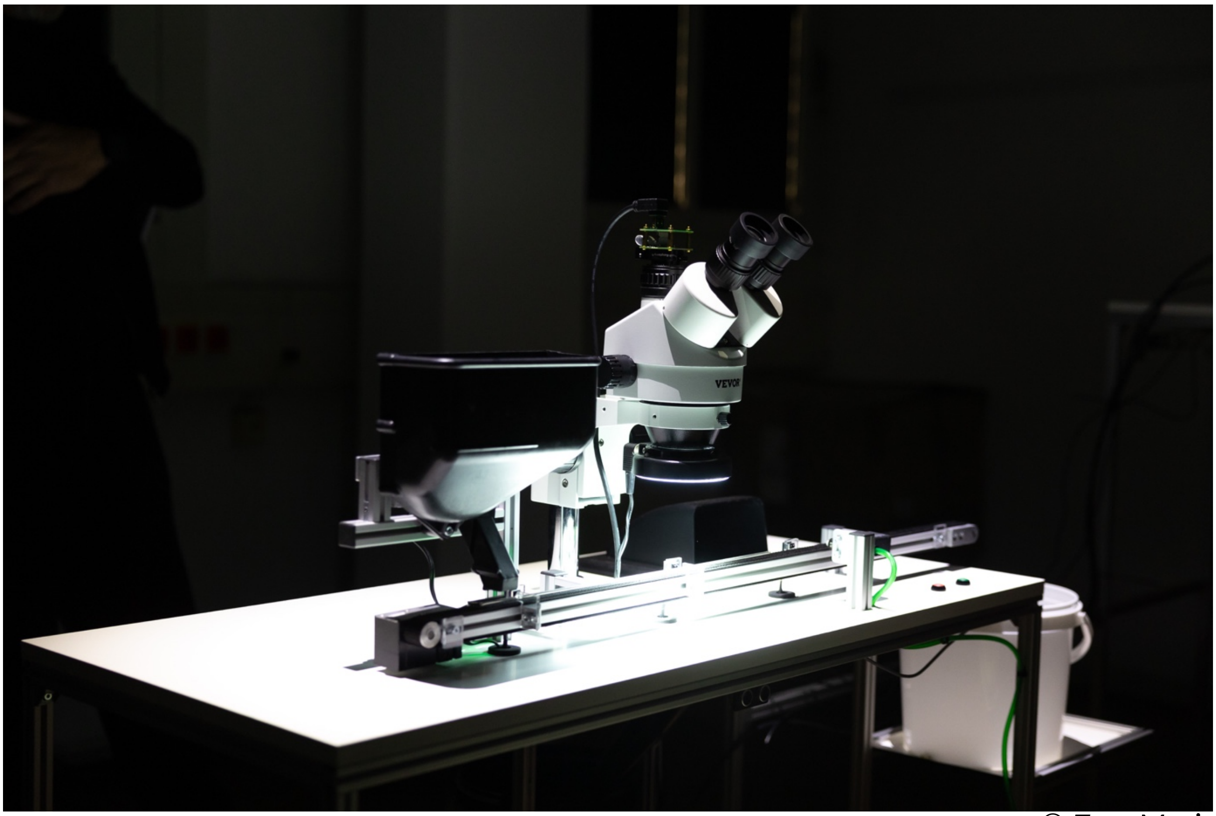
ERBSENZÄHLER Quality Sorter V2 by Verena Friedrich



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Cognitive Ensembles
On the precarious relationship between technology, human beings, and nature
by Georg Trogemann

How do we make decisions in the context of the socio-technological systems that exist today? This question is at the center of Verena Friedrich's installation *ERBSENZÄHLER Quality Sorter V2.*[1] Audience members who approach the installation are invited to take a seat and look at peas through a microscope. By pressing a red or green button, the viewer rates the peas' quality: "red" means the pea is rejected; "green" means the pea is found to be good, at which point it is transported to a container for further processing. If the viewer gets up and leaves, the machine automatically continues the sorting process based on the decisions that have already been made. The decision-making process carries on, dividing a previously undifferentiated quantity of peas into two classes: "good" peas and "bad" peas. It is a simple thing – make a decision and then feel free to leave; except there is much more to it than that! This technologically sophisticated installation has something important to impart to its audience. In the following text, I attempt to contextualize and provide a socio-technological framework for this subjective aesthetic experience. Today we are all participants in any number of various technologically oriented cognitive and decision-making ensembles. Together algorithmic and human actors constitute complex socio-technological configurations that maintain decision-making structures which often lack transparency.

[1]. The German term *Erbsenzähler* has the same meaning as "bean counter" in English but translated literally means "pea counter."

Furthermore, what space there is for our own actions or decisions is generally very limited within such technological arrangements.

The command “draw a distinction”[2] is central to the famous calculus in George Spencer-Brown’s *Laws of Form*. By comparison, what the viewer of the *EZ Quality Sorter V2* is asked to do is narrower and more restrained: “decide between two predefined alternatives” In order to understand the difference that I’m bringing into play here between making a distinction and making a decision, it is helpful to recall the Laws of Form. To make a distinction is, according to Spencer-Brown, a basic act of cognition. Making a distinction takes precedence over making a decision. A decision first requires that alternatives be differentiated from one another. Only that which can be differentiated can also be decided upon, while the decision determines the actions that follow and thus the consequences of the distinction that has been made.

Decisions are made between known alternatives, making a distinction, a differentiation, by contrast, defines how the alternatives are determined in the first place. The first distinction originates from a still undivided space of possibility and divides it through a binary operation of demarcation. Making a distinction means actively drawing a boundary and thus declaring a difference. This difference is not passively determined, it is actively produced; It is not something detected, it is something effected. One could imagine it to be like drawing a circle upon a surface; only what lies within the circle is the “marked” space, what is outside is excluded and not named. What is part of this unmarked context avoids further consideration and additional decision-making. The not marked side remains in the dark for now, it can only shift into focus by another crossing of the boundary, i.e., being marked. The circle metaphor thus suggests that every distinction is a binary, asymmetrical operation, but one that can be reversed at any time.

At the same time, it follows, according to Spencer-Brown, that “Once a distinction is drawn, the spaces, states, or contents on each side of the boundary, being distinct, can be indicated.”[3] Behind every distinction stands a motive, a difference in value, which can be indicated by a name. We draw a distinction and call the selected side the “good” (peas). Through this indication, this designation, we can call up a respective side and establish points of reference for making further distinctions. Differentiating and designating are two sides of the same operation. What do we do with the “good” ones, with the “bad” ones? However, differentiating and designating are just two sides of one single operation. Each differentiation consists thus in (1) an inside that includes what it designates, (2) an outside that excludes what it does not designate, and (3) an operation that carries itself out by creating inclusions and exclusions. Actually, the relationships are even more complicated than Spencer-Brown describes. The operation of differentiation must be carried out by a person or by something (e.g., a machine) that is themselves/itself already previously differentiated from the space in which the distinction is drawn. At the same time, there is also the “observer of the second order,” who watches the process as an outside party and, as I am doing right now, describes the operation of differentiation in its entirety; though the operator and the “observer of the second order” could, however, coincide in a single person (machine, etc.). How the differentiation is implemented and how the subject and object of this distinction first result Spencer-Brown does not say, he explains only how the entire

[2]. George Spencer-Brown, *Laws of Form*, Portland, OR: Cognizer Connection, 1994, p. 3.
[3]. Ibid., p. 1.

classical logic inevitably develops out of the gradual succession of distinctions. The content, for example, in a first step to differentiate the peas from the rest of the world and in a second step the "good" ones from the "bad," is itself carried out through each operation of differentiation. In this respect, "Distinction is perfect continence."[4] It only makes sense to speak of "quality" if qualitative distinctions can also be carried out operationally.

Processes of differentiation, as we have just looked at generally, are increasingly realized through technology in digital societies. Today we are fellow players in very diverse socio-technological cognitive ensembles—usually without us being aware of it. And there is often very little space provided in which we may take action ourselves. In the case of the *EZ Quality Sorter V2*, we do not begin, as in the logic of George Spencer-Brown, with a still undivided space, or an "unmarked space." A whole range of limitations is determined here through the very structure of the installation. The viewers enter into a complex technical setting that is configured in such a way that they no longer may make a distinction, but rather can only decide between two already determined alternatives. Differentiation, as Spencer-Brown defines it, is here split between machine and human being. In order to be able to speak of a real distinction it would be necessary that the viewers themselves could determine and designate the criteria of the differentiation. Part of differentiation is having the freedom to choose the criteria that determine how the space is divided. But here one only has the choice to decide between "good" or "bad" and the motive behind the differentiation is "quality." Even without knowing it is about differentiating "good" and "bad," there are various clues that it involves sorting by quality; for example, the colors of the buttons or that the one sort is rapidly propelled into a black container while the other is gently transported into a white container. The explicit evaluations of "good" and "bad" are very dominant, simply using other designations would change the context of the decision-making process. But this freedom is consciously not given; the technical structure of the work determines the alternatives and minimizes any leeway. The binary decisions of a participant, in fact, enable connections for drawing further distinctions, but they are also unaware of this. They do not know what consequences it creates for the peas when they land in different containers. And this is exactly what it is about. It is important to realize what preliminary decisions underlie the whole setup of the sorting system—which acts as a stand-in for our current socio-technological systems of decision-making. In the *EZ Quality Sorter V2*, the distinctions are realized as the interaction between three components: the sorting system, the viewers, and the peas. These three actors were not chosen by happenstance, they represent three frames of reference that are still usually considered to be in opposition to each other—technology, human beings, and nature—and their increasingly precarious relationship marks a central conflict in our present day. This relationship is specifically addressed in the installation, and it is worth taking a closer look.

Technology

The name of the installation tells us what it is about, a quality sorting machine adapted from industrial models. The key mechanical element, readily apparent at first sight of the machine, is the conveyor belt. Conveyor belts, developed 130 years ago by the American Thomas Robins, are still a central, visible feature of modern industrial production today. They represent the rapid and secure in-house transport of products and goods of all kinds. The mechanized conveyance of goods is also a symbol that stands for the whole of

[4]. Ibid.

globalization. In the *EZ Quality Sorter V2* the conveyor belt serves to transport the peas. Individual peas drop from a full container in regular intervals onto the belt, which automatically stops the moment one arrives directly under the lens of the microscope positioned above the conveyor.

At this point, the second technical element is put to use. An instrument that like no other represents our modern scientific, rational approach to the world: an optical magnification device. Telescopes as well as microscopes are techno-corporeal extensions that expand our access to the world. But these optical apparatuses placed against the body do not expand our physical abilities like, for example, the conveyor belt does, instead they expand the human sensory and nervous systems and thus increase our scope of action. But looking through the microscope does not reveal “reality itself” to the viewer. The eye is presented another world, which requires insight and the ability to conceptually comprehend in order to understand it and communicate about it. The pea similarly presents itself in a new, unusual way to the viewer observing it through the microscope. Before the microscope could become the central medium for medicine and biology, there first had to be a way to objectively reproduce what was observed. Verbal descriptions and drawings have a subjective slant; only photographic reproduction allowed for multiple people to view and evaluate something and at any given time.

The *EZ Quality Sorter V2* also records an image of the pea and feeds this into a processing unit. Here the third distinctive technical element of the sorting system comes into play: the automatic evaluation of the peas by artificial intelligence (AI). The decisions made by the participants of the installation are saved alongside the images of the peas and together these build the learning corpus for training an artificial neural network (ANN). It is therefore the participants themselves who enable the automatic classification of the peas. They deliver the learning data, without which the AI would not have a basis for making decisions. The AI learns from them without their knowing it. Verena Friedrich has built a model for machine learning, based on the web-based tool Teachable Machine, that in just a few minutes learns autonomously how to sort the peas automatically. An interesting aspect to Teachable Machine is that it is a tool freely available online, and thus every layperson without previous knowledge of AI can create a classifier, on the basis of their own training data. This process, however, remains hidden from the audience members, who can only watch and speculate how and according to which criteria the peas are automatically sorted into the two containers. This too is typical of our current technological environments. We are surrounded by countless black boxes, the operating principles of which we do not comprehend, yet they make all kinds of decisions for us. This aspect is further enhanced through the use of Teachable Machine. We are not just bound to technological decision-making ensembles others have created for us, which we provide with a constant flow of data for further automation, but we can also now easily make and use cognitive entities ourselves, without needing to have even some understanding of the criteria that determine the algorithmic decision-making. We cede control to technology without even understanding how the technology wields this control.

The sorting system is made up of three central components: the conveyor belt, the microscope, and the automatic classification through AI. These three elements reproduce the progression of our technological evolution since industrialization. The conveyor belt represents the classical mechanical type of machine that performs its function using the human body as its model. It is made up of movable parts and works by moving these parts. Via the machine, human physical strength is mechanically replaced, usually by either considerably increasing it or making it more sophisticated in its precision. The microscope, on the other hand, expands human senses. The scope of human agency is thus increased, making it possible to experience spheres not accessible to the human senses. Finally, the third element—AI—replaces, supplements, and expands human cognitive abilities. The three elements thus represent the realization and replacement of the motoric, sensorial, and cognitive abilities of humans through technology. From replacing our limbs to expanding our senses to technologically realizing our cognitions—this is the evolutionary direction of the technology in our modern times.

The Viewers

Like in all interactive work, the audience can experience the installation in two different ways, as participants or as observers. In cybernetics, these roles correspond to the "observers of the first and the second order." As an "observer of the second order," I observe what an "observer of the first order" does. I see the overall situation, I notice perhaps that the person at the microscope hesitates with their decision, or maybe they see the whole thing as a game and are just having fun, particularly when the pea is shot into the black container by a blast of air. Perhaps I'm thinking about how the person at the microscope has made their decisions. And when no one is sitting at the microscope, the decisions about the quality of the peas are made automatically by AI. Even then, there is still an entity that makes the decision, but they remain unseen. In this case, am I then still an "observer of the second order"? And what or who is the object of my observation then? The decision-making subject has disappeared and the decision-making has been objectified, that is to say, reduced to a method of calculation that can, in principle, be retraced step by step at any time. But the internal processes of ANN-based algorithmic decisions, that seem to us from the outside neutral and incorruptible, cannot (yet) be completely understood no matter how rigorously they are inspected. Thus in the case of automated decision-making, the question of which observer position I'm actually taking is not easy to answer. In terms of "agential realism,"[5] there is no prior subject and object; they mutually generate each other via the act of differentiation as a result of their situational entanglement. This performative character of cognition, the human as well as the algorithmic, is amplified by the moving conveyor belt. With each new pea that is transported and examined under the lens, the cognitive differentiation operation carries out and updates itself. This is true for human actors as well as for algorithmic decision-making. The ANN also attains its meaning first through its integration in the running apparatus and, although it is hidden and overlooked, it becomes the differentiation subject. Still we cannot equate human and algorithmic decision-making. Algorithms make cognitively unconscious, mathematical decisions; the algorithm (at least in its current development) knows nothing of its function as decision-maker and also cannot refuse to make a decision. Human beings, by contrast, make conscious but also sensorial, bodily, and affective decisions. They have an idea of what situations they find themselves in and which actions are expected of them. Within this framework, they can also refuse to make a decision or change their perspective of the overall situation, and avoid the whole thing by leaving the space altogether.

[5]. See Karen Barad, *Meeting the Universe Halfway*, Durham & London: Duke University Press, 2007.

If I as viewer of the installation do not stay in the role of external observer but rather I accept the invitation and take a seat at the microscope, I become an “observer of the first order.” Here it does makes a difference whether I am invited to participate by a computer voice or by the attendant who looks after the installation. In the first case, I am in a completely technological situation; in the second, there is a person that mediates between me and the technology. Verena Friedrich pursues both versions in the *EZ Quality Sorter V2*. As soon as I am seated at the microscope, I take on an active role and make decisions about the quality of the peas presented to me. Unlike in the case of the automated decision, my decision is subjective. Provided I can find a quiet moment in the exhibition to engage with the situation at hand, I will first perceive the enlarged image of the pea with my senses, perhaps discerning the beauty of its form and the high level of textural detail. This allows me to feel the precarious basis underlying the judgments I reach. At the same time, I will potentially become aware that I am in this moment a part of a cognitive ensemble that forces me to make a decision and allows me no leeway at all. The discernment and feeling involved in the decision-making, its precariousness and arbitrariness, but also the reflexive self-awareness within the situation are very important factors that are completely missing from the automated decision. As a result, an unbridgeable gulf is marked between human and machine differentiation and decision-making processes. It is also not irrelevant that the thing that is being decided upon is something organic. To make a decision about an organic, biological material means something different to us than, for example, to decide whether little plastic parts have production defects, which are then weeded out, melted down again, and cycled back into the production process. The pea represents nature, it is symbolically charged in a different way than something made of plastic.

Nature

What we understand as nature has changed markedly over the centuries.[6] In the ancient world, nature was the everlasting and meaningful order, one that human beings imitated and ideally brought to perfection. In the modern era, by contrast, it was seen as “dead matter that obeyed the eternal rules of formal logic.”[7] Underlying both concepts is the idea of nature as a constant, unchanging entity. In the current conception, nature too has a history; it is understood as always becoming and ever changing. In addition, “the boundaries between living beings and things, between humans and animals, between the animate and the inanimate, are unstable or at least more unstable than before.”[8] It is now about transformation and conversion, about communication and control, about processes of emergence and decay, which cybernetics as well as systems and information theory are particularly well suited to describe. The thus possible coherent description and explanation of the physical and mechanical as well as the biological and organic processes permit the radical approach of these systems under the common objective of design and the synthesis of new materials, new organisms, and new connections among them. Now every module—whether mechanical, electronic, or organic—can be combined with every other, provided that a common code is found that allows the exchange of information between the participating entities. The previous ontological opposition of the organic, the technological, and the textual is becoming increasingly moot.[9] With the growing acceptance of the

[6]. See Jutta Weber, *Umkämpfte Bedeutungen – Naturkonzepte im Zeitalter der Technoscience*, Frankfurt am Main: Campus Verlag, 2003.
[7]. Ibid., p. 22; trans. T. Miklowski.
[8]. Ibid., p. 23; trans. T. Miklowski.
[9]. Ibid.

cybernetic and system-theoretical understandings of nature not only are the boundaries between science and technology dissolving—an idea that the concept of "technoscience" refers to in particular—but also those between culture and nature as well as between organism and machine.

On the one hand, the cybernetic, system-theoretical concept of nature of technoscience is indeed dominant in the sciences, but on the other hand, it is not the only relevant and current concept of nature. For example, in his essays, the American poet and natural philosopher Gary Snyder deals with the meaning of nature and wilderness and proposes ideas for reflecting on our lifestyles and our own relationship to nature.[10] For him, life in and with nature is above all a basic human experience. He sees both Eastern and Western civilizations largely on a collision course with a nature that was once wild. Those who today think of wilderness, think of distant protected areas. But for Snyder, wilderness is not a place that can be visited, it is home and habitat, with more familiar and less familiar places. This phenomenological, poetic, and everyday approach to nature differs fundamentally from the technoscientific understanding of nature.

It is not clear which of the two concepts of nature is referenced by using peas in the installation by Verena Friedrich. What is clear, however, is that the way in which the biological material is used in the installation prioritizes neither the everyday meaning of nature nor the aesthetic symbolic meaning, but rather the scientific and technological meaning mentioned above. From a scientific point of view, nature is not the natural, beautiful, sublime, wild, mysterious, and yet familiar home that Gary Snyder describes, it is objectified nature. Which is to say, cause-and-effect relationships are studied on the basis of observation, measurement, and experimentation.[11] In the technosciences a seed represents information and autopoiesis, the plant reproduces itself via its genetic information. It is the textual aspect of the pea that is interesting from a technoscientific point of view. The pea carries its own specifications, its own blueprint inside of itself. All one has to do is plant the seed in the ground and water it to create a new plant and new peas.

Still, the way the peas are integrated in the technical setting does not mean that they cannot refer to an understanding of nature other than the technoscientific one. From the perspective of technoscience, it makes no difference whether plastic parts or organic materials are transported on the conveyor belt and analyzed. To the nature lover visiting the installation who is compelled to make a decision, on the other hand, it does make a difference. For them at least, the peas represent something that is not just symbolically worth protecting but factually worth it, something valuable in and of itself. While looking through the microscope they will not look primarily for characteristics to aid classification, they will rather more see the value and beauty of the peas, which are seen in a whole different way when magnified than is possible with the naked eye alone. The obligatory decision-making about good or bad then has all the more potential to produce affects that nonorganic materials would not have. The difference between the human and the mechanical gaze is amplified by the organic quality of the pea.

[10]. Gary Snyder, *The Practice of the Wild*, New York: Farrar Straus & Giroux, 1990.
[11]. See also Thomas Kirchhoff, "Zum Verhältnis von Mensch und Natur," in: *Aus Politik und Zeitgeschichte*, 70 (11/2020): pp. 39–44.

Having gone through each of the individual elements, we can now take an overall look at the installation. So far, neither the antagonism of culture and nature, nor that of culture and technology, have been able to show us paths out of the crisis of the Anthropocene. Verena Friedrich's installation also does not offer an answer to this, it instead clearly presents to us the problematics of our current technological behavior, by putting the elements of an industrial sorting system up for discussion in an artistic context. It is an illustrative situation, similar systems are now deployed all over our society. From a technoscientific perspective as well as an economic one, these technologies are extremely successful, but we seldom are conscious of their consequences in our lives. Through the increasing scientification and mechanization of our everyday lives, technological behavior and decision-making arrangements have attained a fundamental status in our society and have led to a rational, objective understanding of life and nature not just in science but also in everyday contexts. At the same time, the role of technology within these arrangements often remains invisible, misunderstood, and with no alternatives. The understanding of nature behind the technosciences has long shown consequences for our outlook on the world and on life. The broad use of technology standardizes and normalizes its own conditions. It is based on the obligation to arrange things and reduce them in such a way that they are algorithmically and technologically manageable. What gets lost in the process usually remains hidden. Thus, we move today in technosocial ensembles in which we can often only decide between predetermined alternatives. We have to recognize the trap that is set for us with networked technological apparatuses that offer much too narrow alternatives to decide between, where by now even the final decision is made by the machine itself. The sensorial, corporeal dimensions are either greatly reduced or completely eliminated in this functionally rational human-technology configuration. To regain agency would mean being again able to make real distinctions and not just binary decisions.

"Let me say again: Nothing whatsoever can be known through telling."[12] Knowledge can only be attained through action, in Spencer-Brown's *Laws of Form*, by alternately carrying out an instruction and critically examining the result, before the next action is taken, and so on and so forth. Cognition is understood as a process, and knowledge follows only from the experience of practical operation. Spencer-Brown's Laws of Form are a mathematical, logical calculus aimed at cognition. If we apply this to the sphere of art and to the *EZ Quality Sorter V2*, this means descriptions and texts like the present one cannot and should not replace practical experience, especially the aesthetic experience of an installation. The quintessence of the installation could thus be summarized as "Draw your own distinctions." We have to envision that there are alternatives to the current understandings of technology and nature and that it is left to us to formulate these alternatives. The necessity to develop other approaches and practices becomes obvious if we can regard technology not just as abstractly interpreted and cut off from culture, but if instead we can perceive it actively within cultural settings. In this sense, the installation by Verena Friedrich offers a vital experience that provides us an opportunity to challenge our own relationship to technology and nature.

(translated by Thea Miklowski)

[12]. George Spencer-Brown, *Laws of Form – Gesetze der Form*, Lübeck: Bohmeier Verlag, 1997, p. xii; trans. T. Miklowski. Translator's note: This poignant statement is found, as far as I can tell, only in the aforementioned German-language edition, from Spencer-Brown's "Introduction to the International Edition" dated February 1985.