (p. vi). Even at the level of unimodal perception, we observe change in perception as a function of experience. Often, it is assumed that it is only at the global, multimodal organization of a self that this level of modification occurs, but as we see, it occurs at the most basic of levels. Freeman (2000) concluded



Figure 2. Dynamic contour plots of odorant stimuli.

that context dependence is an essential property of the cerebral memory system, in which each new experience must change all of the existing store by some small amount, in order that a new entry be incorporated and fully deployed in the existing body of experience. This property contrasts with memory stores in computers, libraries, and telephone books, in which each item is positioned by an address or a branch of a search tree. There, each item has a compartment, and new items don't change the old ones. Our data indicate that in brains the store has no boundaries or compartments, and that it comes into play wholly with each cortical state transition. (p. 99)

This continual feedback process is an endless process of repositioning, and these dynamics are the basis for perception, whether they are at the unimodal level or whether they are at a very broad integrated and evolving percept of us and others. Transference is a specific form of these intentional dynamics, whereby previous emotional attachments both inform and shape current experience and also influence others to participate in our perceptual construction. The complex perceptual construction we refer to as transference helps to orient us as we participate in each new relationship. If historical attachments tend to dictate the terms of perceptual construction, it may be unrealistic and unhealthy, but it will not be unfamiliar. In the analytic setting, we study this process by way of our attempts to become more aware of the transference and countertransference patterns, looking at how an ego function (in Bird's [1972] parlance) becomes truncated, squeezing the self and the other into a restrictive and nearly redundant process.

Discussion and Conclusion

Here as elsewhere, becoming conscious counts for little. The theatrical and dramatic operation by which healing takes place—or does not take place—has a name: transference. . . . In transference, however, repetition does not so much serve to identify events, persons, and passions as to authenticate the roles and select the masks. (Deleuze, 1994, p. 19)

Fear can be conditioned, good behavior rewarded, and learning and memory found deeper and deeper within the trunk of the evolutionary tree. Many creatures from many phyla are capable of incremental learning, some of them with little or no nervous system at all. Plants, without anything resembling a nervous system, lean toward light, and bacteria and insects, particularly in groups, are capable of remarkable organization—a sort of group learning and memory. *Aplysia*, the “lowly” sea snail, can learn, remember, avoid, and approach with a mere 20,000 neurons. The examples of learning and memory in living systems are endless. Even metals have memories of sorts, with the ability to return or snap into a previous configuration (shape memory alloys). Learning and memory appear to be capabilities of most organized entities, and in the human brain, the phenomena of memory and learning have gathered an extraordinary degree of complexity and enrichment. In psychoanalysis, transference is a crucial phenomenon that possesses important properties of learning and memory.

In keeping with the metaphor of the evolutionary tree, in *The Introductory Lectures*, Freud (1916–1917/1963b) stated that transference is like the “cambium layer in a tree between the wood and the bark, from which the new formation of tissue and the increase in the girth of the trunk derive” (p. 444). But transference is very far up on that evolutionary tree, and although it possesses the qualities of learning and memory that are found in other creatures and substances and in other parts of human psychic life, we seek to distinguish the concept further. Let us review how transference is beyond mere learning and memory, what of rabbit olfaction can be generalized to human life and what cannot,

and, finally, how transference can be distinguished from other aspects of human psychic life.

Although there is some dispute as to the evolutionary time and in what species a proto-limbic system first appeared, we know that it was roughly 500 million years ago. Before this time, we think that creatures displaying tropisms were not capable of goal setting—a form of proactively predicting the future, not merely reacting to gradients. To look to the future is to have expectancies, and expectancies are based on hypotheses. A hypothesis is an orientation toward the future based on and emergent from the store of accumulated experience. The limbic system began to allow for this type of orientation, using the sensory organization of each modality. We have labeled this cycle the action–perception cycle and this process intentionality. In our model of perception (which we presented through the olfactory system of rabbits), unimodal percepts are formed on the basis of a creature’s memory and the meanings of specific memories. With the advent of the limbic system, memory and learning now included expectancy as well. All forms of perception are then drenched in expectancy. Piaget has talked about this in terms of the balance of accommodation and assimilation a creature brings to each experience. Broadening to humans, we see that transference, as a prelude to people perception, invokes aspects of memory, learning, and expectancy.

Rabbit brains are different from their human counterparts, and one cannot loosely generalize. Although there are many important differences, let us first focus on an important similarity: Their brains perceive in the same fashion. Our data suggest that no mammalian brain processes information beyond the first synaptic layer in the forebrain, as we have illustrated in this article through the example of olfaction. Mammalian brains create meaning in the form of hypotheses. They seek information relevant to their immediate and remote goals, use it to test and refine hypotheses about their bodies and the world, and then discard the information and act on the revised hypotheses. *All sense modalities work this same way* (Freeman, 2000; Freeman, Burke, & Holmes, 2003). The sensory cortices are primed by a dynamic preaffference from the limbic system, an updating and reorientation for the next event. Brains broadcast their hypotheses and the results of their tests all over the forebrain. The broadcast messages overlap in the limbic system, where they are integrated into gestalts—multisensory percepts. This multisensory, integrated state of expectancy or intention is found in rabbits, humans, and all other mammals.

Another similarity is in the area of emotions. Emotions are important, at least for the reason that no appreciation of transference can do without emotion. We infer that rabbits have emotions, although many neuroscientists are dubious, because rabbits cannot, at least in a language we can decipher or agree on, tell us what they feel. We presume that affect has subcortical beginnings and that these structures are highly conserved across all animals (Panksepp, 1998). Rabbits also have basic attachments to the nurturing parent, although their immaturity at birth and complexity of developmental dependence on the nurturer(s) are minor in comparison with humans. Rabbits have memory, learning, expectancy, attachment, and (we assume) emotions, all of which are features of human minds and brains.

Finally, with respect to similarity, evolution is fundamentally conservative. Humans and rabbits share the anticipation of painful and pleasurable experiences and create corresponding memorial categories. Our brains share with other mammalian brains certain perceptual features such as expectancy and the testing of the environment through trial actions. Emotional memories are invoked or triggered in us as in other mammals by what the philosopher Charles Sanders Peirce (1976, 1992) has described as indexical signs.

Indexical signs are signs that operate through contiguity, signs that point to something else (cf. Freud's [1925–1926/1961a] description of signal anxiety). In the analytic setting, transference can be invoked by metonymic signs, a part substituting for the whole. For example, a single and isolated aspect of the analyst's personality, affective state, or appearance may trigger the expectancy that the analyst is in fact the feared, envied, hated, or loved other. A part substitutes for the whole. This perception is unconscious, automatic, and entirely uncontrollable. In this feature, we are no different from other mammals.

But the differences between rabbit and human mentation are profound, mostly because of the proliferation of a general-purpose cortical mantle with many specialized modules. Unlike rabbits, humans possess a faculty for the creation of meaning through language. This capacity infinitely expands the possible ways in which experience may be interpreted. Our initial response to the affects of transference may be automatic, involuntary, and unconscious, but unlike the rabbit, our language faculty affords us a nearly infinite capacity to create new meanings. Language provides us with nearly immeasurable degrees of freedom. Modell (2003) has, in addition, maintained that emotional memory is categorized according to metaphoric similarities and that metaphor is a primary commerce of the human mind. Distinct from rabbits, we are primed to unconsciously perceive metaphoric similarities in our emotional responses to other persons. Transference, according to our definition, is a necessity for people perception—a way of peopling a room in a familiar manner—situating or orienting oneself so that new forms of experience can be assimilated. We reserve the term for humans because of the near limitless transformations and experiences afforded through language and metaphor.

The human infant's immaturity at birth and extensive dependency on caregivers cannot be underestimated. Humans create (“find”) themselves through others, and this cannot be more clearly seen than in human infancy: For an infant to become a self, he or she is dynamically constituted, to a profound extent, through others. A psychological “self” is shaped out from an immersion with others. Infant studies from Condon and Sandler (1974), Bard (1998), Stern (1999), and others have documented the degree of this immersion (Fogel & Thelen, 1987; Trevarthen & Aitken, 2001). Tronick and Weinberg (1997) spoke of a coordinated and emergent musicality between infant and mother. This profound immersion has three important consequences for our conceptualization of transference.

1. Birds may imprint, rabbits may attach, dogs may bond, but at birth the degree of maturity and presumably of self-definition and organization is far greater in each of these creatures than in humans. Moreover, birds cannot re-imprint; only mammals can do so, and only humans can change allegiance, convert, and be reborn. The conclusion: Just as we are situated through others in our infancy, so there remains throughout our lifetimes the tendency to find an extension and experience of our self through others. This tendency, nay imperative, results from our infantile immaturity and “flexibility” and leads to the specific phenomenon we call transference in humans.

2. The analogy to creative music making, applied to infant development and human relationships, is not merely a constituting of a self through a bounded other. In the infant–mother dyad, in a real jazz ensemble, and in the clinical encounter, real music is to be made through mutual influence (cf. Koblauch, 2000). In the consulting room, the patient is also influencing, shaping, and eliciting the therapist, and for this reason we join many other contemporary analysts in depicting the situation as a transference–countertransference matrix. Renik (1993) described the transference situation in terms of an embroilment as opposed to an ensemble. The term *embrace* might even be more applicable:

It seems likely to me that if we could always closely examine the sequence of events by which an analyst becomes aware of his counter transference motivations, we would find that it *invariably* begins with his noting how he has put them, sometimes imperceptibly, into action. . . . At the same time, we regularly observe that successful analytic work unfolds via a process of continuous, mutually active embroilment between analyst and analysand, and continuous effort on the part of both to become aware of and clarify the nature of the embroilment. (Renik, 1993, pp. 137–138)

3. One might think of an indeterminate zone of experience between self and other or, better, a healthy permeability at the edge of boundedness of self, whereby a playground of linguistic and metaphorical creations is allowed to take shape. Despite how much we are encapsulated by our own private meanings and experiences, a basis must remain for ongoing immersion, uncertainty, a tussle for a new ensemble shaped by the previous melodies constituted by each of the participants. Otherwise we become rigid, Parkinsonian, or autistic, characterologically disturbed, encapsulated selves, insufficiently responsive to the worlds that we experience. It is important to appreciate that the transitory permeability to immersion and influence, which constitutes the beginnings of transference, is different from a more enduring form of change. The fantasies one has of strangers at a cocktail party or at a conference are less influential, in a longer term sense, than the type of change that can result from an important mentoring relationship, from falling in love, or in the depth and compassion of the therapeutic encounter. It is helpful to think in terms of a continuum: from the general transference function at the one end to a transference neurosis at the other (cf. Bird, 1972).

Analysts are accustomed to thinking and hearing that everything is in the transference, or that transference is at the core of all psychic life. These rather general statements possess a certain appeal, and perhaps their appeal has to do with a resonance—the notion that we all construct what we perceive according to our own unique meanings and expectancies. But this general statement of constructivism has broad definitional applications far beyond transference. We must remember that in transference, we are not talking only about learning and memory and expectancy in general; to be transference, it must be part of a percept of another person. Furthermore, it is a distinctively human phenomenon because of our frontal lobes, our language, and our affinity with metaphor. And finally, transference is distinctive in that it depends on early patterns of emotional attachment with caregivers. In the initial interview, the patient begins to enact an unconscious recruitment of self and other based on a chimera of historical and current experience, but the patient has yet to unlearn the restrictive meanings of the past. It is only through the deepening, repeatability, and analysis of the clinical encounter that these transferential impressions become transferential enactments, even transference neuroses. It is here that the greatest capability for enduring change occurs: Our private meanings as expectancies begin to become unlearned, and new “odorants” are capable of having an enduring impact.

Directions for further empirical elucidation of our proposal are possible, although complicated, as they are in any interdisciplinary enterprise, and particularly with such a global process as transference. At the level of neuroscience, support may need to come in different quarters, a bit at a time. In social psychology, work such as Andersen’s (Andersen & Berk, 1998; Andersen et al., 2002) should help to provide strong experimental support for the phenomenon of transference and its psychological and interpersonal characteristics.

One area for further research is to expand our understanding of the global integration that occurs in neurodynamics. This work is already underway with respect to the patterns

of activity that underlie intentional behavior (Kozma et al., 2005). The patterns incorporate large areas of cerebral cortex into cooperative domains known as wave packets, having carrier frequencies in the beta and gamma range and recurring at frame rates in the theta and alpha ranges.

Our view of transference, which involves a constant reworking of past neurodynamic organizations in the presence of new experiences, involves the characteristics of both creation and dissolution. We view the neuropeptides vasopressin and, especially, oxytocin (which birds do not have) as involved in the process of “loosening” the fixity of previous organizations, preparatory to adoption of new modes of relating to others (Freeman, 1995). Interestingly, oxytocin has been implicated in the neurobiology of attachment (Insel, 1992; Kendrick, Levy, & Keverne, 1992), although we know that the best attachments also have the most flexibility in expression. The study of the affective effects of this neuropeptide (Pincus & Varley) as well its measurement in functional MRI (Nahas, Pincus, Morgan & Panksepp) may also help to shed light on perceptual and transference processes.

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