

Chapter 2

Observation and Distinction: The Underlying Method

Draw a distinction and a universe comes into being.
George Spencer-Brown 1997

Observation has a reviving influence on science [1], and is, at the same time, basis of all knowledge and cognition. Knowledge (Latin/Greek: ‘having seen’) refers to visual perception—when we have seen something, we know of it (cf. Fischer in his preface to Spencer-Brown [2, p. 7]). If, particularly, all science is based on observation and if science is proceeding through it (cf. e.g. [1, p. 10]), this term has to be clarified. Penck understands specific geographical observation as ‘being in the field’, and thorough and accurate observation of what the geographer sees there, unveils, as it were, the problems of his subject and prepossesses him with special ideas [1, p. 9f]. With these statements Penck expresses the former—and partly also contemporary—popular opinion within geomorphology that theory automatically reveals itself just by contemplating the landscape—a literature review is, from this point of view, anything but geographic work. (also cf. [Chap. 1](#)).

However, exactly this last sentence is also a geographical observation, an observation by a geographer on how geographers work. This observation, however, focuses the research practice, the empirical studies as such, and allows us to assess the foundation of the empiricism. The question is how to comprehend these two levels or types of observation, that is the observation of the research objects (the earth surface and its forming processes) on the one hand, and the observation of the research practice on the other hand?

The cyberneticist and mathematician Heinz von Foerster (1911–2002) offers a possible answer to this question with his collection of essays “Observing systems” [3]. Heinz von Foerster, Austrian by birth, who went to the US for a dinner and stayed for a lifetime (cf. [4, p. X]), coined the aphorism “We do not see that we do not see” [4, p. 26], which already expresses a central aspect of his observation theory. Within the theoretical context of Heinz von Foerster the term observation goes further than in our everyday understanding. On the one hand, all systems¹ are capable of observing,

¹ However, Foerster understands systems differently, namely as being self-referential (also cf. [Chap. 3.1](#)).

be it biological, psychological, or social systems. Moreover, the theory of observation results in narrow limits for objectivity, and it forms one of the pillars of radical constructivism.

Heinz von Foerster gained his insights from then pioneering studies on neurophysiology and on the cognitive ability of living beings. The basic statement is that every observer has a blind spot, that is, something he or she does not perceive. To start with, this can be very well understood as the physiological blind spot of the human eye. Peculiar about this is, however, not the fact that something is not seen, but rather the fact that the observer is not capable of perceiving that he does not see (something). To put it more simply: We do not permanently have a black spot within our visual field as our brain fills the gap in a quasi-meaningful way (also cf. [5, p. 21ff]). This means that we are blind for the blind spot, and in this sense every observation is blind (cf. [6, p. 38ff]). This can be illustrated by studies on changes in behaviour after certain brain injuries (cf. [3, 4]). For example, certain cerebral injuries result in a considerable loss of the visual field of which, however, the person affected is unaware. Though, certain motoric dysfunctions develop such as a one-sided loss of control of arm or leg. One possible therapy is to blindfold the patient so that he learns to pay attention to the ‘normally’ working inner channels that signal him his body posture. What is important for us here, is that the missing perception is *not* perceived, but that this perception has to be trained with sensorimotoric interaction. What is being perceived thus depends on the inner structures of an organism and is not triggered by external signals.

However, it is not just the visual perception that exhibits blind spots, but for example also hearing. Foerster [4, 5] mentions an experiment during which a tape with one and the same word is constantly repeated. After a specific number of iterations the probands start to hear something else, so called “alternants”. Another example refers to animal experiments where the internal construction of perception could also be shown: A cat, prepared with the respective micro-electrodes, is put into a cage within which it only reaches its food if it pushes a lever just when a certain sound occurs. That is, the cat has to learn that a certain sound means ‘food’. The recorded patterns of its neural activity show that the cat does not perceive the sound—until it realizes the link between sound and food. In other words: only if a perception becomes comprehensible the whole (neural) system starts to work (cf. [4, p. 28–29]).

According to the mathematician and Nobel laureate Bertrand Russell (1872–1970), such physiological findings lead the naïve realism ad absurdum [7, p. 127] (cf. Chap. 9), as these examples show that something is seen or heard effectively is not ‘there’ (the alternants), or that though it is not seen or heard, something is ‘there’ (the limited visual field or the ‘sound for food’). These phenomena cannot be explained by a naïve-realistic position as they contradict the conviction that our sensory organs picture the ‘world as it is’. This, however, is a conviction which is reflected within geomorphology in the assumption that after sufficient training we can read within the landscape like in a book. Especially the cat experiment shows, though, that we already need a theory about how things are connected (food and sound) in order to actually perceive these connections: Observation without theory is impossible.

Foerster corroborates his observations by introducing the “principle of undifferentiated encoding”:

The response of a nerve cell does not encode the physical nature of the agents that caused its response. Encoded is only ‘how much’ at this point on my body, but not ‘what’ [4, p. 29].

The attribution of the stimulations to specific sensory receptors only takes place in the brain as any sensory organ is (normally ‘correctly’) coupled to a specific brain area (also cf. [8]). Hence, our brain works in a very similar manner to an engineer at his control console: A red light in this column and that row assures him that exactly such and such a machine is defect [8]. This then means that all our sensory receptors are ‘blind’ to the *quality* of the stimulation as they are just reacting to its *quantity*. Even if we find this surprising it should not amaze us: ‘out there’ indeed is neither light nor colour, but only electromagnetic waves; ‘out there’ is neither sound nor music, just molecules that are moving with more or less mean kinetic energy etc. [4, p. 29].

On a more theoretical level this aspect of a blind spot—which so far has been dealt with only on physiological or experimental grounds—can be summarized with the words of the mathematician George Spencer-Brown (1997): Draw a distinction. After all, the

act of indicating any being, object, thing or unity involves making an act of distinction which distinguishes what has been indicated as separate from its background. Each time we refer to anything explicitly or implicitly, we are specifying a criterion of distinction, which indicates what we are talking about and specifies its properties as being, unity or object [5, p. 46].

This is a thoroughly ordinary and not a special situation in which we inevitably and continuously find ourselves. Observation thus is defined as the twofold practice of distinction and simultaneous indication of one side of what we have distinguished afore (vgl. [9, p. 69]). This distinction and indication of something, which necessarily leaves all other things aside, is the starting point of every observation and enables us to establish a network of distinctions. Such, information on the observed can be gained (cf. [10, p. 125])

According to this understanding, the act of observation is not exclusively human anymore as it has been suggested for centuries by the western tradition of thought, since for example also an amoeba is capable of observation in this sense—otherwise it would possibly devour itself (cf. [12]).

Thus, observation is done actively—“perceiving means acting” [4, p. 27] – since the observed is distinguished from all other possible things and is indicated as something distinct, e.g. ‘river’, ‘landslide’, and ‘talus slope’. That is, ‘something’, a thing or an object only becomes visible through this act of distinction and indication. In the very moment at which we observe (distinguish and indicate), everything else takes a backseat, we do not regard it. For this reason the credo of the observation theory is “observe the observer”, that is, the self-observation as well as the observation of the world is shifted from first order observation (asking “What is being observed?”) to the level of second order observation, asking “How

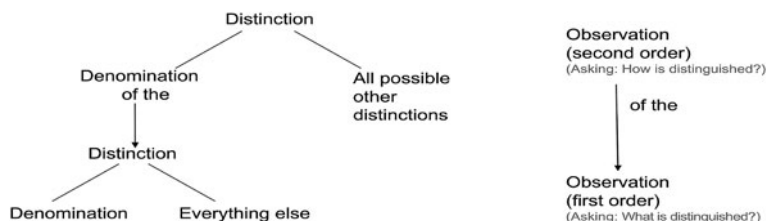


Fig. 2.1 Schematic sketch of the observation theory and of the difference of first and second order observation ([11], modified)

is something being observed?” (cf. Fig. 2.1). It is only at this level that the respective blind spot of the observer can be realized: the blind spot is the respective underlying distinction, which guides what is being observed and what is not being observed. Second order observation is the observation of the observation and can thus reveal the distinctions the first order observation is based upon. Hence, while first order observation brings forth an object, second order observation brings forth the acting, the basic distinction. Furthermore, second order observation usually utilizes two distinctions: First, it distinguishes between the observer and his/her object, second, it distinguishes which kind of distinction the observed observer is using (cf. [12, p. 46f]). From this it becomes clear, however, that with each observation there will result a new blind spot: Any second, third, fourth ... order observation is, at the same time, also a first order observation and therefore blind for something else. Consequently, a fixed reference point for observation from which everything can be impartially and objectively observed, a so-called *locus observandi*, cannot exist. Thus, there are also no grounds on which to judge better or worse, wrong or right, which certainly is a thought that shakes the very foundations of scientific thinking. It points towards a thinking according to which there is no ultimately true observation of the world ‘as it is’, as from this perspective everything is dependent on the observation and the distinction which have been made. If the above is taken seriously, then it becomes clear that the descriptions of reality are endlessly recurring and finally vanish into thin air, just as any clearness and validity. Against this background observers can decide to take over a—paradox—self-foundation (cf. [13]): The decision to support this and no other statement as being valid here and now. Keeping this paradox foundation in mind, one can stay capable of learning, as—after all—within this theoretical perspective statements of ‘real’ truth and rightness or falsity are impossible. What can be shown, however, is which descriptions, results, theories are now viable² and with which we can now work effectively.

² The term viability was coined by Ernst von Glasersfeld (e.g. [14, 15]) and means the functioning of ideas. It is a constricted concept of ‘truth’, as according to the observation theory it is impossible to ultimately state whether a theory is true or false (also cf. Chap. 9.1).

When these thoughts are applied to geomorphology (or other scientific disciplines), it becomes apparent that, first, our observations of the world are solely based upon the internal structures of the cognitive apparatus, and that, second, these observations are largely based upon specific, yet unconscious presuppositions (‘distinctions’). For example, as geomorphologists we ‘automatically’ observe the landscape according to specific criteria of distinction such as form, process, matter, scale, whilst we do not—or only in the second instance—apply other, equally possible criteria such as ‘energy budget’. These initial criteria of distinction that are substantially influenced by the actual paradigm form the directives for the decision about which further research is possible and even feasible. Ute Wardenga [16], a German geographer, named this trained point of view, which is specific for every scientific discipline as “Wahrnehmungsdressur”, that is cognitive dressage. Once more, from this it follows that observation without theory is impossible (also cf. [17, p. 51]).

That observations are theory-dependent can be illustrated by the scientific use of instruments that are generally seen as being more objective than our own observations. But what is an instrument? After all, it is nothing more than an extension or an appendix of our own sensory organs, but which has three tasks to fulfil: First, to make accessible those areas which are normally not directly accessible via our senses, second, to make measurements within these areas, and third, to transform these measurements in such a way that we can perceive them (cf. [18, p. 127]). Therefore, measuring instruments are no “neutral observers”, quite the contrary, as they serve a purpose, namely to confirm a theory. Already the construction of the instrument needs a lot of theory: instruments are theory-loaded. In my opinion, one of the best examples is time, or the watch: According to the theory of the big bang, time came into existence together with matter, energy and space at moment of the big bang [19]. Ever since, the brightest minds have pondered the question what ‘is’ time, after all, and whether it ‘exists’ at all, but so far no answer has been found. Time is a purely theoretical concept (cf. e.g. [20]). Thus, although we don’t even quite know what time is, we do have the most exact instruments to measure it.

One can even take the conclusion further that observation without theory is impossible if one states that there is no observation which does not act back upon the observed procedure.³ Erich Jantsch (1929–1930) [21], an Austrian nuclear physicist and co-founder of the Club of Rome states in his monograph “Die Selbstorganisation des Universums” (‘the self-organisation of the universe’) that it

³ For example, for the observation of elementary particles the choice of the measurement—that is, the type of observation—technique is crucial as this determines whether such a particle is perceived as wave or matter (cf. Chap. 9.2): Hence, the observation acts back on the observed. Generally, such an influence is also accepted for macroscopic systems, but is seen as neglectable. An example from geomorphology could be BTS-measurements during which inevitably a heat flow is initiated but this influence is seen as being too minor. As we will see in Chap. 5, such small changes or fluctuations can theoretically have a major impact if the system is beyond an instability threshold. Presumably, Jantsch is referring to such issues.

is rather ironical that the influence of the observer on the observed process was first formulated for the subatomic field (the so-called Heisenberg uncertainty principle). Jantsch compares the observation of subatomic processes with a watchmaker who uses a bulky hammer to get to grips with a ladies' watch. According to Jantsch this is ironical, because the influence of the observer is much more obvious in macroscopic systems as every action, every thought, and every theory interferes with our research object [22, p. 54].

These remarks show why it is necessary to specify conditions for any statement under which it gains clarity and validity. The decision for or against the observation of something can only be seen in retrospect and/or by another observer, that is by means of second order observation. This is also (or even especially!) true for this thesis: The criteria under which it is valid are the distinctions upon which it is based. After all, these distinctions determine what can be observed: For example, with the difference of good or bad I can—no matter what I am looking at—see something else than with the difference of rich and poor, beautiful and ugly, new and old, or healthy and sick [23, p. 34f].

Within this thesis I have utilized Foerster's observation theory and its methods in order to observe the (implicit and explicit) theoretical basis and its application within geomorphology, and to examine the epistemological and practical consequences that are attached to it. Here, I used the distinctions 'system theory within geomorphology' and 'system theories in other disciplines', or rather 'first order system theory' and 'second order system theory'. Following, the distinctions have been '*coherency and stringency*' and '*incoherency and logical breaks*', as well as '*high connectivity (to other disciplines)*' and '*low connectivity*'. Hence, I was only capable to observe what I have observed—the relevance or irrelevance of geomorphology for our society, for example, cannot be part of my examinations. Therefore, I cannot—and do not even want to—claim any truth (whatever that might be) or picture any geomorphological research 'reality', as this is simply impossible if the theory of observation is taken seriously. It is nothing more or less than *one* way to view geomorphological scientific practice. However, I believe that only if we as geomorphologists perceive our research (objects), that is, based on which distinctions, we will be able to understand which specific positions and with which specific presuppositions we are conducting our studies. Furthermore, we can then actively direct our attention towards those problem areas that we have not perceived before and thus make them visible. If we re-think Penck's words in this way we indeed might state: Observation has a revitalizing influence on science!

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