# VIRTUAL EMOTION
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## TWO M PCS
## TWO BREATHING BIOFEEDBACK UNITS

Virtual reality scenarios are restricted, from a psychological point of view, to the feedback from arbitrary motor responses which are measured with data gloves or suits. However, this only represents one section of human behaviour. This project intends to export physiological parameters for emotions into a virtual world. As a representation for emotions, visualizations of biosignals, such as breathing rhythm, are used.

In the preoccupation with the subject of virtual emotions, one is confronted with unusual perspectives concerning communications and cognitive sciences. In addition to this, there are references to psychotherapeutical techniques of trance induction.

## VIRTUAL REALITY WITHOUT EMOTIONS?

Virtual realities (VR) have a high degree of stimulation because of the transformation possibilities of its actors. Scenarios of transformation are possible with future technologies, in which data travellers can assume any appearance in order to play a role they have thought out. However, if we compare the complexity of VR with our everyday environment, great shortcomings become apparent. On account of the afore-mentioned fact that VR is restricted to arbitrary motor responses, only an extremely limited behaviour is possible. This shortcoming becomes particularly noticeable when we think of the communications possibilities within VR. Inter-personal communication involves, besides pure linguistic information, even nonverbal signals such as posture, intonation and psychophysiology. With the aid of these signals we recognize the irony in a joke or the intention of a statement. Considering this multiplicity, the selection to VR through the interface becomes even more apparent, as what makes everyday communications really exciting, is missing. What is meant here are the correlatives of our world of feelings, which, among other things, become noticeable in non-verbal communication. Non-verbal communication takes place in life, generally, without any conscious reflection. In this way we can recognize the hint of a smile by the fine changes in the muscles and we can recognize when someone is excited or has just woken up.[1]

In this work, the concept of representation is tackled very widely. It is used in the sense of a relation between what should be represented and what is actually represented. This relation can be very different. With the visualization of breathing rhythm, there is a relation between the breathing frequency and animation speed. In addition to this, the contraction and the expansion of the lungs is represented (symbolized) during breathing, by apparent contractions and expansions in the graphics. A further representation level can be effected by allocating frequency ranges to colours. When the graphics change to take on a reddish colour this can signify a high breathing frequency, and a blue colour stands for a low frequency. Representations can be assessed according to the quality of what is reproduced.

All this information forms the context in which we understand spoken language. How can emotional reactions be converted into virtual reality? One possibility would be to give the representation of the protagonist a certain facial expression depending on the desired or actual mood. This direct conversion, however, in a technical sense, still involves a lot of effort. It is one alternative to symbolically convey feelings. An aggressive mood can e.g. be elucidated by

a certain rhythm and/or by a certain colour combination. What is important, is only that the symbol used is to be intuitively accessible and suited to capturing the attention of the interaction partner. With the aid of similies known from telecommunications, statements about emotional connotations can be made but they do not have the complexity of non-verbal communication.

In order to solve this task, we have expanded the biofeedback technology popular in psychology. In the case of biofeedback, the patient receives a feedback message of his biosignals (breathing, brain waves, pulse, skin conductivity, etc.), so that he can learn to influence them himself. In this way, for example, an attempt can be made to learn relaxation states through the change in the skin conductivity. The feedback from such equipment is, as a rule, very simple. A green lamp lights up, for example, when skin conductivity decreases and a red one lights up when it increases.

## BIOFEEDBACK AS AN "EXCITING" REPRESENTATION

It was our aim to create a kind of external representation of mental and physiological states that is more complex and therefore, in at least one aspect, is comparable to non-verbal communication. As a result of lengthy series of experiments, representations were developed for this project which were able to capture the attention of protagonists. Tunnel-like fractals with fine colour nuances proved to be most suited to this task. The first experiments with this technology showed amazingly powerful effects. The mere feedback from breathing through "animated" fractals had such a powerful effect that it soon led to relaxed or hypnoidal states of consciousness with most of the test candidates. The effect that was surprising for us was that even the mere presentation to a larger audience (hynotherapists!) produced clear signs of group trance.

Encouraged by this success, we attempted to theoretically clarify the meaning of such a technology for virtual worlds. This produced very interesting, and at a first glance, provocative references. Research traditions which are largely isolated from each other in psychology, were involved: control mechanisms of the breathing centre in the brain, the cognitive psychology of mental representations, models of human consciousness and of the brain.

## TRANCE RESEARCH: FANTASTIC EXPLANATIONS FOR FANTASTIC PHENOMENA?

When researching trance phenomena, one is confronted with greatly changeable research strategies. First of all, there are the spectacular things that are supposed to be possible under hypnosis. However, when analyzed more exactly and after careful experiments have been performed, the number of phenomena that can be explained by trance alone, clearly dwindles. One or the other of the phenomena that occurs in the literature not only contradicts scientific principles (which is perhaps not that unusual), but also cannot be accommodated in an empirical sense. Or, when subjected to more exact analyses, a "more simple explanation" can be found. One example of this is the memory of a former life conjured up under hypnosis. Who would not like to have the ability to remember a former life? What number of hidden treasures can we resort to, to do this? But, these memories of a former life can generally be explained by concealed suggestions made by the person in charge of the experiment and the anticipatory attitude of the test candidates. Other phenomena, e.g. the "cataleptic bridge", i.e. the ability to lie on two chairs in a very uncomfortable manner when under hypnosis (see Figure), was also achieved with most test persons without hypnotic induction — merely the

command to make oneself stiff was sufficient. Consequently, here it is more a matter of a socially induced phenomenon.

From this perspective, the obvious mistakes that many trance researchers have made in the past is to search for a fantastic explanation for a fantastic occurrence.

What is complicating in the discussion about the trance concept, is the multiplicity of the phenomena described — they range from deep relaxation to enrapture. In order not to wear down the concept any more, it can be said that certain patterns and contents in interpersonal communications can decisively lead to grave changes in mood, and even to changes in the state of consciousness.

**TRANCE AND COMMUNICATION**

Milton Erickson has conceptionalized such hypnotic communications patterns and has specifically used them in psycho-therapy. He and his successors formulated the pacing and leading diagram for this. In the context of psychotherapy, he designated the aforementioned communications pattern as pacing — the therapist "mirrors" the verbal and/or non-verbal behaviour of the client and in doing so signalizes acceptance to him. A leading phase follows this pacing phase, in which the cognitive routine of the client can be influenced.

This communications pattern should be explained on the basis of an anecdote by Bandler and Grinder, two psycho-therapists who have further developed the Erickson approach: in the case of a psychological disturbance which occurs in the course of a bad depression, or even in the case of schizophrenia, the person concerned can become completely rigid (stupor). People in such a state are no longer responsive. They hardly move or they remain fixed in a certain posture and have broken off every obvious communication with their environment. Bandlet and Grinder succeeded, nevertheless, in building up a relationship to such a client by using a non-verbal communications channel: breathing rhythm. In the first few days, therapy merely consisted of the therapist entering the room where the client was and trying to breathe in his rhythm. After a few days, by changing his breathing rhythm, the therapist was also able to influence the client's breathing. As soon as the therapist was assured of communications via this channel, he took out a cigarette and asked the client for a light. The client replied spontaneously that he was sorry, but he didn't have a light and that he would like to smoke. Although this story arouses the impression of a not quite credible miracle healing, it is, nevertheless, based on the relatively simple communications pattern of pacing and leading. By mirroring the breathing rhythm, a relationship was built up - pacing. Then, the therapist was able to intervene in a key way and break through the client's isolation. In this connection, it becomes clear that non-verbal communications are more than just accompanying music to verbal communications.

In Erickson's concept, pacing extends beyond a simple tuning in. By means of the appropriate and extensive mirroring of a client's verbal and non-verbal behaviour, not only is a relationship built up, but a hypnotic state is also induced. This is intensified by further relaxation suggestions in the leading phase.

This pacing phenomenon is not merely restricted to interpersonal communications, but can also be observed with mechanically-conveyed interaction, like the breathing biofeedback described here.

Trance processes can be proven on the physiological level too — Eva Banyai and her staff at the University of Budapest found out that mutual tuning in took place with successful hypnotic induction. This tuning in is not only related to the obvious behaviour but also takes place on the psycho-physiological level. Brain-waves and breathing rhythms are similarly coordinated with successful trance induction.

A further question about why such powerful effects can be achieved with the feedback of breathing rhythms is answered by Richter's (1986) research. The breathing centre in the brain belongs to the vital control centres and, in addition to this, is connected to the cardio-vascular system. Furthermore, via the formatio reticularis, extensive relationships exist to other areas of the brain.

## THE POWER OF THE WORLD OF THE MIRROR

A further facet of the trance phenomenon are the associated connections to mental representation. The effect of a self-hypnosis technique — to go back to Betty Erickson (see Wippich 1985, p. 242) — is proof of the significance of mental representations. With this exercise, hypnoidal states are induced merely by means of more powerful references to the environment and/or "conscious" mental representations.

One looks for a quiet place and commences with the exercise of autosuggestion and after five minutes one wakes up again, fully refreshed. The procedure behind this exercise is conceiveably simple. One makes statements about visual, acoustic and kinaesthetical perceptions which are presently appropriate. First of all, one makes three visual sentences, then three auditive ones, and then three kinaesthetic ones. These sentences can be spoken out loud or quietly (i.e. purely mental). The procedure could look like this. First of all, one begins visually: "I see the red carpet … I see the shadow of the tree on the wall .. I see the flower vase in front of me on the table …", going over to the auditive ones "I hear a car driving past … I hear the hum of the fridge … I hear the noises on the street …", then one verbalizes the kinaesthetic perceptions: "I feel the back of the chair on my back … I feel my breathing … I feel the clothes on my skin". In the next round, only two statements are selected, respectively, and in the next round, only one. Should a deep trance be induced before this, one can shut ones eyes and finish the verbalization. Very often, one can clearly feel a changed consciousness and a deep relaxation, even in the first exercise. The effect is intensified through further exercises.

## WHAT DOES REPRESENTATION MEAN FOR OUR BRAIN?

We assume that our sensory systems are allocated to simulation systems in the brain, which, e.g. make test actions possible. Some researchers propose a kind of internal monitor for our visual system, on which we can produce graphic ideas. A similar thing is assumed for the auditive system, a kind of inner loud speaker on which we can play melodies, for example (see Kosslyn and Koenig, 1992). If we add our working memory to this representation system and proceed from an interlinking of these systems in the brain, then we have an attractive explanation for the puzzle of consciousness. Consciousness is the process which emerges when these systems interact, whereby a new complexity stage is reached (see Crick and Koch, 1992; Gadenne and Oswald, 1991), The significance of this principle of emergence was already recognized in gestalt psychology and can be elucidated on the basis of these graphics: the whole is more than the sum of parts. What one sees is not a number of dots but a circle.

The aforesaid is, of course, also valid for mental representations at a deeper complexity stage. They are not coded in the brain as symbols, but as emergent features of neronal network structures (see Levelt, 1991).

## SUMMARY

When one considers the aforementioned aspects relevant for virtual emotions, no consistent picture arises. This is most certainly due to the fact that in AI, information processing is put on a level with logical consequences. The terms emotion and intuition have only recently been involved in the development of new methods. At this early research stage it appears to be sensible to make the phenomena experienceable in order to stimulate further questions and research. The demand for a traditional scientific approach is too premature.

The installation presented can be understood as being a play with the concepts: virtual emotion, emergence, trance and non-verbal communication.

## DESCRIPTION OF THE INSTALLATION

The installation consists of two cabins in which the active participants sit with their backs to the public. The sense of this structure is that the protagonists are not frontally visible to the observer and they feel relatively unobserved. The cabins are arranged beside each other so that they can be jointly kept in sight by the observers.

In every cabin there is a multimedia PC whose monitor has been arranged so that it is visible both for the participant as well as the observer. A further part is composed of fixtures to determine breathing rhythms. Here, the participant's biosignals are measured and are transformed into an intuitive, comprehensible, complex pattern of shapes, colour and rhythm. As already said, animated fractal landscapes were chosen as representation patterns.

Whereas with a normal feedback application, the participant receives feedback via his own body signals, in this installation, the feedback channels of both participants are switched, crosswise. In this way, both of them are confronted with the other's biosignals on the monitor. As to whether they are aware of this connection, depends on whether they have perceived the relevant information supplied at the beginning of the experiment, or not.

The observer in the installation and the participants can respectively experience, in this way, other sections of the same reality. The participants are confronted with the attention-absorbing feedback and have two reaction possibilities: either they coordinate with the "foreign" biosignals and resonate to each other (acceptance), or they repel (reactance). Which of the two reactions is selected greatly depends on four factors: on the one hand, on the general readiness to engage in the installation and, on the other hand, the acceptance of the colour and shape language of the feedback pattern for every respective participant. A further influential factor is the distance, or the proximity of the psycho-physiological initial states of both participants. If one participant is quiet while the other is active, the initial coordination is less. A fourth influential factor for the behaviour of the participant is the time. The longer they are confronted with the representation pattern, the stronger acceptance and coordination can be observed, as a rule.

The observer who observes the system from the outside perceives how the psycho-physiology of both participants resonates or differentiates, and in this way, he/she can follow the mutual computer-conveyed non-verbal interaction/coordination. In doing so, he/she has the

possibility of tuning in to the foreign feedback himself and consequently, of literally becoming a participant in the system. He/she can observe the emergence of new system features. Both participants consciously experience their "trance state" — as to whether they also consciously perceive the emergence, greatly depends on whether they have made use of the information about the feedback switching.

## OUTLOOK: COMMUNICATION AND ARTIFICIAL LIFE

In accordance with von Neumann, systems can only increase in complexity when they, on their part, interact with a more complex environment. The question of communication is closely linked to that of learning and represents a key question about the creation of artificial life. Future research will show as to whether the forms of communication and information processing discussed here are also relevant for artificial living beings.

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