CASE STUDY
SIMULATION GAMES - PHASE 1
Observer-World-Framework

Part of the
Generative Cultural Anthropology [GCA] Theory
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Abstract

To work within the *Generative Cultural Anthropology [GCA]* Theory one needs a practical tool which allows the construction of dynamic world models, the storage of these models, their usage within a simulation game environment together with an evaluation tool. Basic requirements for such a tool will be described here with the example called a *Hybrid Simulation Game Environment [HSGE]*. To prepare a simulation game one needs an iterative development process which follows some general assumptions. In this paper the subject of discussion is the observer-world-framework.

1 Intro

Usually in science methods of measurement are discussed, how to apply these to some part of the real world, and how to deal with the measurement results, the measured data. The observer as such is not really commented. Even in the era of Quantum Mechanics, where the problems of measurement got more attention, the observer is still some hidden factor, not worth to be thematised.

In the case of the GCA theory (Generative Cultural Anthropology) it is inevitable to include the observer in the discussion of measurement because the cognitive processes of the observer as well as his language capabilities are an

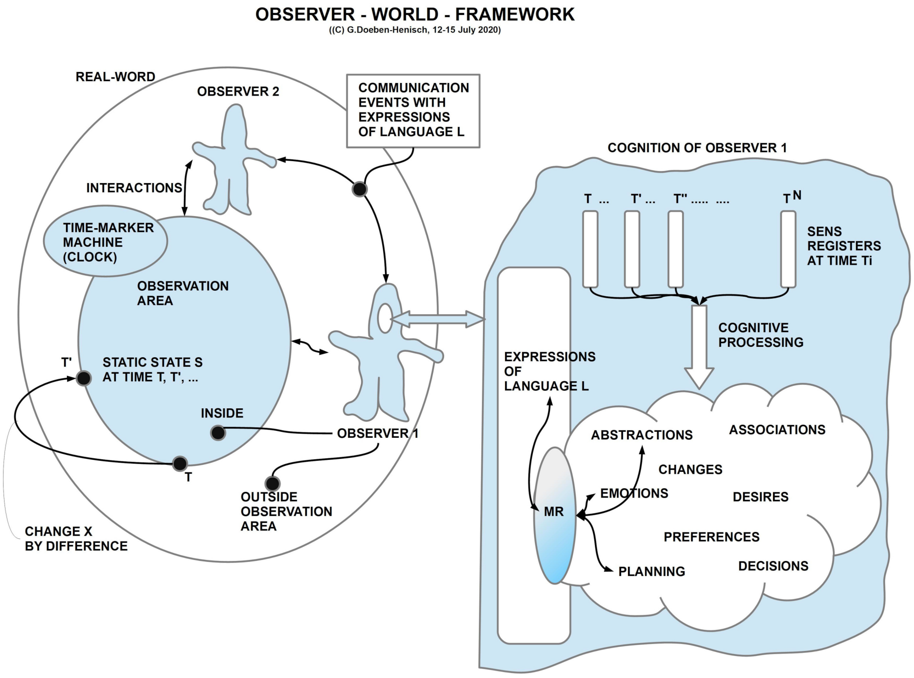

Figure 1: The observer-world framework: being part of the real world an observer has in his brain a cognitive machinery which translates the outer-world properties into a inner-body cognitive model, which can be communicated by some language

essential part of the measurement process. To hide these factors would disable science as science.

Who knows a little bit about the history of science as well as of the history of Philosophy knows that the reflection about the conditions of human knowledge is traditionally a subject of Philosophy and Philosophy has been be separated more or less from ordinary science in the last centuries. But this is bad for science as well as for Philosophy. Therefore in the case of a GCA theory philosophy and science are working 'hand in hand' in a new unity of thinking.

One result of this kind of methodological unification of philosophy and science results in some new characteristic assumptions which will be illustrated in the following sections.

2 The Observer and Its World

The essential idea of this new unified approach is outlined in figure 1.

Every observer which is part of the generation of some *GCA theory* is assumed to be part of the *real world [RW]*, together with other observers, and within this real world the observer is observing some dedicated area which is called here the *observation area [OA]*. An observation area has to provide at least the identification of a reproducible location and the identification of a time marker, a time stamp to locate an event on a common time line. While the space is given by the real world as it is, a time marker has to be generated by a time-marker machine, usually called a clock, which produces time markers which have to have sufficiently equal distances between two consecutive time markers.

Such an observer can either *interact* with the observation area somewhere 'from the *outside*' or *being part of* the observation area.

To *communicate* with the other observers the observer needs some *expressions [E]* of some common *language [L]* whereby these expressions have sufficiently similar meaning relations to the *cognitive representations inside* every observer.

As we can know today the *human knowledge* and experience is associated with the real *brain* in a real *body*. This brain gains his knowledge about the world by several kinds of *senses* which have timely limited *sens-registers* to collect neural correlates of real-world events.[1] These senses can be located at the *surface* of the body but as well *inside* the body (e.g. the equilibrium organ).

Thus if an observer does some measurement he does not perceive the world 'as it is' but in the way 'how the brain is computing a *virtual model* of the world based on neural correlates from different senses as well as from already stored and computed structures'. These computations of the brain are based on *time slices* provided by the different sense registers. Thus the perceived *flow* of events is an artificial artifact computed by the brain using the different processed time slices enriched by the already accumulated knowledge.

All this processing including the sens events is here called *cognitive processing* and in summary all this is called *cognition*.

As brain-science reveals us more and more these cognitive processes are in-

[1]Authors dealing explicitly with the concept of sens buffers are e.g. Card, Moran and Newell (1983), Chapt.2 [CMN83], Baars and Gage (2010), p.34 [BM10]

credible complex. Even without language the cognitive processes are working and enabling a child to move in his world, to understand some spatial structures, to understand even some causal relationships without being able to speak.

But then, after some span of time all children start speaking. First slowly uttering only single words, and then accelerating with more elaborated expressions. Although there are many thousand languages around in our world the world of experience is strongly similar, and the cognitive structures are nearly the same in all children, in all humans. Thus to understand the working of the language one should not look too much to the details of one language but have a look more to the common cognitive structures which are the *point of reference* for all kinds of languages.

Every child, every human person has to undergo a learning phase to set up *internal mappings [MR]* between the used language expressions E and the different kinds of *cognitive correlates C* available by cognitive processes. Thus *meaning* is given by the available cognitive correlates C which are selected by these internal mappings MR and therefore these internal mappings MR can be called *meaning relations*. Usually these meaning relations are working in both directions. We can e.g. say that the expression 'cup' *means* a *certain concrete object* in the observation area or we can say that a certain concrete object of the observation area is *usually named* with the expression 'cup'. Using language in this way hides the fact, that we do not speak directly about the concrete object named 'cup' but about the cognitive correlates available in our brain, which has become associated with the expression 'cup' by a meaning relation.

An everyday language L enables two different observers to talk with each other by using expressions E of L, but only if these two observers O1 and O2 have learned to set up a *sufficient similar meaning relation* between the used expressions E and the cognitive correlates gained by the interaction with the world. As everybody can experience this assumption of a sufficient similar meaning relation between different observers can and is very often wrong, not working. It always cost some learning and communication time to install a sufficient conformance of meaning relations between different observers.

3 Real World - Cognitive Correlates - Communication

Before we proceed with more concrete examples to illustrate the intended processes let us sum up a little bit what has been said so far in a more abstract way (cf. figures 2).

In this figure you see two main sets: the *real world [RW]* which is filled

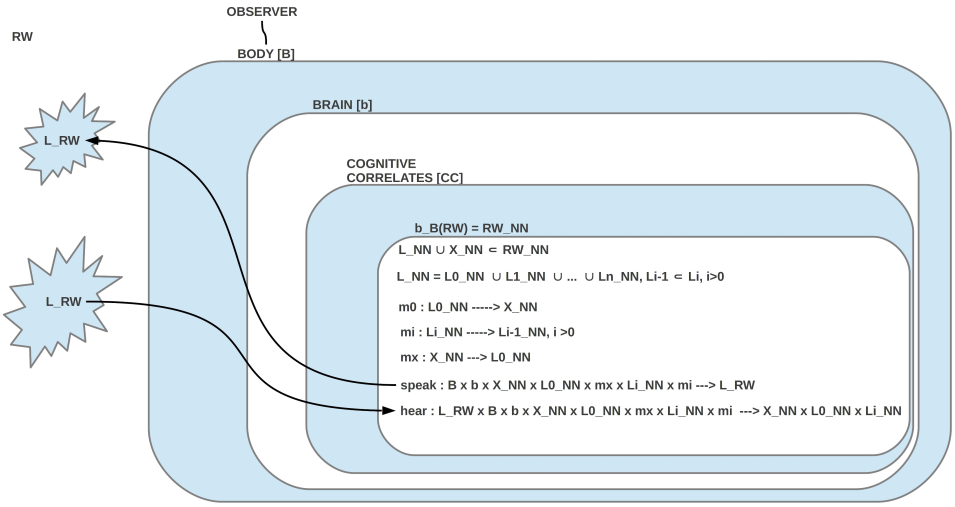

Figure 2: An abstract model of the transformation of the real world RW into cognitive correlates CC and then in some language based communication

up with lots of things, especially with such things X_{RW} which can be part of the meaning of some used *real language expressions* L_{RW}, and possible *real observers [OBS]* interacting with some part of the real world. From the different kinds of interactions between the real world and the real observers only two kinds are mentioned here explicitly: *speaking* of an observer by uttering real world expressions L_{rw} and *hearing* real world language expressions L_{RW}. In this sense real world language expressions L_{RW} constitute the main interface for *observer-observer communication*, but not isolated! The language expressions are always embedded in a rich world context which has to be considered as important for the communicated meaning of the expressions.

The observers have their individual bodies and inside there *bodies* [B] their individual brains [β]. In a certain sense one can conceive the *Body-brain* as a compound function turning parts of the real world into *neural events* RW_{NN}. Thus the *neural correlates* RW_{NN} of the perceived real World RW represent an highly abstracted and simplified neural representation of the real world inside an observer, which I call here the *cognitive correlates [CC]* of the world in this observer or the *cognitive model [CM]* inside the observer of the real world.

From the incredible complex structure of the cognitive correlates of the real world RW_{NN} only two main dimensions are mentioned here: the *language expressions* of a language L_{NN} and those neural correlates X_{NN} which are or can be addressed by the language expressions. In case of the language expressions one has to consider more than one case. While in the ordinary case a language expression $e_L \in L_{NN}$ will denote some neural correlate $x_X \in X_{NN}$ there are different cases where a language expression e can talk about another language expression e'. In this case these expressions belong to two different languages L, L'. Usually such a language L' whose expressions e' can talk about expressions e of another language L is called a *meta language* and the language, whose expressions are the subject of the meta language expressions, is called *object language*. It is a fascinating property of our brain that it can organize a nearly *infinite hierarchy* of language levels in the manner $\{L_0, L_1, ..., L_{i-1}, L_{i,...}\}$ where each language L_i is the meta language of L_{i-1}. While only the expressions $e_0 \in L_0$ are directly connected to non-language neural correlates X_{NN} which partly are correlated with neural structures caused by properties or events in the real world outside the body, all the other expressions $e_i \in L_i, i > 0$ are expressions related to language expressions. This infinite hierarchy of language levels allows the construction of highly complex concepts like e.g. *democracy*; although there does not exist a relation between this expression and some non-language correlate which is directly rooted in the real world, there can exist many different concepts which are partly rooted in the real world outside the body and partly in other complex concepts. It is on the one side very powerful to build up complex concepts, but it is at the same time very dangerous because it is difficult to control to which extend such complex concepts are still *sound*, because there exists no ready made concept of being 'sound'; one has to construct criteria for being a *sound expression* explicitly!

On account of the language level hierarchy one has to assume more than one meaning relation. A first guess runs as follows:

$$m_0 \quad : \quad L_{0.NN} \longmapsto X_{NN} \tag{1}$$
$$m_i \quad : \quad L_{i.NN} \longmapsto L_{i-1.NN}, i > 0 \tag{2}$$
$$m_x \quad : \quad X_{NN} \longmapsto L_{0.NN} \tag{3}$$

To describe the main interactions mentioned above *hearing* and *speaking* the following proposal is given:

$$speak \quad : \quad B \times \beta \times X_{NN} \times L_{0.NN} \times m_x \times L_{i.NN} \times m_i \longmapsto L_{RW} \tag{4}$$
$$hear \quad : \quad L_{RW} \times B \times \beta \times X_{NN} \times L_{0.NN} \times m_x \times L_{i.NN} \times m_i \tag{5}$$
$$\longmapsto \quad X_{NN} \times L_{0.NN} \times L_{i.NN}$$

Thus we can roughly determine an *observer world [RWO]* as a structure like the following one:

$$
\begin{aligned}
RWO(w) \quad & iff \quad w = \langle RW, OBS, L_{RW}, X_{RW}, hear_{RW}, speak_{RW} \rangle & (6) \\
RW \quad & := \quad Real\ World & (7) \\
OBS \quad & := \quad Observer & (8) \\
L_{RW} \quad & := \quad Real\ language\ expressions & (9) \\
X_{RW} \quad & := \quad Real\ non-Language\ givens & (10) \\
hear_{RW} \quad & := \quad Acoustic\ input\ of\ observer & (11) \\
speak_{RW} \quad & := \quad Acoustic\ output\ of\ observer & (12)
\end{aligned}
$$

An observer can roughly be characterized – leaving out many important aspects – as follows:

$$
\begin{aligned}
OBS(w) \quad & iff \quad w = \langle B, \beta, X_{NN}, L_{0.NN}, m_x, L_{i.NN}, m_i, hear_{NN}, speak_{NN} \rangle & (13) \\
B \quad & := \quad Body & (14) \\
\beta \quad & := \quad Brain & (15) \\
X_{NN} \quad & := \quad Non-language\ neural\ correlates & (16) \\
L_{0.NN} \quad & := \quad language\ neural\ correlates & (17) \\
m_0 \quad & := \quad Basic\ meaning\ relation & (18) \\
m_x \quad & := \quad Non-language\ to\ language\ meaning\ relation & (19) \\
L_{i.NN}, \quad & := \quad Meta\ language\ level\ i & (20) \\
m_i \quad & := \quad Meaning\ relation\ between\ languages & (21) \\
hear_{NN} \quad & := \quad Acoustic\ input\ of\ observer\ neural\ side & (22) \\
speak_{NN} \quad & := \quad Acoustic\ output\ of\ observer\ neural\ side & (23)
\end{aligned}
$$

3.1 How Explicit is the Meaning?

Keeping in mind what has been said before one can have a first understanding that the kind of language one is using can support the communication in different ways.

Everyday Language: The so-called *everyday language* L_x is indeed a mixture of different language levels $\{L_0, L_1, L_2, ...\}$ without showing this difference explicitly in the expressions $e_x \in L_x$ itself. I can easily switch between an expression like e1 = "Your red cup on the table..." and e2 = "Your remark yesterday to me about ...". While the expression e1 is talking about some thing in the shared real world the expression e2 is talking about another expression which has been uttered yesterday. Besides this implicit hierarchical structure the expressions of everyday language as such do not reveal anything about possible

Figure 3: Player White Hair and Girl, picture 1: Sitting on the board

meaning. To talk about the moon shining some night from a a cloud-free sky sounds in different languages (Englisch, German, Russian, Chinese, Arabic, ...) completely different although they all are talking about the same matter. This results from the structure described above that the body-embedded-brain $\beta_B()$ transforms the perceivable real world RW first into a set of neural correlates which as such represent the neural-correlate-version RW_{NN} of the world and within this sphere of RW_{NN} all language encoding happens. Although every human person on earth with a body and brain without handicaps has more or less the same neural structures correlated with the outer moon event the different existing everyday languages do encode this same outer world event inside RW_{NN} completely different. Therefore, if you do not know this internal encoding by learning you never will *understand (decode)* the expressions of this other everyday language. An everyday language L_x is therefore a *meaning-hiding* type of language using a *hidden encoding*.

Pictorial Language: Most of us know probably a kind of literature which is called *comics*. Comics are working with pictures ordered in a *sequence* representing a timely order of the events. I call this type of language *pictorial language* L_{pict}. A pictorial language can realize language levels too (by repeating some other picture inside an actual picture), but differently to an everyday language the encoding of meaning is highly transparent. Look to the following series of pictures 3, 4, 5, 6, 7, 8, 9:

An everyday description of figure 3 with German and English:

Figure 4: Player White Hair and Girl, picture 2: Sitting on the board, White Hair takes a pawn

German Everyday Language: Zwei Spieler sitzen sich an einem Spielbrett gegenüber, das wie ein Schachbrett aussieht. Der Spieler links sieht älter aus, hat weiße Haare; der Spieler rechts sieht wie ein Teenager aus, könnte eine Teenagerin sein. Auf dem Brett stehen aufgereiht die Bauern aus einem Schachspiel.

English Everyday Language: Two Players are sitting at the borders of a gaming board which looks like a chess board. The left one looks older with white hairs. The right one looks like a teenager, eventually a young girl. On the board one can see the pawns of a chess game arranged in a line as usual.

An everyday description of figure 4 with German and English:

German Everyday Language: Beschreibung wie bei Bild 3. Unterschied in diesem Bild: der linke, ältere Spieler fasst mit seiner rechten Hand den Bauern ganz rechts außen an.

English Everyday Language: Description equal to picture 3. But in the actual picture the elderly person has stretched its hand and touches the most right pawn.

An everyday description of figure 5 with German and English:

German Everyday Language: Beschreibung wie bei Bild 4. Unterschied in diesem Bild: der linke, ältere Spieler bewegt den Bauern von der Ausgangspo-

Figure 5: Player White Hair and Girl, picture 3: Sitting on the board, White Hair moves the pawn 2 cells ahead

sition zwei Felder vor.

English Everyday Language: Description equal to picture 4. But in the actual picture the elderly person moves the pawn two dells ahead.

An everyday description of figure 6 with German and English:

German Everyday Language: Beschreibung wie bei Bild 5. Unterschied in diesem Bild: der linke Spieler lässt den Bauern, den er gerade bewegt hat, wieder los.

English Everyday Language: Description equal to picture 5. The difference in this picture: the left player draws back his hand from the pawn he has just moved.

An everyday description of figure 7 with German and English:

German Everyday Language: Beschreibung wie bei Bild 6. Unterschied in diesem Bild: der rechte Spieler berührt mit seiner rechten Hand den Bauern ganz rechts.

Figure 6: Player White Hair and Girl, picture 4: Sitting on the board, White Hair redraws his hand

Figure 7: Player White Hair and Girl, picture 5: Sitting on the board, The Girl takes a pawn

Figure 8: Player White Hair and Girl, picture 6: Sitting on the board, The Girl moves the pawn 1 cell ahead

English Everyday Language: Description equal to picture 6. The difference in this picture: the right player touches with its right hand the rightmost pawn.

An everyday description of figure 8 with German and English:

German Everyday Language: Beschreibung wie bei Bild 7. Unterschied in diesem Bild: der rechte Spieler bewegt mit seiner rechten Hand den Bauern ganz rechts ein Feld nach vorne.

English Everyday Language: Description equal to picture 7. The difference in this picture: the right player moves with its right hand the rightmost pawn one cell ahead.

An everyday description of figure 9 with German and English:

German Everyday Language: Beschreibung wie bei Bild 8. Unterschied in diesem Bild: der rechte Spieler zieht seine rechte Hand zurück.

English Everyday Language: Description equal to picture 8. The difference in this picture: the right player draws back its right hand.

Even without any expression of an everyday language you will get some understanding of the content of these pictorial expressions and this understanding

Figure 9: Player White Hair and Girl, picture 7: Sitting on the board, The Girl redraws her hand

would not change if you would use different everyday languages to describe the possible 'message', the possible 'meaning' of this series of pictures. Therefore from the point of view of a maximal transparent meaning are pictorial languages by far better than any everyday language. But as we know, everyday language expressions can encode much more sophisticated structures with the risk of becoming less and less *understandable* for others.

Formal Language: Most of the scientists in the world and every engineer know, that there exists a language, which is understandable independent of an everyday language and whose meaning can be nearly as transparent as a pictorial language because the meaning is reflected in the expressions too. This is true for those formal languages which are called *set-theoretical language* L_{ϵ}, which are in fact instances of the more general concept of a language called *predicate-logic language* L_{PL}. I call both types of languages here simply a *mathematical language* L_{math}, because one can represent the whole of mathematics with this kind of language. Compared to an everyday language a mathematical language has in some sense from the beginning a *built-in meaning*, which is reflected in the expressions itself, and this meaning can become associated with some other structure *external to the built-in meaning*. Thus a mathematical language can 'speak' about concrete things like a cup on a table before you or about some highly abstract concept like natural numbers, real numbers, topological orders etc. But as abstract the meaning of a mathematical expression $e_{math} \in L_{math}$ may look like at a first glance, you can always reconstruct the meaning by analyzing only the expression. With an everyday language expression e_x this is impossible. Without knowing the internal encoding of an everyday language you are lost.

An Informal Hierarchy: These considerations point to a kind of a hierarchy related to the grade of *meaning transparency*: $L_{pict} > L_{math} > L_x$. Today all three types of languages are used heavily and widely. In the case of an GCA theory we will try wo use these three types always in parallel with enabling automatic translations between them.

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