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Reference and Affect

Abstraction in Computation and the Neurosciences[1]

Chapter 16 of

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The Iconology of Abstraction

Non-Figurative Images and the Modern World

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Introduction

Twenty First Century computational neuroscience and Twenty First Century psychoanalysis have two very different ways of representing the mental life of the subject, each with its own merits and limitations. This paper performs a superimposition of Peircean semiotics onto André Green's model of unconscious representation. The idea of reference in Peirce (distinct from representation) can be better understood in light of how affect emerges from the unconscious according to Green. The mental representation, according to Greene, is accompanied by a quantum of affect. From this I construct a theory of reference: the role of affect within mental representation is what we can describe as the "feeling" of reference. While this is primarily a contribution to linguistics or semiotic theory, it could also be used to think about how the sciences consider their objects of knowledge—in this case the mental life of the subject. Perhaps

[1] Different parts of this writing appeared previously in an earlier form: *Future Computing and Robotics: A Report from the HBP Foresight Lab* (Christine Aicardi, Michael Reinsborough, Nikolas Rose, 2016, deliverable 12.1.3 under FLAG-ERA project award 604102); "The quest for brain-like machines" newsletter 2015-16 winter issue, Scientists for Global Responsibility; "Reference and Affect" (Université de Reims Champagne-Ardenne, France: Res Per Nomen 3, Conference Publication, , 2016).

the most relevant example is the application of neuroscience to computing and in particular "affective computing", the computational recognition of human emotion. I therefore begin with a brief description of the neurosciences.

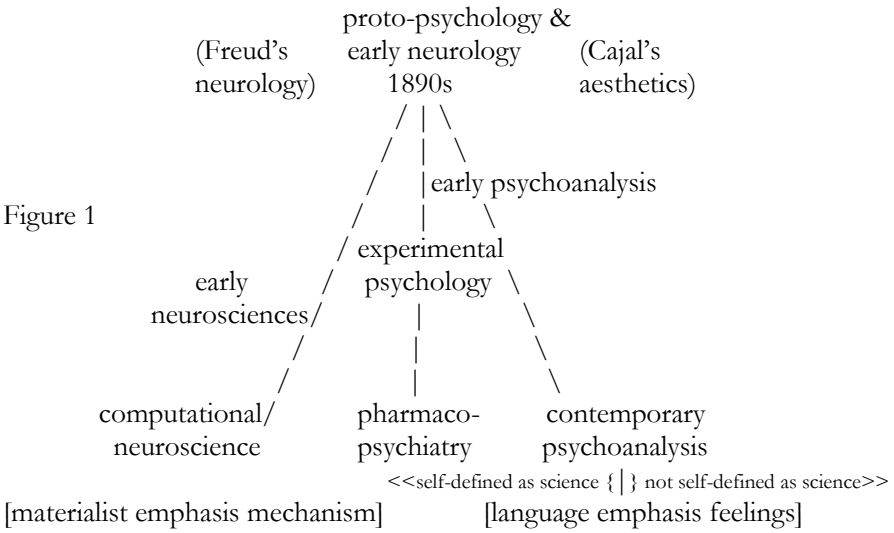

Figure 1

Figure 1 Differentiation of different trajectories for contemporary traditions of considering the mental life of the subject

Interest in the brain and neurological functions of the body has a long history. In the 1890s the aesthetic skill and early staining and microscopy techniques of Santiago Ramón y Cajal enabled him to make the first hand-drawn pictures of the long, extended cells that we now call neurons. The physician Sigmund Freud originally hoped to make a careful materialist study of the object (if we take that object to be the brain/neurological body) of the mental life. Indeed, he initially published on the topic of neurology and his early models of the unconscious were conceived as a type of neural stimulus/memory model of the mental life of the subject.[2] Perhaps because the mechanism of the mental life was simply too complicated to know with the methods of the 1890s, he developed instead a method of asking the subject about their mental life, what I will call a more subjectivist method. Advances in psychology were achieved by Freud's new method, which came to be known as psychoanalysis. Freud continued to identify this as a scientific method. Later psychology also developed what could be described as a more objectivist framework of knowledge- basing knowledge on a more traditional type of controlled

[2] Elizabeth Wilson, *Psychosomatic: Feminism and the Neurological Body,* (Duke University Press, 2004).

experimental method. Throughout the Twentieth Century the objectivist tradition with its strict materialist interest in the neurological basis of mental life continued the gradual accumulation of knowledge leading to the interdisciplinary establishment of the neurosciences.[3] What would now be thought of as several very different traditions of considering the mental life of the subject can trace part of their origin story through the heady mixture of ideas and experiment in the cauldron of the 1890s when in some important ways they were not differentiated.

The leading edge of contemporary neuroscience seeks to model brain structure, function and activity using computational systems. More recent research investments include large-scale projects for computational neuroscience such as the Human Brain Project. This EU initiative uses several different computational platforms to map brain structure and model brain activity. This in turn creates innovation in computer science which benefits from the attempt to emulate brain activity.

Ever since Cajal saw and drew the first pictures of a neuron in the 1890s, scientists have tried to understand the electrical properties of our constantly changing brains. In 1952 the Hodgkin–Huxley nonlinear differential equation to describe relations of charge and exchange (sodium-potassium ion gradient) at the synaptic cleft between the neurons was discovered in a patch clamp study of the giant squid. The changing relationship between neurons has been simplified as "What fires together wires together".[4] This neural plasticity allows the brain to strengthen links that acknowledge patterns in its environment.

This same principle is emulated when building neuromorphic computer chips—chips that mimic the decentralized memory and unusual firing patterns of the brain. Since much energy lost in computing happens between memory storage location and the central processor, a decentralized structure of memory stored in/near the relationships of firing patterns that do simple calculations can be more energy efficient, crucial for supercomputers. This efficiency is like a video graphics card that performs calculations and stores memory away from the central processing unit of a computer.

The 86 billion neurons within the human skull utilize 20 watts of power (up to a thousand trillion synaptic interconnections) and can solve complex problems like movement or recognizing

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[3] Nikolas Rose, *The Politics of Life Itself* (Princeton: Princeton University Press, 2007).

[4] Donald Hebb, *The Organization of Behaviour* (John Wiley & Sons, 1949); Carla J. Shatz "The Developing Brain", *Scientific American.* 267:3 (September 1992), 60–7.

a face. In comparison an exascale supercomputer (probably the size of a football field, requiring the equivalent of a small coal-fired power station to run) would be necessary to simulate this amount of neuronal interconnection.[5] Most visual or other pattern matching tasks (such as those necessary for moving in an environment) quite simple for a person are beyond the ken of advanced computing and robotics.

Our smart phones now guide us to our destination using mapping algorithms and speech recognition software. Brain-inspired machines are expected to have numerous applications (in robotics, surveillance, self-driving cars, knowing what consumers want, and potentially in medical informatics). But they won't make motivated decisions that take into account embodied existence in an immediate environment (as any simple-minded rodent can do). The science fiction imagination of AI (so-called "strong AI") is either not possible or a long way off.

Affective computing

In most discussions of artificial intelligence, it is the cognitive capacities of computers that are at the forefront. However, the increasing sophistication and greater uptake of intelligent calculation machines raises another key issue, which concerns the affective dimension of the relation between humans and such machines. The recognition of emotions is an important part of human-to-human communication, providing the context and sometimes the content of communications. Even when we do not know the precise feelings of another, we often estimate or impute a sentiment and respond accordingly. As computers come to have a greater capacity to provide information to humans in an interactive and situationally responsive way, it is likely that we will judge these interactions by the standard of our human interactions. *Affective computing* is the ability of computers to recognize human emotions and thus to be able to respond more appropriately.[6]

Charles Darwin was one of the earliest writers to suggest that we might be able to classify emotions scientifically.[7] But it is only more recently that science has attempted to classify and

[5] An exaflop is a billion billion floating point calculations per second, a thousand-fold increase in the performance of the first petascale computer developed in 2008.
[6] Rosalyn Picard, Affective Computing (Boston: MIT Press, 1997)
[7] Charles Darwin, *The Expression of the Emotions in Man and Animals* (1872). Other writers in the 19th century had also considered this issue, for example, Sir Charles Bell, *The Anatomy and Philosophy of Expression* (1824). Henry James suggested that some emotions have "distinct bodily expression" and thus

categorize these distinct bodily expressions, and therefore also make them measurable. In 1978, Paul Ekman published the Facial Action Coding System (FACS) which is used to describe how faces express emotion through muscle movements.[8] The development of computer systems that can visually recognize these movements and then classify them according to the FACS has been a strong driver of further investigation in affective computing. Facial micro-expressions, brief muscle movements that indicate an emotion sometimes too quickly for another human to see, can be discerned by more sophisticated facial recognition systems.[9]

The growing literature in the 1990s around the physio-psychological FACS system encouraged the development of affective computing. As two researchers explain,

> [E]motion detection in general and FACS in particular each lends itself naturally to the field of pattern recognition research that has a rich literature and a wide scope of techniques from the simple template-matching to multilayered neural nets and scores of classifiers, all of which gave researchers in computational emotions the basis to start developing emotion detection systems.[10]

Researcher interest then extended to many more potential modes of affective computing such as the analysis of speech, video, text and images, and other forms of physiological response such as electrodermal measurements of arousal linked to the sympathetic nervous system.

Affective computing typically relies on collecting some type of physiological data from the user. There are various modalities for the analysis of the emotional content of interaction.[11]

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opened up the possibility of physiological measurement. Henry James, "What is an emotion?" *Mind*, 9 (1884), 188-205.

[8] Available at https://www.paulekman.com/product-category/facs/ [accessed Nov 2 2019].

[9] In some cases, these cues to what another human is feeling might be more readable by machine observer than a human observer. See P. Ekman, & W. Friesen, W. 'Nonverbal Leakage and Clues to Deception.' *Psychiatry* 32 (1969), 88-97; P. Ekman, 'Lie Catching in Microexpressions' in Martin, ed. *The Philosophy of Deception*, (Oxford: Oxford University Press, 2009) 118-133.

[10] A. Ayesh, W. Blewit, 'Models for Computational Emotions from Psychological Theories Using Type I Fuzzy Logic' *Cognitive Computation*, 7:3 (June 2015) 285-308.

[11] From speech acoustic properties such as pitch, intonation, loudness, or speaking rate and voice quality can be combined to estimate emotional content. Body gesture recognition focuses on finding body alignment patterns of movement that indicate some emotional state, perhaps agitation, enthusiasm, or being tired. By using a Facial Action Encoding System (FACS), developed by Ekman, muscle movements in the face can be categorized and learned by a computer with a camera and a visual recognition system. Slightly more intrusively, facial electromyography measures muscle movement in the face. Electro encephalography (EEG) measures electrical patterns in the cortex which can sometimes be correlated to emotions. Normally EEG is not thought to provide a good indication of the activity of the lower part of the brain which some theorists associate with certain types of affect. Galvanic skin response can be used to

The user's emotion can then be classified using some theory of how emotions express themselves physiologically. There are various theories of this; and how precisely to classify emotions is still a matter of debate. The physiological data could be as varied as the sound of the voice, a visual image of the face, or galvanic response measured from the skin. Even word semantics or how the user physically interacts (smoothly or agitatedly) with keyboard, touch screen, and mouse are being investigated for recognizable patterns of emotion.

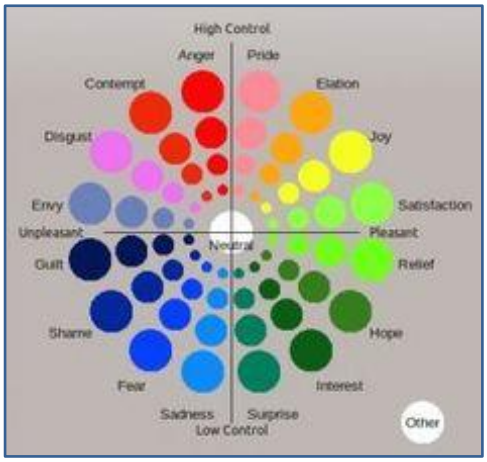

Figure 2: The Geneva Emotion Wheel

Source: K. R. Scherer, "What are Emotions and how can they be measured?" *Soc. Sci. Inf.* 44:4(2005) 469-729

Regardless of computing power, advances in algorithm development, or use of ever smaller wearable devices more efficient at measuring response, the validity of affective computing will in some ways still have to do with the theories that are used to correlate

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measure arousal. The changing electrical properties of the skin are thought to be closely associated with the sympathetic nervous system (which, for example, in situations of extreme arousal, is associated with the so-called "fight or flight" response). Other physiological measures influenced by emotions include heart rate, breathing, blood pressure, perspiration, or muscle contractions. Affective computing methods are normally accomplished by initially correlating physiological measurement to some judgement of actual emotion (perhaps self-reported). When intense emotions are correlated with physiological measurement values these can be used to predict affect in computing scenarios [G. Stemmler 'Introduction: Autonomic psychophysiology' in Davidson, Scherer, Goldsmith, eds., *Handbook of Affective Sciences*. (New York, NY: Oxford University Press, 2003) 131-134; J. Schwark, 'Toward a Taxonomy of Affective Computing', *International Journal of Human-Computer Interaction*, 31:11 (2015) 761-768]. Algorithms are developed that the developers can then test against more examples where it is thought that the actual emotion is known. Often training sets of data are used to train an algorithm to recognize particular emotions.

physiological indexes to their emotion explanation. A brief review reveals affective computing researchers have been building their affective models from psychology theorists, including: Millenson's 3 dimensional scale of emotional intensity (1967), in the lineage of Watson (1930) with a behaviourist model; Scherer (2005) with the Geneva emotion wheel- valence and control- or the Circumplex model- valence and arousal wheel adapting Russell (1980) in the lineage of Wundt (1903); Watson et al (1999) with the PANA model- quite similar to the Circumplex; Ekman (1967); Damasio (1996); Plutchik (1980); and Pörn (1986).[12] Many measurement systems use a two-dimensional arousal and valence scale. Sometimes a third category "dominance" is also used to express the strength of the emotion, or in some categorizations "control", how much control the person expressing emotion feels with regard to an event, is a variable paired with valence as in this emotion wheel.

Beyond identifying emotion, some types of affective computing hope to respond to the user with an appropriate emotion. When a computer does this, it simulates the outward signs of an emotion rather than has emotion itself. Thus, it is simulating the expression of an emotion (providing expected emotional aspects in message communication) rather than feeling the emotion.[13] Nonetheless, this may lead the human interactor to mistakenly impute an internal world to the computer—or robot—and this may have consequences for future interactions.

Finally, it is worth noting that, under the label of "affective computing", a small subset of researchers are examining the role of emotional memory in cognition. By linking an emotional valence to aspects of a cognitive representation (possibly through the hypothalamus) an organism

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[12] J. Millenson, *The Psychology of Emotion: Theories of Emotion Perspective. 4th ed*. (Hoboken: Wiley 1967); J. Watson, *Behaviorism (revised edition)* Chicago: Chicago University Press 1930); K. R. Scherer, "What are Emotions and how can they be measured?" *Soc. Sci. Inf.*, 44:4 (2005) 469-729; J. Russell, 'A circumplex model of Affect.' *J. Pers. Soc. Psychol*. 39 (1980) 1161-78; W. Wundt, *Naturwissenschaft Und Psychologie* (1903); D. Watson, D. Wiese, J. Vaidya, A. Tellegen, 'The Two General Activation Systems of Affect: Structural Findings, Evolutionary Considerations, and Psychobiological Evidence' *Journal of Personality and Social Psychology*, 76:5 (1999) 820-838; P. Ekman & W. Friesen, 'Head and Body Cues in the Judgement of Emotion: A Reformulation.' *Perceptual and Motor Skills*, 24 (1967) 711-724; A. Damasio. 'The Somatic Marker Hypothesis and Possible Functions of the Prefrontal Cortex.' *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 351 (1996) 1413-1420; R. Plutchik, *Emotion: A Psychoevolutionary Synthesis*, (New York, NY: Harper & Row 1980); L. Pörn, (1986). 'On the nature of emotions.' *Changing Positions, Philosophical Studies*, 38 (1986) 205-214.

[13] Rosalind Picard, 'Affective computing: challenges,' *Int. J. Human-Computer Studies*, 59 (2003) 55-64; J. Schwark, 'Toward a Taxonomy".

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has an advantage in understanding its environment through its past experience of similar situations. Specifically, emotional memory records a situation in reference to the conative goals of the organism. By modelling in robots this emotional memory representation of conative goals, these affective computing researchers might be said to be going beyond mere surface simulation of an emotion, at least to the extent that one understands the "feeling" of an emotion as the expression of conative goals (for examples see Gokcay and Yildirim).[14] In some ways this is similar to the idea that a mental representation of an object is accompanied by a quantum of affect.

Reference and Affect

The difference between reference and representation is an elusive but useful distinction to think about how it is useful distinction to think about how it is that we come to know what an object, or indeed anything in our lifeworld, is, how it is that we have some interpretive connection to a thing. Our knowledge of the object is always 'situated knowledge' to know a thing is also to have some affinity to it, to be in relation to it.[15]

I will be grafting Peircean semiotics onto André Green's model of unconscious representation. It is particularly the idea of reference in Peirce that I am interested in reinterpreting, in light of how affect emerges from the unconscious according to Green. Peirce defines a sign, or *representamen*, as "Anything which determines something else (its interpretant) to refer back to an object to which itself refers (its object) in the same way, the interpretant becoming a sign, and so on ad infinitum".[16] Thus for Peirce we might say that reference is the illusive relation between an interpretant (or subsequently the interpretant's interpretant) and the original object. This line of reference can never be studied directly but instead can only be intuited from the logical relations of representation. These relations of how a sign can represent

[14] Gokcay, D., Yildirim, G., ed. *Affective Computing and Interaction: Psychological, Cognitive and Neuroscientific Perspectives.* (Hershey, Pennsylvania: IGI Global 2011).
[15] Haraway, Donna "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective" Chapter Nine, 183-201 in *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge 1991).
[16] Charles Sanders Peirce, "Elements of Logic" *Collected Papers of Charles Sanders Peirce Volume Two* ed. C. Hartshorne and P. Weiss. (Cambridge: Harvard University Press, 1931)

its object (For example, as an icon, symbol, or index, etc.) are the subject of Peirce's philosophy of logic and especially the portion of his philosophy dedicated to semiotics. I will return to this idea of what reference means within Peirce's system after introducing the work of Green.

André Green has been publishing in the field of psychoanalysis for 50 years. *Key Ideas for a Contemporary Psychoanalysis: Misrecognition and Recognition of the Unconscious* (2005) is an excellent survey of contemporary psychoanalysis and a sort of Rosetta Stone for reuniting what had seemed (especially for the non-analyst) like an increasingly diffuse, splintered and contradictory field.[17] The failure of the original subject oriented approach (Freud, Strachey) to adequately account for the effects of an external object of affection upon the subject (Klein) lead to departures from the early theoretical framework.[18] Some insights were left behind in the quest for new explanatory powers. However, Green has now reinscribed the original and differing directions within one another by using a subject line/object line continuum approach (or theory of complimentary series). This sensibility of inclusion and translation reunites the many insights of what had been a fragmenting discipline and opens the way for a major contemporary renewal of theory.

Because of the breadth of peripheral topics that psychoanalysis touches upon *Key Ideas* could be mistaken for an exercise in interdisciplinarity. However Green, writing for the practicing analyst makes the first section of the book a nuanced discussion on practice. Readers unfamiliar with the field will have some difficulty. Nevertheless, the description of analytic listening is instructive even for those without the advantage of an apprenticeship in psychoanalysis. Analysis is rooted in a dialogical couple, where the patient speaks as much as possible in free association and the analyst listens with "benevolent neutrality". Discernable in free association are hesitations of speech and discontinuities of narrative logic which indicate the unconscious organization of the patients psyche. "Transference" is the situation where learned patterns of attitude towards a previous listener (for example the patient's primary caregiver in childhood,

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[17] André Green, *Key Ideas for a Contemporary Psychoanalysis: Misrecognition and Recognition of the Unconscious,* trans. Andrew Weller, (London and New York: Routledge, 2005).

[18] S. Freud, "Mourning and Melancholia" (Collected Works S.E. X1V, 1917) 237; S. Freud, "Beyond the Pleasure Principle" (Collected Works S.E. XVIII, 1920) 7; S. Freud, "The Ego and the Id" (Collected Works S.E. XIX, 1923) 3-66; J. Strachey, "The nature of the therapeutic action of psychoanalysis", *Int. J. Psycho-Anal*., 15 (1932) 127-59; M. Klein, *The Psychoanalysis of Children* (London: Hogarth 1932); M. Klein, "Envy and Gratitude" in *Envy and Gratitude and other works 1946-63*, (London: Hogarth (1957) 1975).

subsequent romantic relationships, etc) are adopted towards the analyst. The representation of external reality within the psychical mechanisms of the person forms a type of internal reality. It is towards the correlation of external and internal reality (which is to some extent shaped by the learned influence of previous dialogical relationships) that the psychoanalytic process directs the patient.

Theoretical frameworks for psychoanalysis do finally show up in the second half of the book but chiefly in such a way as to inform a practicing analyst. Again, the primary achievement of the book is to provide a common platform from which the insights of both object relations theory (Klein, Bion, Guntrip, Fairburn, Winnicott) and the more traditional subject oriented approach (Freud, Strachey) can be united.[19] Jacques Lacan's premise that the unconscious is structured like a language (important for structuralism) is refuted by Green. The method of psychoanalysis, "speech delivered lying down to a hidden addressee", creates psychoanalytic discourse.[20] Psychoanalytic discourse is, according to Green, "the result of the transformation of the psychical apparatus into a language apparatus".[21] From the unusual character of dreams this transformation process was first intimated.[22] In the illogic of dreams certain wish fulfillment phantasies of the unconscious are discernable despite being reinterpreted to protect the conscious from the disorganized "primary processes" of the unconscious. Primary processes relate drive activity to the memory traces of previous relations with the external world. For example, an infant that is hungry cries (seeking to end unpleasure) and creates a relationship with an object in its environment that is either fulfilling or unfulfilling. The memory of this is laid down in the unconscious.

The system unconscious is made up of representations which exclude the sphere of word presentations, or of ideas and judgments representing reality (material). Representations and affects are governed by the characteristics ...(1) absence of negation and contradiction; (2) absence of doubt or degree in certitude; (3) ignorance of the passage of time; (4) mobility of the

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[19] Klein, *Psychoanalysis of Children*; Klein, *Envy and Gratitude*; W. Bion, *Learning from Experience* (London: Heinemann 1962); W. Bion, *Elements of Psychoanalysis* (London: Heinemann, 1963); W. Bion, *Second Thoughts, (*London: Heinemann, 1967); H. Guntrip, *Personality Structure and Human Interaction: the developing synthesis of psychodynamic theory* (New York: International University Press, 1961); W. R. D. Fairburn, *Psychoanalytic Studies in Personality* (London: Routledge, 1952); D. Winnicott, D. *Collected Papers: Through Pediatrics to Psychoanalysis* (London: Tavistock, 1958); Freud, "Ego/Id"; Strachey "therapeutic action".

[20] Green, *Key Ideas*, 205.

[21] Green, *Key Ideas,* 205.

[22] S. Freud, *The Interpretation of Dreams*, Collected Works S.E. IV and V (1900) 1-621.

intensity of cathexes; (5) prevalence of mechanisms of condensation and displacement, together defining the primary processes. On the other hand, all these characteristics, qualified negatively here, are present and make it possible to recognize the secondary process.[23]

Because primary processes relate directly to memories of pleasure/unpleasure rather than the material reality facing the individual at any given moment, and because the potential intensity or mobility of these emotional memories (cathexes), primary processes are not suitable for an organism that must engage with external reality or perish. Thus secondary processes are used to translate the system unconscious to a consciousness that engages with reality. Language is found here, in the region of consciousness.

One of the themes that Green delivers in the book is the importance of the original drives that motivate a living organism. The first topography (1900) of the psyche (a sort of virtual diagram distinguishing unconscious and preconscious from conscious space, primary from secondary processes) was updated (1920, 1923) with a set of conceptual structures that take specific roles in relation to the psyche (id, ego, superego).[24] While the first and second topography are not incompatible Green is keen to note the differing conception of the ego and the role of the drives in the second topography, or structural model. The id (rooted in the somatic level of the body) is a function of the drives whereas the ego attempts to be a form of coherency that can relate the drives to reality. But note the ego has both conscious and unconscious aspects.[25] Thus the function of mediation between the drives and external reality is not solely the remit of conscious thought. Affect also now has a greater role in explanation of psychical phenomena.

According to Green, "one could conceive of the entire psyche as an intermediate structure between soma and thinking".[26] This intermediate structure correlating internal and external reality is the subject of Green's schema of unconscious representation. Green's figure 9.1 is reproduced below.[27]

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[23] Green, *Key Ideas,* 99.

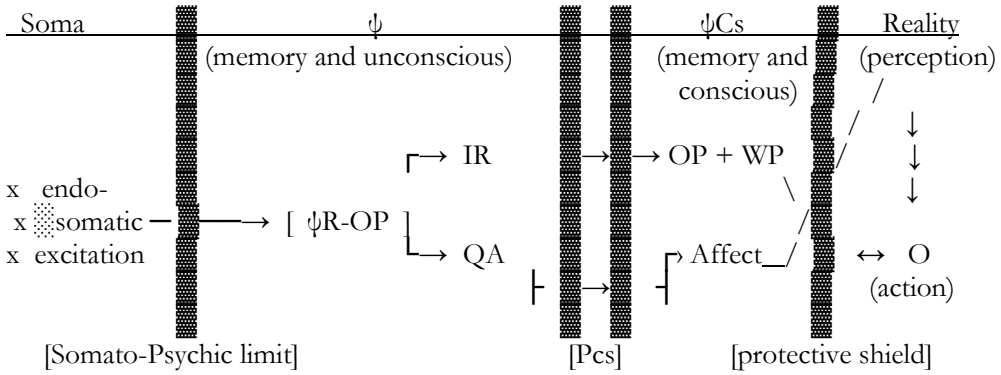
[24] Freud, *Dreams*; Freud, "Pleasure Principle"; Freud "Ego/Id".

[25] Acknowledging the majority unconscious aspect of the ego allows the therapist to consider problems that do not arise out of the instinctual drives but instead are a dysfunction of ego. Ego is defined functionally as relating drives to reality.

[26] Green, *Key Ideas,* 128

[27] Green, *Key Ideas,* 129.

Figure 3



ψR = psychical representative of the drive
IR = ideational representative
QA = quantum of affect
OP = thing or object presentation
WP = word presentation
O = object

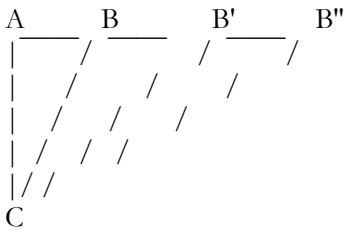
The three zones of transition are the Somato-Psychic limit (ψUcs), the barrier of the Preconscious (Pcs), and the protective shield (PS). These separate the four territories (soma, unconscious, conscious, and reality)

The internal reality is a function of the psychical representative of the drives (ψR) plus the internal presentation (that is memory traces derived from previous interaction) of the object (OP); whereas external reality consists of the action of the subject in relation to an external object. We might think of a linguistic statement in the form of subject-predicate where the predicate includes the object in relation to which action is taken. What can we say about this linguistic statement (WP) by situating it within Green's model of unconscious representation?

From the unconscious, according to Green's schema, the combined psychical representative of the drive and internal presentation of the object (ψR-OP) splits into both an ideational representative (IR) and a quantum of affect (QA). The ideational representative is a set of memory traces of an object outside the psyche. Traditionally representation (memory traces) and affect (discharge of excitation) have always been seen as distinct. Because affect is discharged it can not remain as a representation. But Green introduces the idea of residual quantum of affect. It is easy to conceive of an affective memory. If affective discharge can itself be remembered (leaving memory traces) it can itself have a relation to representation. Thus in the consciousness when the "thing presentation (OP)" (previously the ideational representative) is associated with the word presentation, affect, as a representation, is also available for association (OP+WP/A*ff.*). Writes Green, "if one takes into account the product of the division of the

psychical representative [of the drive] into ideational representative and affect representative, it is not illegitimate to see in affect a derived form of the instinctual representative".[28] Between the external reality (perception-action taken in relation to an object) and the internal reality (ψR-OP) lies any linguistic statement. For the purpose of consideration let the statement be in the form subject-predicate (inclusive of object). If ψR is a significant referent for the statement (WP) then the affect presentation (A*ff*) forms a more direct link than does the thing presentation (OP) via the ideational representative. Recent science has intimated that affective memory is an important aspect for successful intuitive associations.[29]

Figure 4



I would like to now set Peirce's triadic theory of the sign upon this schema. We can differentiate representation from reference by noting the logical forms of representation (iconic, symbolic, indexical, etc) that allow one sign to represent another. Thus, in triangle 1 sign A determines interpretant B to refer back to object C to which it itself refers. The logical set of relations AB and AC are forms of representation describable by logical semiotic principles, i.e. A represents C to B because it has the shape or is visually similar to C (iconic sign). B is also a sign because it can represent C to B' perhaps because it is also iconic or perhaps because it is a symbol (representation by rule or convention, such as a word which by convention refers to such and such a thing). Whereas the relation BC, or through subsequent signification B'C or B''C, is only formally describable through the AB-AC relation (add BB'-BC and B'B''-B'C for subsequent signification). BC, B'C and B''C are forms of reference. Semiotic logic has no way to directly represent them but intuitively we know they are meaningful.

Using Green's schema of unconscious representation, Peirce's theory of reference can be thought of as two triads: thing combination presentation/word presentation (B/B') link back to

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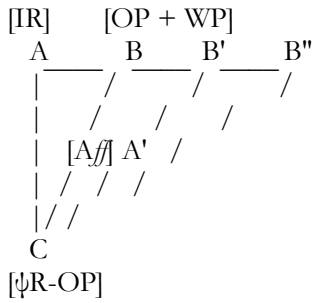
[28] Green (130)

[29] A. Bechara, H. Damasio, "Deciding advantageously before knowing the advantageous strategy." *Science*, 275 (1997) 1293–1295.

the ideational representative (A) (because thing presentation OP is the *representamen* interpreted by word presentation WP); and via affect OP+WP (B/B' thought of as a combined single interpretant) also links to the original psychical representative of the drive (C). Thus affect is a more direct link to the drive, or at least another link and a qualifying link. Both triads can be considered independently as representation (neither as reference) but *comparatively*, affect "refers" the word presentation (an interpretant determined by the sign) to the original drive "referent" to which the sign (thing presentation or ideational representative) itself refers (C= ψR-OP). The line of reference BC or for the linguist B'C can be thought of as passing through the affect presentation (A*ff*). Thus reference can be thought of as affective, uncanny. I am suggesting that affect, rather mundanely, represents reference.

Figure 5



One potential advantage of this for the linguist is an operational definition for 'reference': Affect Presentation (A*ff*) is also a sign A' which determines interpretant OP+WP (B/B') to refer to the referent ψR-OP (C). The relations A'[B+B']-A'C are in this case determinable by semiotic principles of representation, although admittedly the principles specific to this particular situation are unknown. These relations A'[B+B'] A'C (determined using the affect presentation) could serve as an operational definition of linguistic reference BC, B'C of the original triad in which the word presentation was considered in the traditional linguistic manner (through an ideational representative and without any consideration of affect). If so, linguistics would require semiotic rules particular to understanding affective representation as well as methods to "see" the affect presentation in action.

In addition to methodological gaps it seems to me there may also be moral gaps in such a project. For whose purposes would scientific objectification of affect through linguistic study be suited? This is to say, if "linguistic knowledge" is thought of as word presentation (WP)

associated through an object presentation with a particular ideational representative what might affect presentation for this particular word presentation tell us about the ψR of ψR-OP in an increasingly commercialized knowledge economy. Or, as Nietzsche might ask, whose will animates the form and purpose of this apparently neutral knowledge?[30] Unlike advertising or governance applications at least psychoanalysis, for whatever its other occasional moral failings, is clear about for what use affective knowledge is to be put: providing interpretations within a dialogical relationship that might better enable the analysis and (by their own will and on timing of their own choosing) to correlate internal and external reality. We begin to appreciate the virtue of a very disciplinary approach to psychoanalytic knowledge.

Regarding the utility of knowledge, the ending discussion of science (linguistics in particular) has a resonance with a particular theme of Green's book announced in the subtitle: "misrecognition and recognition of the unconscious". The third and final section situates psychoanalysis in relation to the knowledge claims of several other disciplines. Green considers both philosophy and the sciences, of which biology (particularly neuroscience) and anthropology seem to be the most relevant. A host of intriguing references are provided, a few of which I will reproduce for those interested in pursuing further the various directions here initiated: in mathematics, concerning salience and prégnance, René Thom; in law, Peirre Legendre; in complexity theory, Edgar Morin; in psychoanalysis/neurobiology, suggesting a possible brain topology of psychoanalytic functions, K. Kaplan and M. Solms; in neurobiology, a theory of primary and secondary emotions, J. Panksepp; in neurobiology, a theory of the selection of neuronal groups, G. Edelman; in anthropology, Godelier, Jullierat, and Héritier; and in linguistics, for his defence of Spinoza's "affect-concept", Meschonic.[31]

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[30] For commentary on Nietzsche's critique of sciences see G. Deleuze, *Nietzsche and Philosophy (*London, New York: Continuum, 1983) 68-70. For Green's comment on a psychoanalytic response to questions of utility see Green, *Key Ideas,* 286.

[31] R. Thom, *Saillance et Prégnance. L'inconscient et la Science*, R. Dorey éd., (Paris, Dunod, 1991) 64-82 ; Peirre Legendre, *Jour du Pouvoir* (Paris: Editions de Minuit, 1981); E. Morin, *Introduction à la penseé complexe* (Paris: ESF Editions, 1950); E. Morin, E. (2001) *La Méthode, vol. 5 L'humanité de l'humanité* (Paris: Le Seuil, 2001); K. Kaplan and M. Solms,. (2000) *Clinical Studies in Neuro-Psychoanalysis* (London: Karnac, 2000); J. Panksepp, J. "Emotion as viewed by psychoanalysis and neuroscience: an excercise in cons ience", *Neuropsychoanalysis,* 1:1 (1999) 5-15; G. Edelman, *Bright Air, Brilliant Fire. On the Matter of the Mind* (New York: Basic Books, 1992); M. Godelier, M. and M. Panoff, *La Production du corps. Approches anthropologiques et historiques and Le Corps humain, supplicié, possédé, cannibalisé* (Amsterdam: Archives contemporaines, 1998); F. Héritier, "Inceste et substance", in F.Héretier *Incestes,* (Paris: Gallimard, 2001); B. Jullierat, *Penser l'imaginaire*. *Essai*

Most remarkably, the long claim of psychoanalysis to the status of a "scientific" discipline has been left aside by Green in favour of a greater disciplinary self confidence in psychoanalysis' own particular epistemological contribution: "Scientific knowledge is not knowledge about objective reality but only knowledge of that which lends to treatment by the scientific method, in contradistinction to knowledge of the psyche which has to account both for that which is treatable by the scientific method and that which is not".[32] Green goes on to note the particular way in which certain partisans of scientific method have minimized or misrecognized the human unconscious, "Wittgenstein for his part lent support to the critique of the unconscious with his theory of logical positivism. One could not 'explain' what language referred to; one could only say what things looked like through its bewitching effects".[33] From this history we might take caution. Linguistics in particular has held a leading role in building an 'objective' science, free from the disturbances of the affect.

The human sciences were keen to show that they had emerged once and for all from a childhood and laid claim to the respectability belonging to objective knowledge, in the image of the exact sciences. Hence the interest of recognizing linguistics as a pilot science; for, as phonology showed, it knew how to rise to a level devoid of subjectivity, while flourishing in the sphere of what is significant.[34]

This review does not present a critical reading of Green.[35] I have myself added only a small overlay to the extensive work of Green (who himself writes on the shoulders of a century

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d'anthropologie psychanalytique (Lusanne: Payot, 2001) ; H. Meschonic, *Spinoza. Poème de la pensée,* (Paris: Maisonneuve and Larose, 2002).

[32] Green, *Key Ideas,* 282-3, 290.

[33] Green, *Key Ideas,* 290.

[34] Green, *Key Ideas,* 291.

[35] If forced to write in this direction one might start with examining to what extent that the psyche Green describes can be considered historically, to what extent Green's smooth and admittedly attentive language liberates/fails to liberate analytic theory from particular formulations (Oedipal narrative, death drive) accused in the past of being ideological or even reifying particular narratives about the reactionary possibilities of human nature. Green's debate with anthropologists about the universality of a prohibition of parricide makes one wonder how far Green is prepared to universalise a narrow body of psychoanalytic research knowledge gathered only in only one particular (industrialized) portion of world during one particular century. The issue of the psyche's historical relation to economic exchange [G. Deleuze, F. Guattari, *AntiOedipus: Capitalism & Schizophrenia. Vol 1.* Trans. Robert Hurley, Mark Seem and Helen R. Lane (London: Athlone 1984)] does not seem to be considered anywhere in the book. One wonders whether Green saw past Deleuze and Guattari's at times awkward anti-establishment language and their propensity to celebrate a world universally and permanently populated with "partial" objects (such as what circulate in the psyche of an infant). Thus while ethics (analyst/patient) are prominent in Green's writing

of psychoanalytic investigators, himself among them for half that time). The overlay adds little for psychoanalysis but for semiotics or linguistics it offers an insight into how we might conceive of reference [...] or even how we think about what we do.[36]

If we wish to construct an iconology of abstraction in the sciences (laws or description of how images in the sciences represent or attempt to represent their object) then this theory of reference points to the role of the affective, which in science seems underacknowledged. By contextualizing how the brain might see an object in relation to a situated, embodied affect we can begin to write a theory of reference for objects and compare this to computational strategies in neuroscience. The role of emotion theories in affective computing (what types of emotions, how and why do they occur) or the modelling of brain visual circuits on a computer could be productive starting points. The concept of affective memory from psychoanalyst Andre Green's schema of unconscious representation (here translated into the semiotic terms of Charles Sanders Peirce to generate an interpretation of Peirce's theory of reference) could be used to explore how affective memory may weigh into cognition, vision, visual abstraction, the presentation of evidence, and more generally, the culture and visuality of science.

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the role of institutional ethics and the historical imbrications of methods/theories of subjectification into existing power relations are unaddressed. Perhaps for a book intended as a practical reference for practising analysts this is an understandable omission.

[36] Questions of utility regarding 'what' we do might best be considered in a continuum 'what/why/for whom' (ψR).

Figure 1

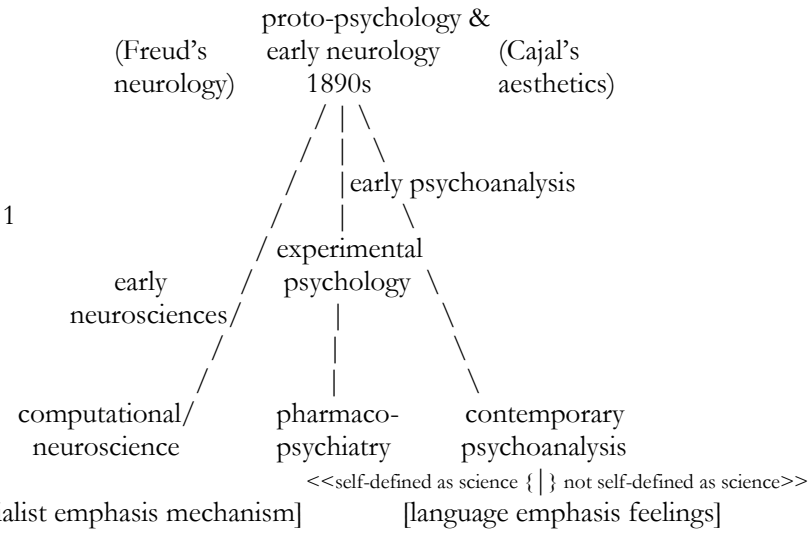


Figure 1 Differentiation of different trajectories for contemporary traditions of considering the mental life of the subject

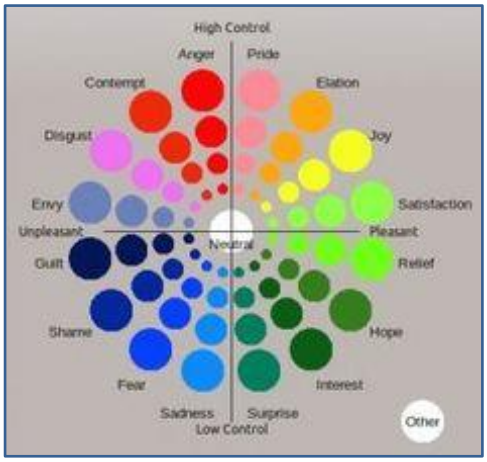
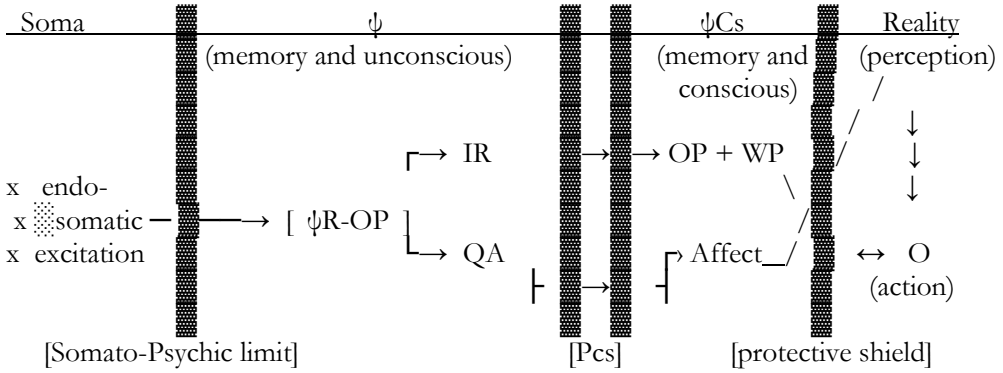


Figure 2: The Geneva Emotion Wheel

Source: K. R. Scherer, "What are Emotions and how can they be measured?" *Soc. Sci. Inf.* 44:4(2005) 469-729

Figure 3



ψR = psychical representative of the drive
IR = ideational representative
QA = quantum of affect
OP = thing or object presentation
WP = word presentation
O = object

The three zones of transition are the Somato-Psychic limit (ψUcs), the barrier of the Preconscious (Pcs), and the protective shield (PS). These separate the four territories (soma, unconscious, conscious, and reality)

Figure 4

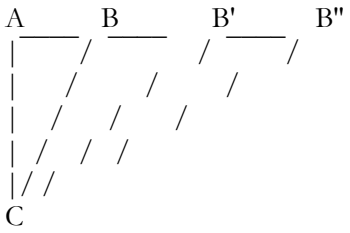
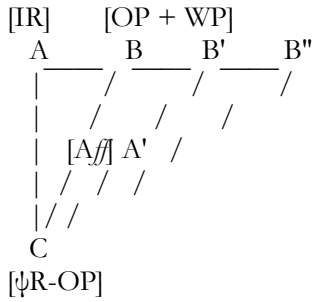


Figure 5



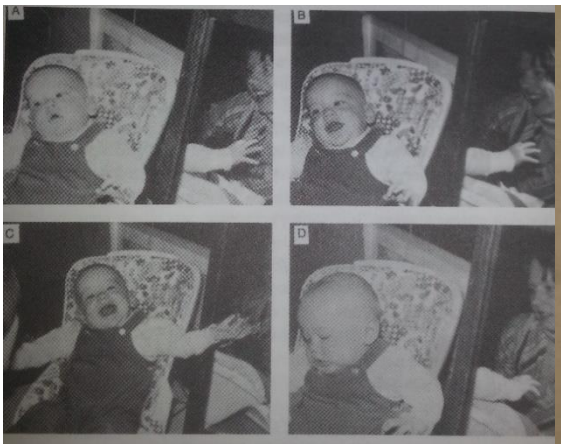


FIG. 6.4. A typical sequence observed during "attuned" interactions of normal infants and their mothers: (A) the infant looks at the mother and the mother shows an exaggerated facial expression (mock surprise); (B) the infant and mother smile; (C) the infant laughs, the mother "relaxes" her smile; and (D) the infant looks away, the mother ceases smiling and watches her infant. From Field and Fogel (1982). Reprinted by permission of Lawrence Erlbaum Associates

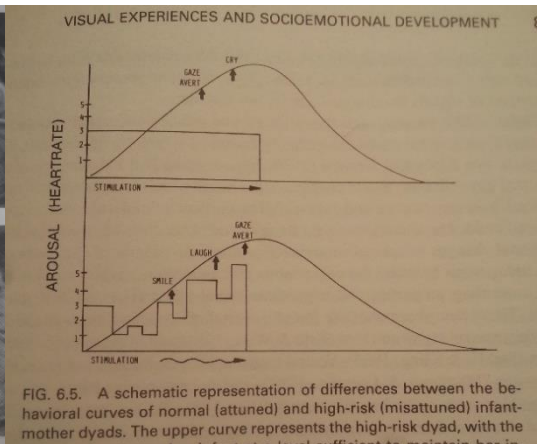


FIG. 6.5. A schematic representation of differences between the behavioral curves of normal (attuned) and high-risk (misattuned) infant-mother dyads. The upper curve represents the high-risk dyad, with the mother stimulating her infant at a level sufficient to maintain her infant's attention but then sustaining that level rather than modulating stimulation during infant gaze aversion and crying. The lower curve depicts the normal infant-mother dyad, showing varied or modulated stimulation by the mother as a function of the infant's affective signals and a cessation of behavior at infant gaze aversion, with the infant never reaching a crying state. From Field (1985a). Reprinted by permission of Academic Press.

Compilation Figure x
Two figures reprinted within a survey of neurobiology of emotional development showing mother-infant "attuned' interactions with modulated stimulation by the mother.

Source: Allan N. Schore, *Affect Regulation and the Origin of the Self: The Neurobiology of Emotional Development* (New Jersey: Lawrence Erlbaum, 1994).
Original Sources: T. Field and A. Fogel, *Emotion and Early Interaction* (New Jersey: Lauwrence Erlbaum, 1982); T. Field "Attachment as Psychobiological Attunement: Being on the Same Wavelength. In M. Reite, T. Field eds., *The Psychobiology of Attachment and Separation* (Orlando, Florida: Academic Press, 1985) 415-454

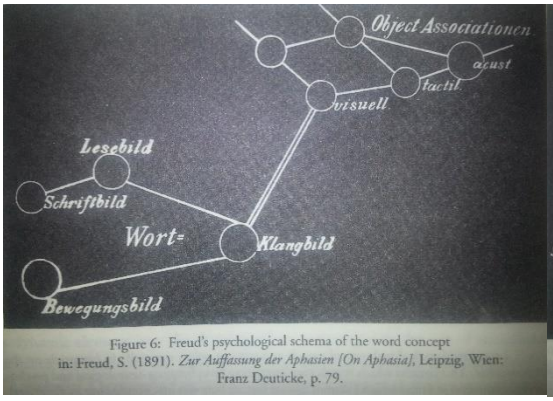


Figure 6: Freud's psychological schema of the word concept
in: Freud, S. (1891). *Zur Auffassung der Aphasien [On Aphasia]*, Leipzig, Wien: Franz Deuticke, p. 79.

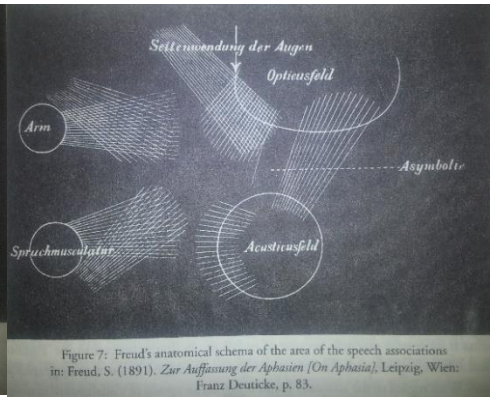
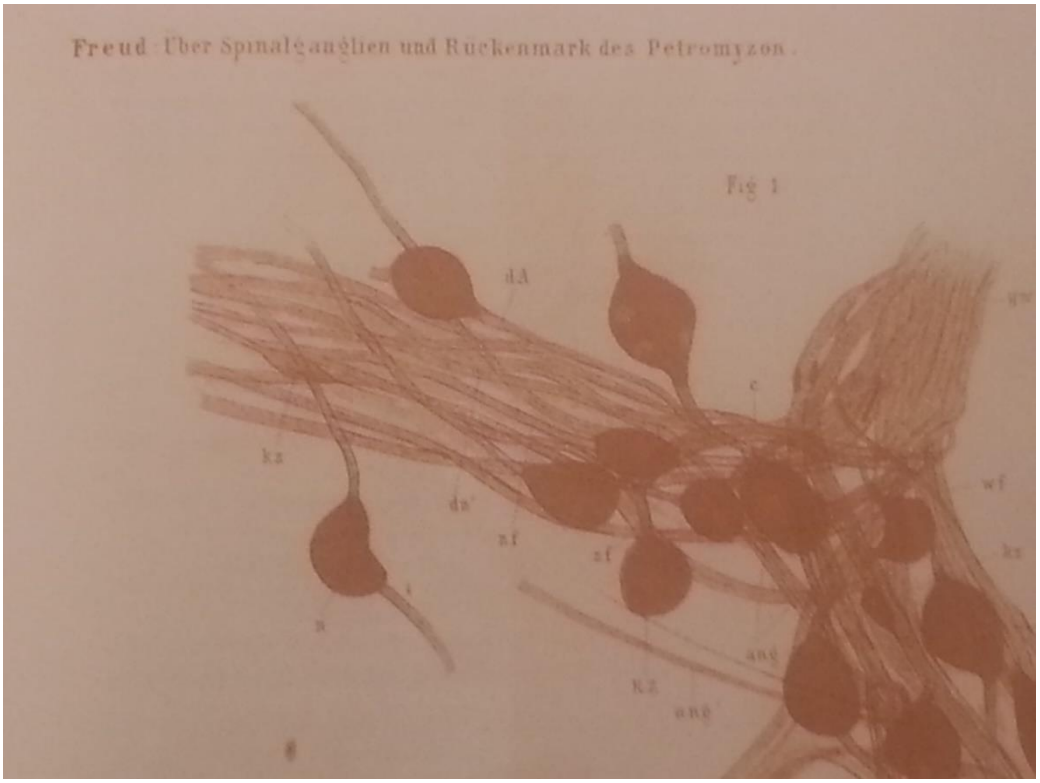
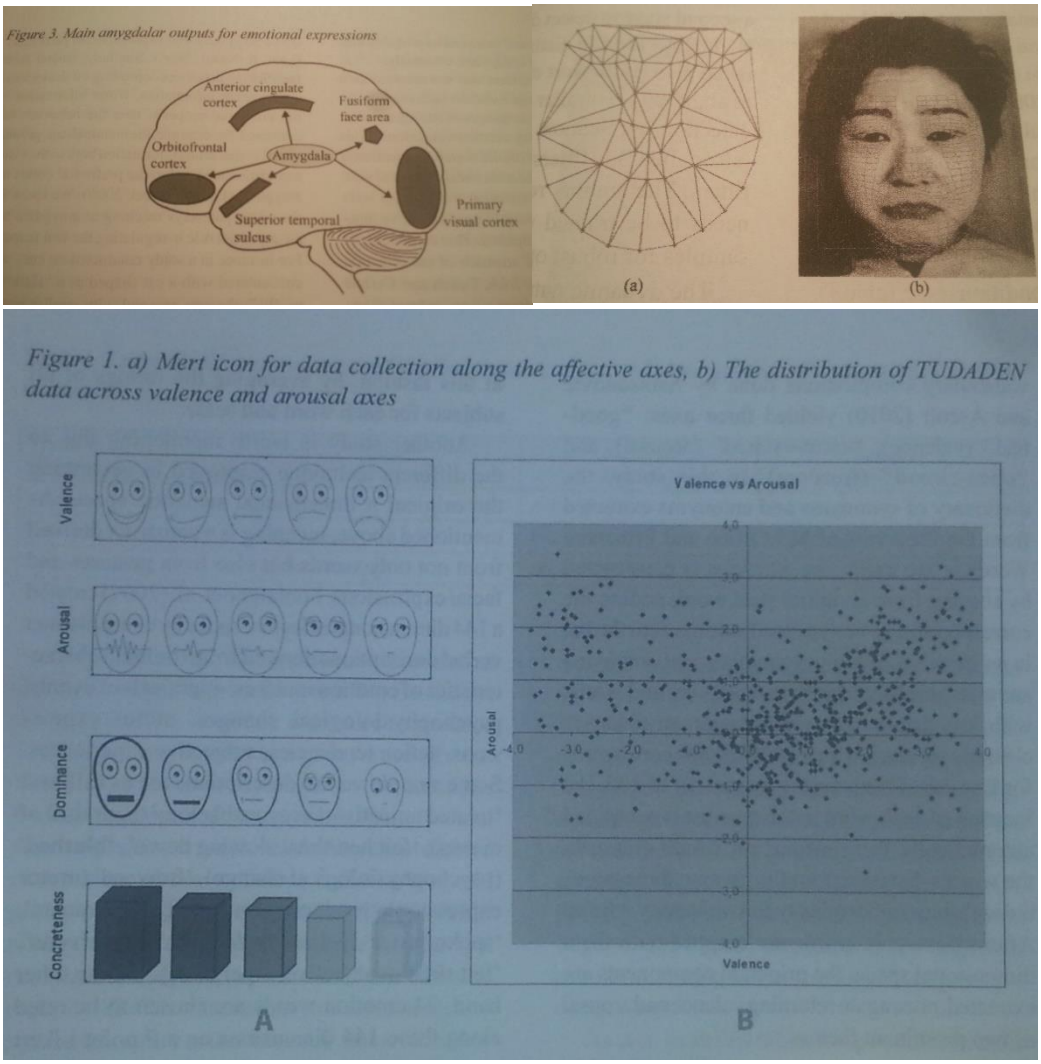


Figure 7: Freud's anatomical schema of the area of the speech associations
in: Freud, S. (1891). *Zur Auffassung der Aphasien [On Aphasia]*, Leipzig, Wien: Franz Deuticke, p. 83.



Compilation Figure y
Three Figures by Sigmund Freud reprinted in *Freud and the Neurosciences*. Top left: Freud's 'psychological schema' of the word concept (1891). Top right: Freud's 'anatomical schema' of the word association area (1891) Bottom: Freud's drawing of the neural ganglia of the Petromyzon worm made during his training and research as a neurologist (1879).

Source: Cornelius Borck, "Visualizing Nerve Cells and Psychical Mechanisms" 57-86 in Giselher Guttman, Inge Scholz-Strasser (eds) Freud and the Neurosciences: From Brain Research to the Unconscious (Wien: Austrian Academy of Sciences Press, 1998)
Original Sources: S. Freud, *On Aphasia* (Wien: Franz Deuticke, 1891); S. Freud, "On the Spinal Ganglia and Spinal Cord of Petromyzon" *Sitzungsberichte der kaiserlichen Akademie der Wissenschaften. Mathematisch-naturwissenschaftliche Classe*, Vol 78 Nos. 1-5 (1879)



Compilation Figure z
Three figures from compilation book on Affective Computing. Top left: Amygdala seen as an anatomical source for emotional influence within the brain. Top right: Paul Ekman inspired computer modelling for graph of arousal (excited/dull) vs valence (happy/unhappy) for data set.

Source: Didem Gökçay, Gülsen Yildirim *Affective Computing and Interaction: Psychological, Cognitive and Neuroscientific Perspectives* (Pennsylvania: Information Science Reference IGI Global, 2011)
Original Sources: (top left) A. Erdem, S. Karaismailoglu "Neurophysiology of Emotions", 1-24 in Gökçay, Yildirim *Affective Computing*; (top right) M. B. Stegmann *Analyssi and segmentation of face images using point annotations and linear subspace techniques* (Report, Technical University of Denmark, 2002); Cohen et al. "Facial Expression Recognition from Video Sequences: Temporal and Static Modelling. *Computer Vision and Image Understanding*, 91:1-2 (2003) 160-187; [images reprinted in "Communication and Automatic Interpretation of Affect from Facial Expressions" 157-183 in Gökçay, Yildirim *Affective Computing]*; (bottom) D. Gökçay "Emotional Axes: Psychology, Psychophysiology and Neuroanatomical Correlates" 56-73 in Gökçay, Yildirim *Affective Computing*