VALUATION: ITS LOGICAL STRUCTURE, ORIGIN AND EVOLUTIONARY DEVELOPMENT

By

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Abstract

In order to understand complex human valuative relations, it is helpful to examine the development of valuation. This work is concerned with investigating the logical structure, origin, and evolutionary development of valuation. I analyse the structure of valuation as goal-directed, while examining its evolutionary development based on three stages of cognitive complexity. This methodological combination makes it possible to reveal both the stable basic logical valuative relation between a subject, a valued object and a goal, and the logical structures and objects that change in the course of evolutionary development. A crucial factor is a twofold differentiation of the goals of valuation: while there is a difference between instrumental and final goals on the one hand, on the other hand, a distinction must be made between aspects of valuation from the third-person and first-person perspectives. By differentiating these dimensions of valuation, this work contributes to the understanding of valuation in general and lays the foundation for an analysis of human valuation in all its complexity.

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Contents

List of Figures

List of Tables

1 Introduction

There are so many feasible options for what one could do, why do we do one thing rather than another? We choose based on some things having more value to us than others. But the world of values is complex and hard to understand. In this thesis I will investigate the origin and development of value.

In philosophy, the terminology around "values" and hence also "valuation" originates in the turn from the 19th to the 20th century. In the dictionary, *Historisches Wörterbuch der Philosophie*, Anton Hügli defines "value", with reference to Martin Heidegger's account, as the "latest and at the same time weakest descendant of "agathon"[1], the traditional Platonic term for "the good". As Hügli explicates, the modern term *value* is a subjectification in which the "appreciation" of something is expressed, and has its origin "not 'in the world' but 'in the human being'".[2]

For this thesis I want to set aside the question of whether there is a good in the world, independent of a subject that can appreciate anything. I am interested in the process in which a subject finds something valuable. I call this process *valuation*. In this thesis I analyse how it comes that things matter to us and other living beings.

One way of understanding something is to analyse how it came into being. We as human beings are living creatures; hence, I want to explicate how our valuative setup evolutionarily developed. I will combine this evolutionary investigation with a logical analysis of what valuation is. The framework I use to describe the logical analysis is influenced by Francis Heylighen (2023), while Kim Sterelny (2003) inspires the framework of the evolutionary development. Sterelny does not provide an overarching definition or explication of valuations. He does not even use the term "valuation".[3] Therefore, I will first provide a framework for us to better understand what it is that

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[1] Grunder, Ritter and Gabriel 2005, p. 556; my translation.

[2] Cf. Grunder, Ritter and Gabriel 2005, p. 557; emphasis adopted.

[3] Sterelny does differentiate between different stages of valuation, in the form of drives and preferences, but does

changes along the steps of evolutionary development and which aspects of valuations stay the same. In this I merge both, Sterelny's description of the development of cognitive complexity along biological evolution, and Heylighen's analysis of valuation being goal-directed. While with Sterelny, I can explicate where value and goals originate, with Heylighen I can explicate what goals and valuations are. This makes the combination of the author's frameworks extremely valuable.

The basic feature of the logical structure of valuation is goal-directedness. There are two kinds of goals that we need to differentiate between: instrumental and final goals. After analysing the characterizing features of instrumental goal-directedness, the final goals, on which even instrumental goals valuatively depend, will be analysed. Here I enter a detailed explication of the evolutionary development of cognitive control, based on Sterelny's work. Sterelny describes a gradual development of cognitive complexity in behavioural control. He differentiates three important stages in which important additional features show up. These stages consist of the possibility for *detection systems*, *response breadth* and *decoupled representations*. The combined analysis of logical structure and evolutionary development of valuation allows us to finally analyse what aspects of valuation change and what stays the same along biological evolution.

In the final part of the thesis, I will present a thought experiment of a malfunctioning bacterium where tensions within the bigger picture are made visible. These tensions can be resolved by adding a first-person aspect of valuation to the functionalist, third-person analysis of valuation, with which Heylighen and Sterelny work.

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not classify them explicitly as one phenomenon. He uses the terms "evaluation" and "re-evaluation“ but leaves the grouping of valuative phenomena implicit. The main reason is that while valuation is a major theme in "Thought in a hostile world", it is not the main focus.

2 The origin of valuation

2.1 The basic logical structure of valuation

As mentioned, I ignore here the possibility of things having intrinsic value. What I am interested in is the relation between a valuating subject and an object that is valued, which can include physical objects as well as behaviours as objects of the valuation. I here understand as object any entity that can be valued. I assume in the following that the origin of the valued entity's value in this dynamic does not stem from the entity itself but the subject and its relationship to the world. I assume therefore, that valuation is not only the recognition of the presence of some positive or negative feature, since positiveness and negativeness of such features cannot be found in the object. Conversely, value is not only in the subject either. If we assume that value is relational, it follows that there must be a reason "in" the subject for why the subject gives value to this specific object. I will use the term "need" to fill this gap for referring to the reason for valuing an object.

The need of the subject is a need for something; it is a relationship between subject and world. One can always ask what a valued object is good for or what makes it useful or desirable. This "what for"-relation connects the valuation logically to a goal. Without a subject with a goal, there would be no need and hence no valuation. The directedness towards a goal also explains the positiveness or negativeness that comes with it: the further one gets away from one's goal, the stronger the situation is negative; the closer one gets, the more positive it is. Hence, valuation is a teleological term, which makes a goal necessary for valuation. Additionally, wherever there is a goal, there are states that are closer or further away from this goal, which translates into better or worse states. Hence, as I assume for now, goals are also sufficient for valuation. Therefore, valuation and goals are coextensive: wherever there is a goal, there is valuation, and vice versa.

I will illustrate the resulting logical structure I arrived at with an example: A safety rope has value to someone working at great heights, (a) because this person has a need for safety, and (b) safety is needed for this person, because it has a need to survive, which stems from (c) the basic goal of survival. The value of the rope in this case comes from it being a means to fulfil this person's goal of survival. Without the goal of survival there would be no better or worse state for fulfilling this goal; hence, without the goal there would be no need and no valuation.

There might also be other kinds of goals, not directly related to survival. I, for example, value the taste of olives because I enjoy their taste and I have a need for pleasure. The taste of olives has value *for* me because I prefer to have it instead of not having it, or at least I would like to have it in the future. The taste of olives has no value in and of itself, it has value because a subject (like me) values it. The taste does not have a benefit for my survival; I can value it just for the goal of enjoyment. The goal, hence, can differ, while the general logical structure of valuations stays the same: Valuations happen in relation to goals. The basic logical structure of valuation we derived at is this: a subject (S) values some object (O) regarding some goal (G). This structure is illustrated in Figure 2.1.

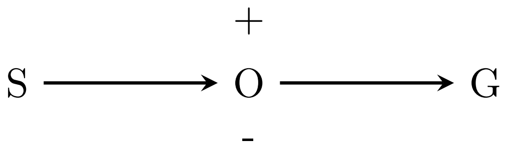

Figure 2.1: Basic structure of valuation

Description: The basic logical structure of valuation, is a relation between a valuating subject (S), a valued object (O) in relation to some goal (G).

This analysis is helpful, but it raises the questions: how do systems get closer to their goals? This is where I make the first step towards the realm of the living: embodied goal-directed systems. Kim Sterelny's description of the realm of the living is especially helpful here. The framework in which he operates is based on Peter Godfrey-Smiths environmental complexity thesis: "The function of cognition is to enable the agent to deal with environmental complexity"[4]. This functionalist definition of cognition sets the stage for a mechanistic approach. The link between

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[4] Godfrey-Smith 1996, p. 3.

environment and cognitive system is usually moderated via behaviour.[5] When, for example, I value the taste of olives positively, I connect the taste to a positive behavioural disposition towards eating olives. The positive valuation is, for now or later, a *reason* for initiating or continuing a positive eating behaviour towards olives. There might also be plenty of counter-reasons, such that the positive reason never gets realised. I might, for example, be convinced that there is a severe health risk connected with eating olives, since I could choke on the olive stone. This imagined health risk leads to a negative valuation of the eating of olives. The weighing between valuations for and against an action (whether I eat or don't eat more olives), finalising in a judgment like "olives are safe to eat", would be an *evaluation*, which uses valuations as its building blocks.[6] I consider the relation between valuation and evaluation here to be gradual, in that valuation is the pre-reflective or implicit process of recognizing something as good or bad, while evaluation is reflective or explicit.

2.2 How does goal-directedness work?

In my explication of a naturalist approach to goal-directedness, I will engage mainly with the analysis of goal-directedness by Francis Heylighen (2023). I contextualize their findings by help of a critical introduction on functions and goals, provided by Justin Garson (2016).

When a system is goal-directed, in some way a future state, the goal, has an effect on an earlier state. This is tricky to make sense of, since I assume any account on goal-directedness must hold up to the rules of physics: effects cannot predate their causes. Modern theories of goal-directedness are able to avoid explanations by intelligent design of biological goals, vitalist life forces, or backward causation.[7]

The mechanism[8] that needs to be analysed is the one by which the goal has an effect on the initial state, without falling for intelligent design or vitalist forces. Ernest Nagel proposed that

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[5] Cf. Godfrey-Smith 1996, p. 12.

[6] The Oxford Dictionary defines evaluation as "to form an opinion of the amount, value or quality of something after thinking about it carefully" (Hornby 2007, p. 511.). The prefix "e-" means *out of*, *from* or *beyond* (Cf. Sheehan 2000, p. 27, 31.) and indicates the meaning of *evaluation* to be related in this way to its root word *valuation*.

[7] Cf. Garson 2016, p. 19.

[8] In the 1950s the discussion around goal-directedness split up into two groups, which both were influenced by the technical progress and goal-directedness of artifacts: a behaviouristic and a mechanistic/cybernetic approach. I focus on the cybernetic approach here. Cf. Garson 2016, p. 17, 24.

such apparent backwards influence can be explained by a *negative feedback system*.[9] In these systems the current state is always measured in comparison to some goal state, which allows to counteract deviations. With the measurement of the difference between current status and goal status, the system produces parts of its own input and hence is not entirely dependent on its environment.

An example that illustrates such a correction mechanism is an automatic plant watering system.[10] This mechanism can be realised by the help of a thin tube with a little water tank sticking to the ground. Whenever the ground is dry, it takes in water from the watering system till it is so wet that no more water gets soaked into the soil. It takes some time till the plant has used the water or it evaporates, but as soon as the soil is dry enough, more water is automatically released to the ground. This system fulfils the goal of keeping the soil at a specific moisture level. The gravitational and diffusion forces regulate that there is always enough water in the ground, while the negative feedback loop stops the watering as soon as the ground gets too wet.

In such a mechanism, what exactly is its goal? Is it to release water? Is it to keep the ground wet or the plants alive? I differentiate between two kinds of goals: instrumental and final goals. In this example, one can ask why the watering system releases water, and the answer would be that it does, because it keeps the ground wet. Therefore, keeping the ground wet is a goal in the sense I described above. However, one can continue asking: why does the mechanism keep the ground wet? The wet ground provides the plants with water, which is a necessary resource for them to stay alive. Here one finally comes to an end. One has reached the level of final goals, explaining all the instrumental goals in the chain: the mechanism was installed to keep the plants alive.[11]

The two levels of goals do interact, so for the full picture I need to understand both of them, including their interaction.

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[9] E. Nagel was influenced in this by the biologist Sommerhoff. Cf. Nagel 1953, Sommerhof 1951; as cited by Garson 2016, p. 21, and Heylighen 2023, p. 374.

[10] The classic example is a thermostat.

[11] Sterelny makes a similar differentiation. Cf. Sterelny 2003, p. 87 f.

2.3 Instrumental goals

Instrumental goals and functions are very tightly linked in their definitions. One way to phrase why some organisms have hearts is to say that they allow the organism to achieve the goal of pumping blood and thereby distributing nutrients in the system, which is one way of proceeding in the organism's goal of survival. Another way of phrasing it is to say hearts have the function of pumping blood, which has the function of making organisms survive. The key difference is the perspective from which the terms phrase the situation. The goal describes the final state which shall be achieved, while the function describes the use of a specific feature for the sake of the goal, focusing on the initial state. Nevertheless, both are teleological terms which are so tightly linked in their definition that theories of the one also influence the understanding of the other.

There exists a variety of understandings on instrumental goals and functions, of which no single theory appears to be able to resolve all its objections.[12] I assume here that the most promising answer to this situation is to accept a pluralism on the concepts involved, which means that several important features of goals need to be explained, of which no single one is sufficient for the presence of instrumental goals. I leave it open whether the list is sufficient to detect goal-directedness, at least together the criteria are a very reliable indicator. In the following I will discuss a list of four features, namely plasticity, persistence, far-from-equilibrium goals, and concerted action. In sum, they make it possible to differentiate for our purposes sufficiently well between the presence or absence of instrumental goals. I leave it open for future research to add features to this list.

For living beings, instrumental goals are either the potential or de facto orientations towards their final goal. This means that instrumental goals are immediately connected to the behaviour of an organism, since they display the steps towards some further instrumental or final goal. An organism starts treating a stimulus as significant and organises its behaviour around it. In case the instrumental behaviour is adaptive, it gets stabilized. Thereby, instrumental goals provide the raw material for selection (developmental and evolutionary) and learning.

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[12] Justin Garson discusses a variety of these theories in chapters three to six of his work "A Critical Overview of Biological Functions" (2006). Cf. Garson 2016.

2.3.1 Plasticity and persistence

Cybernetics describes two crucial features of feedback mechanisms in instrumental goal-directedness: plasticity and persistence.[13] Plasticity is the property that goal-directed entities end up at the same position even when they start from different initial conditions.[14]

Francis Heylighen suggests a schematic way of portraying this relationship by defining the goal as the attractor for the goal-directed system.[15] The surrounding conditions from which the attractor can be pursued form a basin, leading to that goal. Every starting point within the basin leads the system closer to the attractor, while initial states outside of the basin lead to random action, not allowing the system to approach anything.

Following E. Nagel's definition, there is a second essential feature of instrumental goal-directedness, which is *persistence*. Persistence has the effect that even perturbations do not hinder the goal-directed entity to continue approaching its goal. The behaviour of the goal-directed system has the effect to compensate for or suppress the perturbations. In terms of the attractor field scheme, this can also be portrayed with a large enough basin (figure 2.2). In a small basin, even little perturbations let the goal-directed system lose its track towards the attractor as they quickly get out of the basin around the attractor field. In large basins those perturbations can be compensated, since even in throwback situations one is in range of recognizing the direction towards the attractor. I conclude that goal-directedness is dependent on sufficient plasticity and persistence.

2.3.2 Far-from-equilibrium goals

A key problem for theories on instrumental goal-directedness is to distinguish systems which clearly are goal-directed from those that are not, or only to a negligible extend. An especially tricky example for a system that is not goal-directed is that of a ball in a bowl.[17] This ball appears

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[13] As mentioned earlier, these terms were introduced by E. Nagel, based on the research of Sommerhoff. Cf. Nagel 1953, p. 265; cf. Sommerhof 1951; as cited by Garson 2016, p. 21 and Heylighen 2023, p. 374.

[14] Lyman 2004 defines this feature as *equifinality*. Cf. Lyman 2004; as cited by Heylighen 2023, p. 373.

[15] Cf. Heylighen 2023, p. 377.

[17] My use of this example stem partly from discussions with Klaus Rössel, partly from a similar example provided by Dan McShea (2012), who refers back to an example in E. Nagel (1979). Cf. McShea 2012, p. 680; Nagel 1979, p. 288.

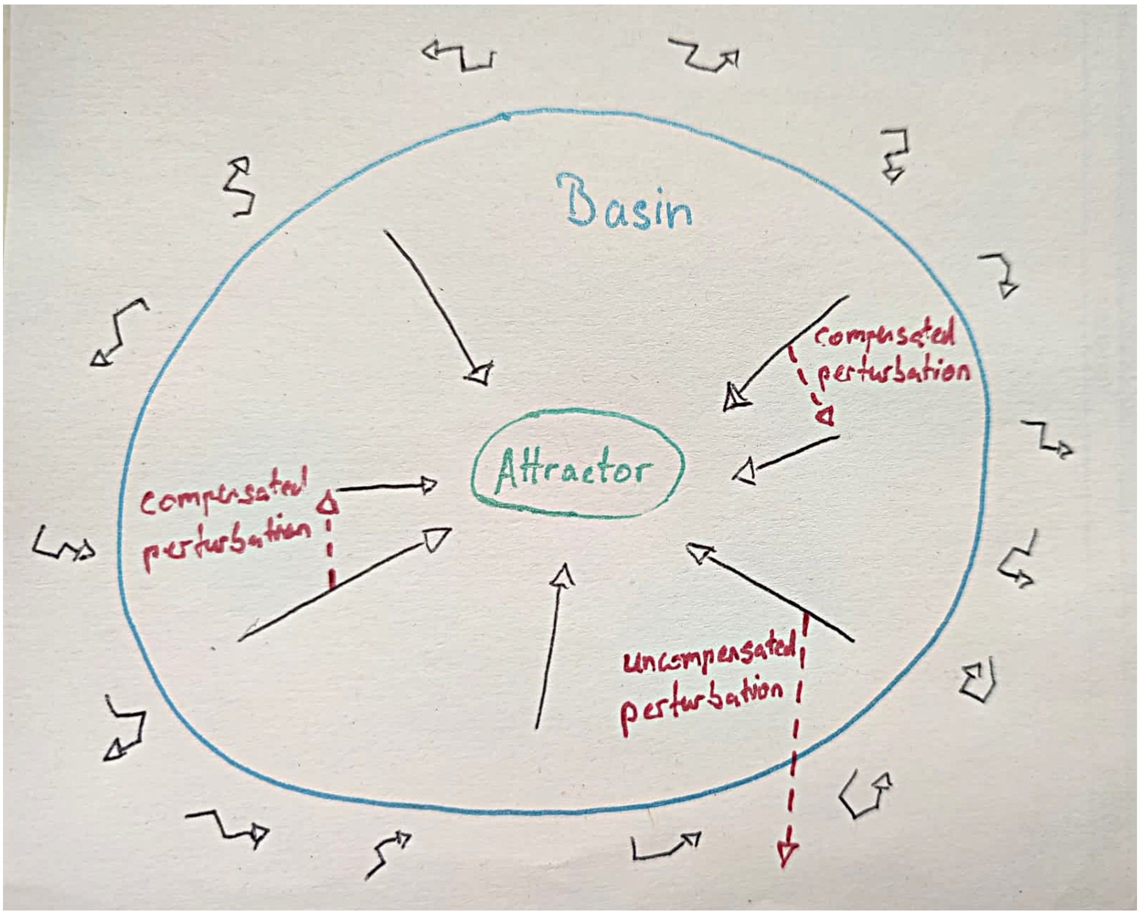

Figure 2.2: Attractor basin

Description: Attractor-field of a dynamical system and its possible trajectories (black arrows). The system has an attractor (green, centre), and all trajectories inside the basin (blue) lead towards this attractor. Trajectories outside the basin are undirected. The system can compensate perturbations that do not lead the trajectory outside the basin. An only marginally different image is provided by Francis Heylighen (2023).[16]

to have the goal of reaching the lowest point in the bowl. The ball is not a goal-directed system as I understand it, and yet it fulfils the features of plasticity and persistence: The ball would reach the lowest point from whatever point in the bowl it is starting; hence it has the feature of plasticity. Furthermore, it also can counter perturbations. Imagine I release the ball at some point of the bowl, but put my finger below it, so that the path to the lowest point of the bowl is blocked. The ball will find its way around my finger to the bottom, hence it is persistent. As we see, the definition is yet insufficient, so we need an additional condition for how to differentiate between goal-directed systems and simple causal relationships, without feedback loops.

One further condition, Francis Heylighen suggests, could be to take a look at the kind of final state involved. Suppose it is my goal to eat olives. To reach that state I need to invest plenty of energy, since the intended state does not coincide with the spontaneous tendencies of the system. According to Heylighen, the goal which is approached in a stereotypical goal-directed system, is a *far-from-equilibrium* state.[18] This is the opposite situation to what happens to the ball. It invests no energy to get towards its goal, quite the opposite: it comes closer and closer to a state of equilibrium.

I argue that Heylighen's criterion fails, since equilibrium states can also be goals, so far-from-equilibrium goals cannot be decisive for goal-directedness. Consider a contrasting example to the ball in the bowl: an opossum uses the tactic of playing dead to survive. Therefore, playing dead is an instrumental goal of the opossum. This involves that the opossum must for a while follow the spontaneous tendencies of its system and set a close-to-equilibrium state as its goal. The opossum lies, very similarly to the ball in the bowl, on the ground and does not move. What is happening is very similar in both cases: the opossum and the ball are following spontaneous tendencies of their system and reach a close-to-equilibrium state. Nevertheless, in the case of the opossum we clearly have a goal-directed process, while in the case of the ball we do not. Playing dead is one instrumental goal in a row of goals, relating to the final goal of the opossum to survive. I take this to be conclusive evidence that far-from-equilibrium states are not necessary for instrumental goal-directedness.

Heylighen could object that, while it might be true that in particular examples far-from-equilibrium states can be goals, goal-directed systems must at least have the potential to realise far-from-equilibrium goals. However, not even this is true. I presented earlier the watering mechanism. In this example the goal of the mechanism is always a close-to-equilibrium goal, it relies heavily on physical forces to fulfil its goal. Nevertheless it still is a goal-directed system. I therefore conclude that having a far-from-equilibrium state as goal is an ill-suited criterion for recognizing goal-directedness.

2.3.3 Concerted action

If the properties of the goal do not help defining goal-directed systems, it might help instead to focus on mechanism. The question one must ask here is: how can the mechanism allow for some

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[18] Cf. Heylighen 2023, p. 371.

goal-state to influence the current state of the system?

Implementing this needs some kind of arrangements of parts of the system that work together for a feedback-and-correction mechanism. In case of the watering mechanism, it is a simple feedback system via negative feedback of the level of humidity. The parts of the system are specifically arranged so that it detects[19] too little or too much humidity in the soil and reacts to this by releasing more or less liquid into the ground. In case of the ball, there is no arrangement of parts for some goal. There is no mechanism that reacts in any way to the ball's trajectory. Furthermore, the lack of a reactive mechanism does not allow for any interaction with the environment. While the watering mechanism senses a state in its surrounding and reacts to it by changing it if it does not fit its goal, there is no interaction in this sense happening in the case of the ball. We can conclude from this comparison, that we need a mechanism that allows for a comparison between how a situation is and how it should be. Only in the case of the watering mechanism there is a mechanism that interacts with its environment via a feedback mechanism that is organised towards the goal. I will call the interaction of different parts, working together in a concerted manner for reaching some goal, *concerted action*.[20]

We now have three robust features that are good indicators for instrumental goal-directedness: plasticity, persistence, and concerted action. There is no clear line of to which degree these features are needed to be expressed for something to be goal-directed. This is only natural, since the transition along all those factors is gradual rather than all-or-nothing.[21] As Heylighen points out, it is no wonder that over time goal-directed systems become more likely.[22] In the reactionary interplay between molecules and other resources, more stable interaction circles are those which persist, while other interactions fall apart. The first of these systems will probably collapse, since their attractor-basins will be relatively small and small perturbations destroy them. However, the bigger the basin, the more stable the system, the more likely this system survives. The chances for enhanced persistence of reaction chains are even higher if

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[19] In Sterelny's terms we could describe the system as a simple detection system. More on this later.

[20] This terminology is based on Heylighen. Cf. Heylighen 2023, p. 378.

[21] Artifacts could be an exception, since in their case an intelligent designer creates systems with goals. With artifacts the goal does not evolve, but is put into the system from outside, so the gradual development in this case does not play a role. Non-artificial systems must still be explicated from their slow evolution.

[22] Cf. Heylighen 2023, p. 383.

a system becomes able to sustain itself. With a sufficient number of trials, it is therefore to be expected that self-maintaining systems develop – a non-biological evolutionary filtering system for stable, self-sustaining systems. The evolutionary pressure in this case selects for goal-directed systems which have as their goal to maintain and/or reproduce themselves. At this point we come close the domain of living beings, which is the subject of the following chapter.

To summarize: Goal-directedness is causal, but more than simple causality since the goal has some effect on the initial state. This happens via feedback mechanisms. In this way, the system's output partly influences the input, allowing the system to correct its behaviour and thereby become autonomous, i.e., capable of controlling its own behaviour without the complete dependency on external stimuli. For being able to set instrumental goals, the goal-directed dynamic system needs sufficient plasticity and persistence, which means that it needs a sufficiently large basin of attraction for being able to fulfil its goal. Furthermore, it needs sufficient concerted action for being able to realise a feedback-and-correction mechanism. What counts as sufficient here is a question of degree. The evolution of self-maintenance is a crucial step for especially stable goal-directed systems.

2.3.4 Instrumental goals in living beings

What we found already in general for instrumental goal-directed systems, we can now apply to living beings: plasticity, persistence, and concerted action are crucial to understand the valuative interaction between an organism and its environment. How does this work in simple organisms, like bacteria? Chemotaxis is behaviour based on the sensation of certain molecules. There are two kinds of chemotaxis: positive chemotaxis in which the organisms move towards the higher concentration of this molecule and negative chemotaxis in which they move away from it. Escherichia Coli for example have chemoreceptor proteins with which they can sense both attractant and repellent chemicals, which increase or decrease the tendency to tumble, creating an overall bias towards the attractant and away from the repellent chemicals.[23] Here we see that in different milieus, in different starting points, the bacterium persistently strives towards its goal of survival. When it comes closer to a concentration of harmful and by help of the evolutionary

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[23] Cf. Baker 2012, p. 10.

pressure thereby repellent chemicals, it manages to avoid this obstacle on its way towards its goal of survival, which shows an adaptive plasticity. These adaptations are allowed by a mechanism between sensory organs and their connections to the motoric parts of the bacterium. In their interplay they proof concerted action.

I proceed with analysing in more detail what happens in the case of positive chemotaxis. Here a beneficial molecule, like sucrose, is an attractor so that the bacterium in tendency moves towards the higher concentration of sucrose molecules. The bacterium is able to detect this cue in its environment (the presence of sucrose) and reacts with its program to this sensation by adapting its behaviour so that it moves towards the niche in which the concentration of food is higher than in the surrounding area. The environment does not need to be represented explicitly in any way via neurons, symbols, or any other form of coding. For adapting a behaviour to a sensation, nothing but the environmental information and a feedback mechanism are needed, which corresponds to the internal goal-state of the respective system (as I explicated above). The systems only implicitly need to "know" when to act or when to stop acting (when the goal is reached), but this information can be completely stored in their body composition – in other words: it can be embodied. Here I rely on the research of embodied cognition. John Steward explicates in an introductory chapter on embodied cognition, that the bacterium cannot have what usually is called “knowledge-that,” in form of explicit propositions. Rather, the sensed information directly guides action, which is a form of "knowledge-how".[24] Like the watering mechanism, also a bacterium is organised in a way so that it responds in a specific manner to specific environments. It is this interplay of internal mechanism and external stimuli that allows the bacterium to fulfil its goal.

2.4 Final goals: the biological evolution of value

Instrumental goals stand in a relation to end points of reasons for why to pursue a behaviour: final goals. Hence, ultimately, we need to understand final goals for answering where value comes from. I assume, that no further reason can be provided for why a final goal is pursued.

The defining feature of the realm of the living is autopoiesis, the ability to actively maintain

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[24] Cf. Stewart, Gapenne and Paolo 2010, p. 3.

its own bodily organisation and identity in interaction with its environment.[25] For illustrating the difference between the realms of the non-living and the living, border cases, like viruses, are helpful. Viruses are macromolecular complexes that came about by biological evolution. They have the capacity to make copies of themselves by using genetic instruction which they enclose in a host cell.[26] Viruses do not have a metabolism, and without a host they are not able to reproduce. Nevertheless, viruses are goal-directed systems which were evolutionarily filtered to maintain themselves as a quasi-species. Viruses are organised to protect the genetic material they carry by a protein shell (capsid).[27] In their capsid form, when they are outside of their hosts, there is no interaction with the environment, no metabolism, and no active maintenance of their organiation and identity.

To bridge between a state of non-living entities without any valuation and the world we know with highly complex human valuations, it is worth examining what changes along the path of biological evolution. Evolutionary development is not linear. Nevertheless, I want to try to group cognitive evolutionary development along the development of complexity for behavioural control, which also allows comparing systems that developed on evolutionary paths that split early on. Therefore, I provide a framework, inspired by Sterelny's categories of behavioural control[28], to explain the crucial changes along this evolutionary development.[29] Even though Sterelny himself does not explicitly write about goal-directedness in the way we described above, it is a suitable expansion of his functionalist framework. When a system tracks environmental features and responds to them adaptively, functionality emerges.[30]

Sterelny's framework provides two developmental dimensions along which the complexity of

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[25] As Di Paolo describes, this originates in Varela's early works. Di Paolo 2018, p. 78; Maturana and Varela 1980 and Maturana 2002.

[26] Cf. Mateu 2013, p. 4.

[27] Cf. Mateu 2013, p. 7 f.

[28] Sterelny based his analysis on the framework of Peter Godfrey-Smith for analysing the evolution of behavioural control. Cf. Godfrey-Smith 1996, as cited by Sterelny 2003, p. 11.

[29] In a commentary on Helmuth Plessner, Markus Rieder-Ladich points out that classifications into hierarchical sequences of living beings have a long history in Western tradition. Thus, Mirandola 2023/1485 already contrasts humans with plants and animals. Cf. Rieger-Ladich 2025, p. 53.

[30] Sterelny also has a gradual idea of functionality in this cognitive sense. In complex environments, when organisms are capable of flexible responses and are able to modify their environments, we find functionality. Sterelny does not, however, think of functionality outside of the cognitive domain of living organisms.

cognition can be mapped. The first dimension is *tracking robustness*. This dimension explains the number of cues that an organism can track. The more cues tracked, the more information about the environment can be processed. This is especially relevant in cases of mimicry and camouflage, in which predators and prey try to provide misleading cues to their hostile counterpart.[31] For the tracking organism it becomes necessary to find further distinguishing features that enable it to recognize relevant features, like a predator or a prey, even given the misleading information. This explains the evolutionary pressure in certain hostile environments, what supports the emergence of organisms with a higher tracking robustness, due to higher chances of survival.

The second dimension of cognitive complexity is *response breadth*, which explains the range and flexibility of possible responses of an organism towards tracked information. The evolutionary drive behind this developmental dimension is the adaptive divergence of behaviour. The more options are available towards a given number of cues, the finer grained and nuanced the response can be. This is for example needed in cases in which dangers and resources are present at the same time.

For the explanation of valuation, response breadth is the more relevant dimension. Tracking robustness is also instrumentally important, as I will explicate in the following paragraph since it enables the development of response breadth in its starting phase.

As one can see in figure 2.3, the biological development can be modelled along a curve that has a low beginning and a sharp rise after that. In the beginning phase of biological evolution only tracking robustness provides an evolutionary drive. For organisms that can only track a single cue, there is no use for more than one behavioural response to this cue since there could not be any relevant information for why one response should be preferred before the other. This explicates why the selective pressure for a divergence of behavioural responses comes in only after a certain level of tracking robustness has been reached. Also, the instrumental importance of tracking robustness for questions of valuation becomes clear here. Without the evolutionary drive for more environmental cues to be tracked, the relevant evolutionary drive for valuation would have no chance to show up.

With cognitive complexity the valuative capacities change. The starting point of the environ-

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[31] Sterelny 2003, pp. 17, 24 f.

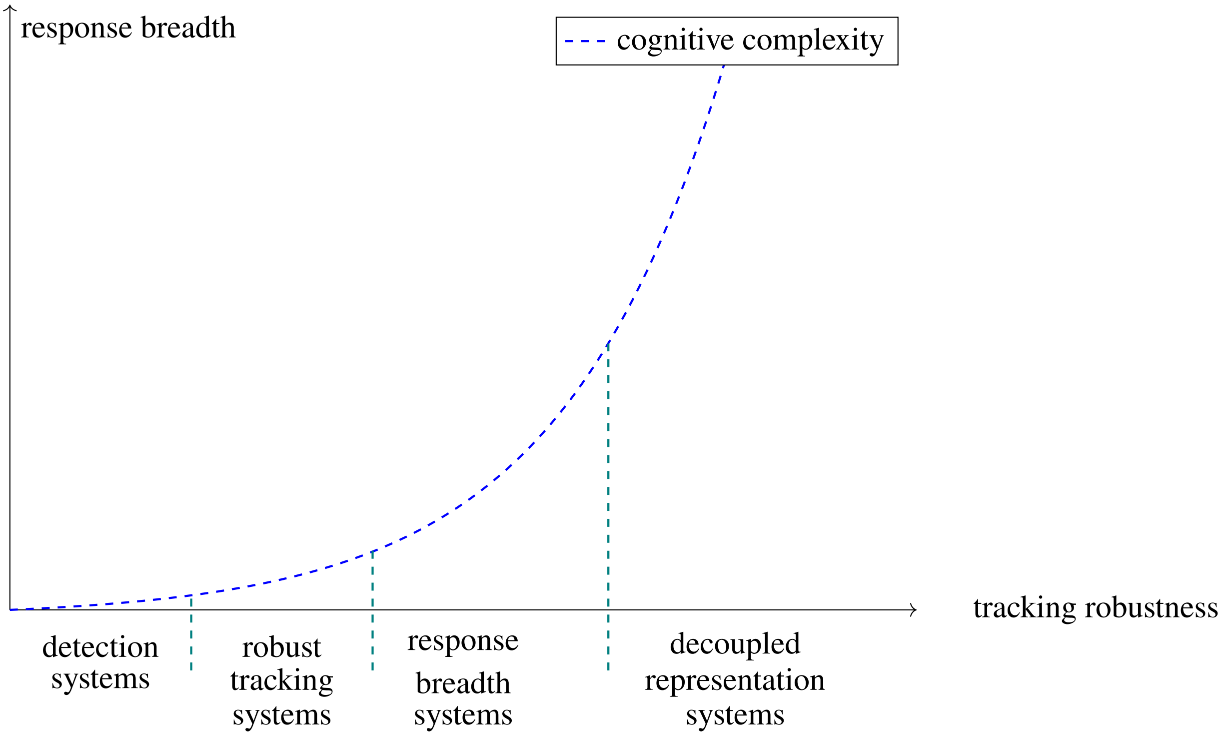

Figure 2.3: The development of cognitive complexity along the two dimensions of response breadth and tracking robustness

Description: Sterelny's analysis of evolutionary development for behavioural control, interpreted as a development along two dimensions: response breadth and tracking robustness. The development can roughly be portrayed in the form of a delayed exponential growth curve, due to its first development only along the axis of tracking robustness. The organisms which evolved along these dimensions can be separated roughly into four basic categories: detection systems, robust tracking systems, response breadth systems, and decoupled representation systems.

mental development are detection systems which are only able to track single environmental cues. The second relevant group I want to discuss is the one of response breadth systems. These systems have a variety of possible behavioural responses, given the same cues. The endpoint of this development along the dimension of response breadth is the state of decoupled representations, in which the behaviour can be chosen independently of the context in which this behaviour was learned.

Living beings, with their goal for survival, emerge due to evolutionary pressure, are inherently goal-directed, and thereby valuating entities. I will proceed in explicating a proposal for what the goal-directedness of living beings consists in and what evolutionary dynamics support the development of those features.

2.4.1 Detection systems

Detection systems are the simplest behavioural control systems among living beings, as they detect only one relevant feature, which directly drives a behavioural response. The stimulus is one specific environmental signal that tracks a relevant environmental feature (or features). The response is always the same and the stimulus is sufficient to cause the response. We met one such example already in the case of bacteria in chemotaxis. The bacterium has a sensor for one relevant feature, and the detection of this feature leads to a specific response.

There is a specific evolutionary use of these simple detection systems. In terms of survival and reproduction, it is beneficial to hold the costs that are needed to maintain oneself, to defend oneself against dangers and to produce offspring, as low as possible. Those creatures which can deal with their environment cost effectively have an evolutionary benefit compared to those who are less cost effective, what leads to more offspring or longer lifespans compared to the cost ineffective group. On the long run hence, the cost-effective group asserts itself in the population. If a single cue tracks the relevant environmental feature reliably enough, it is very cost effective to work with only a single cue tracking mechanism. If it is not reliable, however, it comes with the price of an error trade-off. The trade-off happens between false positives and false negatives, which is easiest explicated with the help of an example.

Cockroaches are equipped with antennae on their backs, which detect wind gusts. These antennae are connected to a very simple response mechanism. As soon as a wind gust strives the antennae, the cockroach automatically moves in the opposite direction, away from the direction of the gust.[32] This is, apparently, a very cost-effective way of protecting against predators. However, there surely are many false positives, in which the automatic flight response is triggered without a predator being present. There is a cost for false positives, which are the resources invested for unnecessarily running away. On the other hand, there also is a cost for false negatives, which is to get eaten when a predator is present, but the cockroach did not escape in time. The cost of the false negative is so much higher than the cost of the false positive, that the sensitive mechanism prevailed.

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[32] Cf. Sterelny 2003, p. 14. The behavioural analysis of cockroaches goes back to Camhi 1984, pp. 79-68.

There are plenty of similar examples: The same single-cue-response-mechanism applies to organisms, reacting to light (phototaxis), temperature (thermotaxis) or food gradients (chemotaxis), since here always a single environmental cue in combination with the organism's bodily organisation is sufficient to lead to a specific behaviour. Similarly, there are plants which are detection systems, since they are reacting to day lengths[33] and even human reflexes display an underlying detection system, like the hamstring reflex. Also, in this case a single cue in form of a tapping of the hamstring tendon is sufficient[34] for the contraction of the hamstring muscles, leading to a slight flexion of the knee.[35] All detection systems have only a single possible response to a given cue. Even the absence of movement performatively is a behaviour and thereby a response. Hence, they cannot value this response, since regarding their goal the response they choose does not make a difference: it is a fixed system with a pre-programmed response to every single cue they detect.

2.4.2 Response breadth systems

Along the developmental dimension of response breadth organisms emerge, which have not only one, but many potential behaviours in reaction to the same cue. Since a sensation here is not strictly connected to a single possible behavioural answer, a mechanism has to exist in these systems which allows to go with one behaviour rather than another. In other words: there must be a valuative process in which different behaviours are valued positively or negatively for that one behaviour can be executed rather than others – and one behaviour always is performatively executed.

One of the strengths of Sterelny's setup is that it has the power to explicate why certain systems developed. Why is it helpful to have response breadth, a variety of responses for the same cues? Sterelny assumes that response breadth evolves from an increasing flexibility in the use of information an agent picks up.[36] Starting from this assumption he develops a hypothesis of how such flexibility could evolve. The range of possible responses is dependent on the behavioural

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[33] Cf. Sterelny 2003, p. 14.

[34] It probably is not necessary, since the contraction might be triggered not only by physical stimulation, but potentially also by electrical stimulation for example.

[35] Cf. Esene, Ignatius 2012, chapter "Technique of medial hamstring reflex Examination".

[36] Cf. Sterelny 2003, p. 34.

flexibility needed in the specific environment of the organism. In environments in which a single cue is reliable to track a relevant feature, a simple cue-driven behaviour can succeed. In Sterelny's terminology in such a case an organism lives in regard to this feature in an *informationally transparent environment*.[37] Environments in which the relevant features map in complex ways onto the detectable cues are *informationally translucent environments*. Here it poses a problem for an organism to have only one possible response towards a cue, since this cue might map to several different relevant environmental features.[38] Therefore, the range of possible response to environments increases with the complexity of the environment, driving the development for tracking more cues and developing a wider range of possible responses to cues. Tracking more cues means that more features of the environment can influence behaviour. The difference in the transparency of the environment and the range of possible behavioural responses between detection systems, response breadth and robust tracking is only one of degree.[39]

One case for a translucent environment in which a variety of available responses to the same cue is needed, is an environment in which resources are strongly linked to predators. In his paper "I, Plant: Sterelny's 'Thought in a Hostile World' and Plant Cognition" (2016), Phila Msimang provides an illustrative example: A zebra is highly likely to find a crocodile at a watering hole. Water is a rare resource, and zebras need water to survive. Therefore, it would be maladaptive, if the zebra would only have one available behavioural response when it recognizes a crocodile. The zebra might have come a long way to the water and running away could mean its death by dehydration. In this situation it is not helpful to run in all cases it recognizes a crocodile. Leaving the water would mean certain death due to dehydration, which is in evolutionary terms a huge cost. Running towards the water, ignoring all dangers, however, is also no solution, since it also comes with the high cost of getting eaten. The zebra needs to weight risks against each other in dependency on its need for water based on limited information. This means that there is a selective pressure for a variety of more nuanced responses to crocodile-cues for the zebra.[40] It might be better to take the risk and drink, despite the danger, which again needs a nuanced range

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[37] Cf. Sterelny 2003, p. 20.

[38] Cf. Sterelny 2003, p. 21.

[39] Sterelny explicitly just says response breadth is a matter of degree, but since he describes the two developmental directions as dimensions, I am sure he would agree that both dimension are in a gradual relation to each other. Cf. Sterelny 2003, p. 34.

[40] Cf. Msimang 2016, p. 8.

of risk estimation necessary to adapt correctly to dangers.

What plays a crucial role for Sterelny are representations as part of the valuative mechanism that moderates between sensations and behaviour in complex environments. Here we enter the tricky domain of what intellectual descendants of Franz Brentano would call "the mental". Typically, cognitive acts like thinking, believing, feeling, perceiving, and also valuing are considered mental. These stand in opposition to physical states of the physical bodies of living organisms. With his naturalist approach and terminology Sterelny avoids a dualist cut between the physical and mental domain. This is an approach that he shares with the approaches of embodied and especially enacted cognition, on which I will come back later. In opposition to those accounts, however, Sterelny does keep representations in his conceptual repertoire, as he contrasts coupled with decoupled representations. While coupled representations are "internal cognitive states, which [...] function to track features of the environment"[41], decoupled representations additionally "are not tightly coupled functionally to specific types of response"[42]. I interpret this as sufficient reason to assume that for Sterelny coupled representations are coupled functionally to specific types of response.

As I have explicated, in response breadth systems there is a gap between a sensation and the appropriate response. Representations play a crucial role in bridging this gap, as in more complex representational states many environmental features can be clustered and represented as only one internal object. Furthermore, in the case of coupled representations this internal object is tightly coupled functionally to specific types of response.[43] Nevertheless, the coupling between the internal object and the appropriate behaviour can be learned and re-learned, what allows for behavioural flexibility.

At this developmental stage learning becomes possible. Organisms can build expectations, based on previous experiences, and adapt to new situations. These expectations do not need to be explicit representations but the information about what will happen can be stored implicitly. The conditioning of Aplysia, a genus of sea snails, is an illustrative example for implicit,

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[41] Sterelny 2003, p. 30 f.

[42] Sterelny 2003, p. 31.

[43] Cf. Sterelny 2003, p. 31.

non-representational information processing, by which the organism adapts to the expected circumstances. In this example I rely on the analysis of Romuald Nargeot and John Simmers (2011). As the neuroscientists explain, the Aplysia can learn about positive consequences of its goal-directed behaviour. In the process of operant conditioning the snail creates an association between a specific act and a rewarding, reinforcing, or punishing, aversive stimulus. As a result of positive reinforcement, the variability of internally driven behaviour is limited.[44] Here the snail builds a memory, by which the positive consequences of action are implicitly remembered and lead to a reinforcement of this behaviour. In the case of Aplysia this happens by changes in the active membrane properties and reciprocal connections of constituent neurons, influencing the connection between sensory and motor neurons.[45] This new neural connectivity is fit for the circumstances to which the system adapted. The bodily organisation of the system adapts, based on previous information of similar situations, and adapts to optimize for those situations. Hence, in this adaptation we find an expectation of how relevant future stimuli look like.

In other words: a system expects a certain situation and optimizes its bodily organisation for it. In the end of the valuative process this restructuring of the system is either rewarded or punished, since either the expected result (or something even better) sets in or the failing of the system leads in optimal cases to a re-learning and thereby again to adaptation, in worse cases of maladaptive systems, to an evolutionary disadvantage.

I explicated already how evolutionary pressures ensure the final goal of survival for all living organisms. But survival is not the only final goal that exists, as we have seen with the final goal of pleasure already. I want to use the example of pleasure to explicate how a new final goal emerges and the relation between instrumental and final goals.

There are many response breadth systems that do not experience pleasure. Still, the increasing availability of responses enables the emergence of it. Andrzej Elżanowski (2024) presents a plausible proposal for how the setting of final goals may have come into being.

There are all kinds of approximate mechanisms which try to maximise chances for survival. Especially indicators for bodily damage are helpful. At first there is a tight link between the

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[44] Cf. Nargeot and Simmers 2011, p. 803 f.
[45] Cf. Nargeot and Simmers 2011, p. 813.

biological goal of bodily protection as an instrumental goal for survival and experiential goals. The intensity of pain corresponds, for example, with the severeness of tissue damage in case of burns or cuts.[46] This tight link suggests that there is a connection between the experience and the appropriate behavioural response: the pain is an approximate indicator for what an appropriate response would be. Assuming that human pain experiences are not too different from those of creatures showing up on earlier steps of the evolutionary development, the link between pain and body damage seems to be this: in cases in which I am severely injured I have a more intense experiential response and also a huge motivation to care for my wound – especially compared to rather small injuries. At this stage, the avoidance of pain is an instrumental goal for survival.

Similarly to the way how negative experiences indicate danger, positive experiences indicate benefits for survival. The pleasure of something sweet might for example indicate that it is safe to eat. At this level we find that both, the avoidance of pain, and the going after pleasure are instrumental goals to the final goal of survival.

The special thing about positive phenomenal experience is, that the actual biological benefit and the positive experience also can come apart. At first the positive experience is a means that helps as an internal signal to navigate biological needs. An intense feeling of thirst is usually linked to a severe need of water. The phenomenal experience in this situation is a means to the end of survival, as it approximates the needs of the organism and presents them in a hierarchical order: the more pressing the experience, the bigger the need. Gradually the positive experience stops to be merely a means and can be aimed for its own sake. The organism from this moment can strive for two things that might be in conflict with each other: the positive experience and survival.[47] This conflict can be found in everyday situations: I want to eat olives because I like them, but I am also worried about choking on the olive stone. I at the same time want to and do not want to eat the olive. None of the goals can instrumentally be reduced to the other.

What we have seen now was the transition from a former instrumental goal to a final goal in itself. We can take from this that we end up with at least two final goals in highly developed response breadth systems. I do not exclude that there are further final goals already at this level, but the extension of final goals becomes especially relevant in the next developmental step of

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[46] Cf. Elżanowski 2024, p. 193.

[47] Elżanowski formulates it in the following way: "in some mammals and birds the subjectivation of biological values led to their ontification, i.e. the transformation from a means to an end". Elżanowski 2024, p. 195.

decoupled representation.

2.4.3 Decoupled representation systems

Based on Sterelny's description of some organisational states of organisms as decoupled representations, I will group those organisms that are capable for those states as *decoupled representation systems*. Sterelny introduces decoupled representations by explicating that they are "internal cognitive states, which (a) function to track features of the environment, and (b) are not tightly coupled functionally to specific types of response."[48] I take from this definition three core aspects: decoupled representations are i) internal cognitive states, which ii) are accurate tracing states, iii) are potentially relevant to many actions, and hence functionally specific to no single behaviour.

In Sterelny's setup decoupled representations give rise to a special kind of valuation, he calls preferences. For him there are two kinds of valuations: drives and preferences. Drives are automatic, behavioural responses, in which a cue is tightly coupled to a behaviour. In preferences goals are represented in a decoupled manner, what allows to form and modify them on a cognitive level. Without making it explicit, Sterelny links the development along the translucency of environments towards decoupled representations with the emergence of preferences. In preferences the goals for behaviour outcomes must be represented. With the representation of outcome value, valuation and re-valuation of behaviours becomes possible.[49]

Having available cognitive states that are not coupled to a specific response allows for different things: it has an influence on instrumental goals in two ways: i) it broadens the number of available instrumental goals. Decoupled representations allow for tools to be used across contexts. Objects or states are internally decoupled represented, which means they can be the goal of action even if they are not in the immediate sensory space. For a task in which one never has used a specific instrumental tool, now it might be useful and available for this task. ii) The valuating mechanism changes. By internal decoupled representation, these represented goals can be weight against each other. When there is no need to immediately act on a cue, the organism can mentally simulate and plan towards hypothetical future states.

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[48] Sterelny 2003, p. 30 f.

[49] Or in Sterelny's terms: "evaluation and re-evaluation of behaviours" (Sterelny 2003, p. 92).

Also, in regard of final goals decoupled representations change something: with the decoupling of representations these internal representations become available as goals. Some of these goals can be completely decoupled from the previously developed goals this system had. One might, for example, build the decoupled representation of the political ideal of justice. This person finds enormous injustice in the world and decides to go into a hunger strike for reaching their goal of justice. The goal of justice is not an instrumental goal, however. One indicator for this is that it stands in direct conflict with the final goals we mentioned before: survival and pleasure. A hunger strike puts one's survival at direct risk, and it does for sure not feel good. Therefore, justice is not an instrumental goal for one of the other final goals and hence must be its own final goal.

One needs to critically ask here: why do not more life forms eventually develop towards decoupled representations? Apparently, the human situation is relatively lonely, Sterelny does not even want to consider great apes as being fully capable of decoupled representations.[50] Maybe he would say that it also comes with high costs to develop decoupled representation. It requires larger nervous systems, which come with a higher energy demand and an increase in complexity means that a system potentially is more prone to errors and is vulnerable in its development. Furthermore, for many creatures their capacities are sufficient to survive in their niches, so there does not seem to be any need for decoupled adaptation.

2.5 Summary

I will summarize our findings so far. Goal-directedness is the crucial feature for valuation. The basic logical structure of goal-directedness is that some goal state has an influence on the initial state that an entity is in. This counts for both kinds of goals, instrumental and final goals. For instrumental goals I could make out three characteristics. An instrumentally goal-directed system has to be plastic since the goal must be reachable for it from different initial positions. It also has to be persistent, as it should be able to counterbalance perturbations. Furthermore, it must have a

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[50] He writes that his best guess is that "they have some partially decoupled capacities" (Sterelny 2003, p. 76).

mechanism of concerted action in which many variables have to work together in the correct way for achieving the goal. All these characteristics are a matter of degree. This means that there surely are pre-forms of instrumental goal-directedness and hence of valuation.

Instrumental goals are instrumental to final goals. One final goal that self-maintaining systems got filtered for is survival. Within the realm of the living we made out three stages. In detection systems the final goal of survival is dominant. The developmental dimension of response breadth opens a gap between sensation and behaviour, whereby the same cue can lead to different behaviours. This gap needs to be bridged by the help of valuation for selecting a behaviour. In this evolutionary stage decoupling processes begin, which enable the emergence of another final goal: pleasure. The endpoint of this development is the stage of decoupled representation systems, in which the decoupling process is put to an extreme. Over time, creatures can adapt their behavioural response, which means that they are able to learn. These learnings can in the next step be applied to different contexts, so behavioural responses get available across contexts. By decoupling representations from immediate behaviour these decoupled representations can form new final goals, as in the case of justice.

2.6 Integrating the logical and evolutionary analysis of valuation

Having analysed both the logical structure and the evolutionary development, we can begin to systematize. As we found out, goal-directedness is the basic logical structure for all valuating systems. Nevertheless, there are significant differences in the way in which valuation works at different evolutionary levels of cognitive complexity. Since the basic logical structure of valuation must stay the same, the question is in what way they differ.

First, I would like to recall the basic logical structure: S-O-G, a subject values an object in relation to some goal. This basic structure of valuation is similar to the evolutionary structure on the level of detection systems. In the case of detection systems, the object can be both a state of affairs that is detected (like the presence of light) or an actual energy resource (like food). In any case, what is valued is instrumental to the goal. The logical structure reflects our example of the bacterium (S) that values a sucrose molecule (O) regarding whether it is beneficial for its survival (G).

Things get a little more complicated in the second evolutionary stage that matters for us, in which there is some degree of response breadth. Now the Subject (S) not only values some state of affairs or a molecule, but there has to be a valuation of different available responses (R), so that one response is finally performatively chosen. Again, the positiveness or negativeness of the response becomes clear only in regard of the goal of the system. This dynamic is illustrated in Figure 2.4.

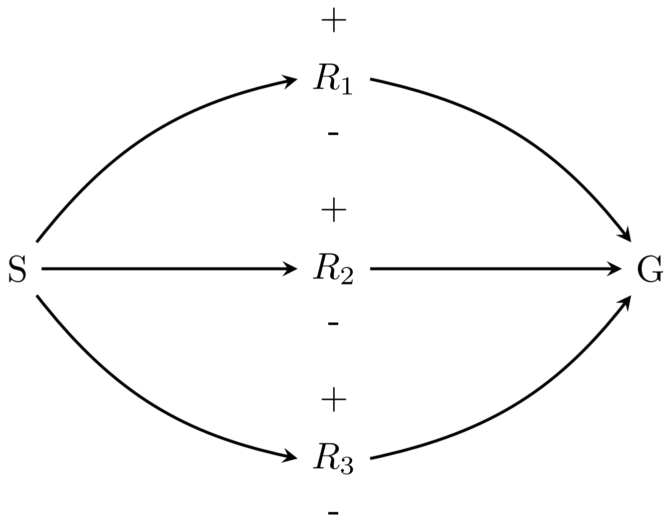

Figure 2.4: Valuation of behaviours towards a single goal in response breadth systems

Description: The logical, evolutionary structure of valuations in response breadth systems as a relation between a valuating subject (S), valuated responses (R) and the goal (G) in relation to which the responses are valuated positively or negatively. The responses are valuated towards the same goal in the same context.

The example we discussed for this case is the zebra (S), which has to choose between running away (R_1) or coming closer to the water hole (R_2), beside there being a crocodile present. The different responses are valued again in regard to the zebra's final goal of survival (G). The different responses (R_1), (R_2), are learned within the same context of approaching the watering hole, aiming at fulfilling the same final goal of survival. The individual responses themselves can be analysed along the lines of the basic structure of valuation, like in Figure 2.3: The subject (S) values a response (O) in regard of some goal (G).

Response breadth systems have more flexible repertoires and learning capacities than detection systems. Alternative responses can be explored via trial-and-error or conditioning. We start to see a closer alignment between instrumental and final goals, as instrumental goals can begin to decouple from their instrumental status.

The third stage of development is the continuation of the response breadth dynamic and allows for decoupled representations. Here it becomes not only possible for the subject (S) to navigate with the help of responses (R) between different goals (G), but decoupling representations from immediate responses frees the response from the context (C_1, C_2) in which the behaviour was learned. When completely decoupled, a behaviour can be applied to any other context in which it appears useful. Figure 2.5 portrays how different behaviours become decoupled from the context in which they were learned and can be applied to different goals. While earlier behaviours that were learned in the context of approaching one goal could only be applied towards this goal, here the same behaviour can be applied to different goals.

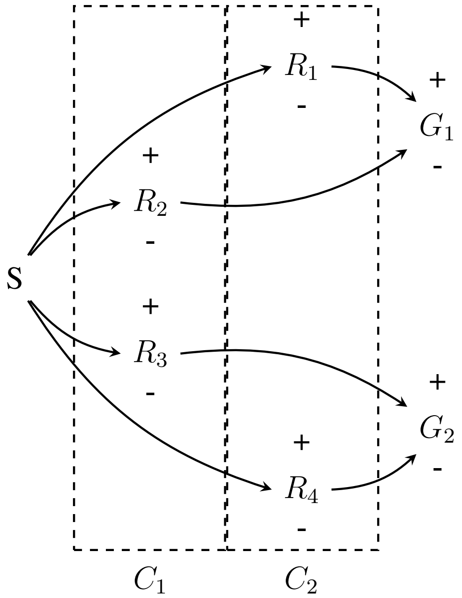

Figure 2.5: Valuation of behaviours towards multiple goals in decoupled representation systems

Description: The logical structure of valuations in systems with multiple goals. C_1 refers to context 1, in which R_2 and R_3 were learned, C_2 to context 2, in which R_1 and R_4 were learned. Other abbreviations as in figure 2.4.

In the example portrayed in figure 2.5 the behaviours are decoupled representations in the form of instrumental goals. However, decoupled representations can also become new, final goals. We know the struggles that come with the availability of multiple final goals from our daily life: we can strive at the same time for our own survival and overall biological fitness, while also aiming for pleasure, justice, the well-being of our pet etc. These goals can come and often do come into conflict. Since the goals are not just instrumental but final, even an optimization function will hardly ever fulfil all final goals we set ourselves.

The problem for this last analysis, however, is that in my foundational analysis of valuations I explicated that all valuation is goal-directed. When final goals can come into conflict, even the final goals are subjects of valuation. But what is the goal for which these final goals can be valued as positive or negative? We have seen that neither final goal can be reduced to the other, hence neither survival nor pleasure can serve as an ultimate goal against which every other goal could be measured. I propose as a solution, that the goals serve as goals for themselves in the valuative process. Whether the goal of survival (G1) shall serve be guiding one's behaviour can be determined when setting it in relation to the goal of pleasure (G2). One needs to ask oneself in this case, whether survival matters when it comes at the cost of pleasure and whether pleasure matters when it comes at the cost of survival. The valuative judgment would in each case be negative, since in regard to pleasure, survival does not matter and in regard to survival, pleasure does not matter. Hence, at the same time as one asks oneself whether survival matters in view of pleasure, one cannot completely disregard the goal of survival. This means that survival must be compared both to the goal of pleasure and the goal of survival. This complex relation at the level of final goals is illustrated in figure 2.6.

For further clarification, think back to the example of the motivational conflict between reasons for and against eating an olive: it does taste good but there is a danger of suffocating because of the olive stone. These two aims are connected to the two goals of pleasure and surviving. The decision for or against eating an olive must be solved by negotiating between these two goals. What goal is more important to me, however, can only be measured in comparison with the other goal. I therefore have to set the two goals in relation to one another. Once this negotiating

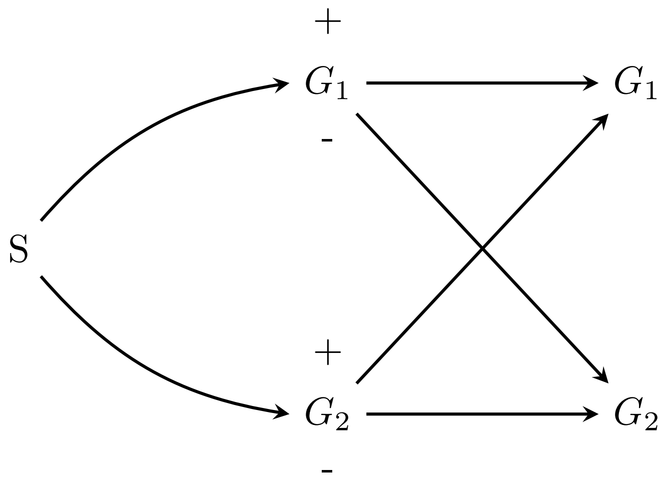

Figure 2.6: Valuation of goals towards goals

Description: The logical structure of valuations of final goals in relation to other final goals. Abbreviations as in figure 2.4.

process is finalised, the former evolutionary structures of valuation have to be used, since after knowing where one wants to go, one still needs to value a proper behaviour for getting there. Here again the basic logical structure of valuation is present. A Subject (S) values an object (O), which is in this case G1, in relation to a goal (G), in this case G2.

What I do not have an answer to, however, is the positive aspect of the value of final goals. In the case of survival, the system ends up with the goal by evolutionary pressure. Even the case of pleasure can be explained with its origin as an approximation for enhancing the wellbeing of an organism. In the case of self-set final goals, I see only a possibility for turning back to needs as an explanation for why which final goals are chosen. This is a project for future research.

Reflecting on the similarities and changes in the logical structure of valuation, some regularities come to view. The basic logical structure S-O-G describes the instrumental aspect of valuation. Here the most prominent aspect of change is the content of valuation that differs between different valuative systems. The logical position of the object is occupied by different entities, depending on the cognitive capacities of the organism. The valued object can be a concrete physical object or cue, a behavioural response, or a goal, dependent on whether we look at a detection system, a response breadth system, or a decoupled representation system.

Beside the content also the logical structure of valuation changes. The further along the dimension of response breadth a system developed, the more layers in the logical structure appear. Response breadth systems value objects in view of how useful they are in certain behaviours, in light of several different goals which must be valued all against each other. The same behaviour might even serve several goals at the same time, like when eating olives I nourish myself and experience pleasure at the same time. What I provided are the basic building blocks that help analysing such entangled valuation processes.

3 A second dimension of valuation

3.1 Goals in maladapted bacteria

I want to introduce a thought experiment that helps to identify the limits of the framework that I proposed till now. Suppose a bacterium emerges from other bacteria with a processing mechanism for sucrose. In the forming process of this bacterium something goes wrong, and the sensory mechanism is not functioning as it should. Instead of the sucrose molecule it now recognizes trehalose, a molecule broadly similar to sucrose, but, as I assume for the sake of the argument, the bacterium is not able to process trehalose. While the metabolism of the bacterium is only fit for sucrose, the sensory mechanism is only selective for trehalose.

The question is now: what in this scenario is for what reason valuable to the bacterium? With the framework I developed above, where I combined Heylighen's and Sterelny's account, the final goal of the bacterium appears to be still survival, since the bacterium is still a self-maintaining system. As long as one can still speak about the bacterium as a unity, it succeeds to keep up its autopoiesis. If this is true, sucrose is instrumental for survival, hence sucrose has a positive value to the bacterium. However, in the beginning of the thesis I started to investigate necessary and sufficient conditions for instrumental goal-directedness, which do not apply to sucrose. Sucrose is not pursued at all, hence neither plasticity nor persistence or concerted action apply to it. Trehalose on the other hand does fulfil all three conditions of valuation: plasticity applies since it does not matter where in the milieu the bacterium starts, it always moves towards the higher concentration of trehalose. In its behaviour it can also cope with obstacles and in the interaction with its environment many parts work together to enable going after trehalose. This means that if we were to follow only these conditions, a situation would come up contrary to the functionalist framework I developed, based on Heylighen and Sterelny: trehalose would be a goal, while sucrose is not. How to make sense of the tension between the functionalist framework based on Heylighen and Sterelny on the one hand, and the cybernetic framework of necessary and sufficient conditions of goals on the other?

For solving this puzzle, I would like to refer back to the logical analysis of valuation that I provided above. Recall the basic logical structure of valuation: S-O-G, a subject (S) values an object (O) in relation to some goal (G). This structure applied to the evolutionary stage of detection systems means that a subject values a feature or physical object in relation to the detection system's goal.

How to apply this structure to the case of the maladapted bacterium? There appear to be two conflicting valuative structures: In scenario one, the subject is the bacterium, the goal is the bacterium's survival and sucrose is the object that is of positive value in regard of that goal, since it would serve the metabolic need for energy and energy is necessary for the bacterium to survive. Trehalose, in this setup, would be considered as nothing more than noise, a sensory error. It does not enter the logical structure as a genuine object, because it does not contribute to the bacterium's goal. According to scenario two, the subject is still the bacterium, the object is trehalose but the goal cannot be survival. So, what goal does explain why trehalose is valued positively? One might argue that the value of sucrose, scenario one, is all value there is, and that the functionalist can address the case of trehalose, scenario two, as a simple malfunction where no further value can be found. But, as the cybernetics framework shows, there is additional value in the bacterium's engagement with trehalose. Trehalose is an attractor and thereby a goal. Due to the co-extensiveness of goals and value, this means, that the engagement with trehalose is a source of value.

With the material I gathered till here, I am not able to answer the question of where the value in the interaction with trehalose stems from, since in the functionalist perspective I would have no way for explaining trehalose as a goal. What I need is a further theory that explicates the point of view of the bacterium. After all, it is from this point of view that trehalose appears valuable. The theory I want to consider here is Autopoietic Enactivism.

3.2 Autopoietic Enactivism

Autopoietic Enactivism, which is a branch of Embodied Cognition, conceives of cognition as the biodynamics of living systems.[51] Proponents of this theory, like Evan Thompson (2005, 2017) or Ezequiel Di Paolo (2005, 2018), hold that bacteria (and other detection systems) have a specific point of view of the world from which they do not perceive their environment neutrally, but interpret their surrounding and apply values based on their interpretations. While for Enactivists the interpretations are the primary source of value, for Sterelny interpretations are only approximations with an instrumental value in regard to the bacterium's goal.[52]

I will first explicate what Autopoietic Enactivism is and why interpretation, or in their terminology *sense-making*, is so crucial for them. Starting with the name, I will investigate two core aspects: for Autopoietic Enactivists it is also *autopoiesis* that differentiates the realms of the living from non-living existence. This feature helps us to understand the second crucial aspect, the *Enactivist* aspect, which allows for an understanding of the individuated organism only in relation to its concrete and historical environment. With the help of those concepts I then can finally approach how Enactivists think about interpretation or sense-making and compare their account with the functionalist framework.

Autopoiesis, as I defined it in chapter 2.4, is the ability to actively maintain one's bodily organisation and identity in interaction with the environment. In Enactivism, its organisation is still the defining feature of the living, but the idea has developed, since the focus is not the organisational stability anymore, but the fragility in which living beings always are at risk of being extinguished.[53] This risk can be seen in a fundamental conflict in their relation to the world: between the need for organisms to open up towards the environment for gaining energy to maintain themselves, on the one hand, and the tendency to close their boundaries towards the environment to protect and individuate them from the background of their environment, on the other. This balance between openness and closure towards the environment is enabled by a dynamical process which characterizes the living, rather than a stable organisation. According to Thompson, the crucial aspect is the relation between the organism and its environment,

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[51] Cf. Varela, Thompson and Rosch 2017, Di Paolo 2005, as cited by Shapiro and Spaulding 2024.
[52] Cf. Sterelny 2003, p. 12.
[53] Cf. Di Paolo 2005, p. 86.

which constitutes the foundation for understanding the enactive aspect of their theory.[54] The organism can adapt to its environment or can manipulate the environment suitable to its needs. Di Paolo describes this relation as a structural coupling, which means a close interaction.[55] One example of these couplings are so called sensorimotor feature loops, which link the sensation and behaviour of an organism: The way an organism behaves is directly dependent on what it senses and what it senses is dependent on how it behaves.[56] The sensory information of sucrose molecules, for example, leads to a movement towards the molecules, leading to new sensory information, leading to a new movement and so on. This interaction results statistically in a behaviour towards the higher concentration of sucrose compared to the surrounding environment. Basis of this behavioural mechanism is the autopoiesis, enabled by the energy gained from the sucrose molecules.[57] In this way organisms do not passively recognize an existing world, but they constitute in their interaction their specific world, in which they react only to specific features and change the circumstances and the milieu around them by their behaviour and metabolism. In other words: they *enact* their world. This description is close to Sterelny's analysis of detection systems, as at this point it is also a functionalist, mechanistic description of the relation between subject and environment.

According to Di Paolo, this coupling process already bears a temporal aspect in it: the organismic individuation is "at odds with itself"[58], as Di Paolo expresses the conflict between openness and closure, hence the relation to the environment must be regulated. The temporal organisation of the tension between openness and closure enables the organism to open itself at times up towards (specific aspects of) the environment and close its boundaries at other times. This resolution gives rise to the crucial term that I am after: sense-making. In Di Paolo's words:

> "Sense-making is precisely the opening into the temporal/historical dimension in which viability is made possible by time-managing otherwise unsolvable contradictions."[59]

Sense-making is seen here is a function in regard to enabling the survival of the organism via

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[54] Cf. Thompson 2005, p. 417.
[55] Cf. Di Paolo 2018, p. 88.
[56] Cf. Thompson 2005, p. 418.
[57] Cf. Thompson 2005, p. 418.
[58] Di Paolo 2018, p. 90.
[59] Di Paolo 2018, p. 90.

time-management.

Thompson and Varela co-authored with the psychologist Eleanor Rosch "The Embodied Mind" (1993/2017), in which they explicate interpretations and sense-making from a similar angle. Their setup is that a pressure for engagement with the environment comes up at points at which relevant distinctions need to be made. The authors explicate that dependent on the properties of a system, what it encounters with changes it. If a system is able to adapt or at least react, this means that "over time this coupling selects or enacts from a world of randomness a domain of distinctions [...] that has relevance for the structure of the system. In other words, on the basis of its autonomy the system selects or enacts a domain of significance"[60]. Any change that effects the organisation of an organism in some relevant way in this reasoning is *significant* or *relevant*. These terms shall indicate that there is an interpretation of the environment, as the authors write: "We use these words significance and relevance advisedly, for they imply that there is some kind of interpretation involved in the encounters"[61]. Tying the circle of definitions back, the authors link interpretation back to distinctions: "[W]here interpretation is understood widely to mean the enactment of a domain of distinctions out of a background"[62].

In this interpretation it is again the environmental circumstance in relation to the conditions of the organism, its needs, coping mechanisms and resources, which define which aspects of the environment are relevant for it. The relevancy for the organism drives the differentiation between features of the environment. This is a process in which the organism interprets these features not as they are but in relation to its needs.

Only in the milieu that the bacterium is in interaction with, the molecule gains meaning, because this difference of whether there is or is no presence of this molecule is relevant and leads to a behaviour towards it. In the Enactive approach it is the individual in relation to its environment which explains the autonomy and thereby the value-creating, interpretative feature of living organisms. The environment-related action of the organism exposes the embodied knowledge of what is of value for this organism. This means that even in the case of positive phototaxis the sensation of light would *mean* something positive for a detection system since

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[60] Varela, Thompson and Rosch 2017, p. 155.
[61] Varela, Thompson and Rosch 2017, p. 155.
[62] Varela, Thompson and Rosch 2017, p. 156.

it reacts to it.[63] The meaning is determined by the functional use of a sensed feature. Also for Enactivists the phenomenal aspects of detection systems are independent of any cognitive neural processing and are fully embodied.

Summing up, for Autopoietic Enactivists detection systems differentiate relevant features in the environment dependent on their needs. This bringing forward of differentiations in the environment constitutes a perspective, a point of view, from which some aspects are more significant than other environmental features. Thereby, every information the bacterium receives is linked to the bacterium's needs and not neutral. This means that according to Enactivists the sucrose is not neutrally sensed but is directly interpreted *as* something positive, as a resource.

I want to directly qualify the Enactivist's point. One does not even need to look at the maladapted bacterium, but even for a bacterium in phototaxis the sensed stimulus is not interpreted as concretely as food or resource. I do agree with a softer reading, in which there is indeed something inherently positive in the relation the bacteria have to, in this case, light, or, in the case of positive chemotaxis, to sucrose.

The question is now, how Enactivists interpret the case of the maladapted bacterium. In the background of their theory there is a third-person aspect, since it is autopoiesis that gives rise to making distinctions in the first place. However, the focus of the theory is on the actual distinctions the organism makes. In the case of the maladapted bacterium the relevant differentiation is the one between whether there is trehalose or not. The maybe surprising enactivist answer to the question, what explains why trehalose is valued positively, is therefore: because it appears as meaningful in the world of the bacterium. The interaction with its environment creates the final goal of going after trehalose.

In the Enactivist framework value emerges not from the mechanism or processing of sensed features, but from the differentiations that the bacterium is able to make. This process of sense-making leads to the projection of a world by the individual, consisting of those features relevant to the organism.

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[63] In the case of aversive, negative phototaxis it would accordingly mean something negative.

3.3 Enacted value

In the following I will explicate how the accounts of Sterelny and Enactivists relate to each other. Autopoietic Enactivism shares an intellectual history with Sterelny's approach. Sterelny builds on Peter Godfrey-Smith's framework, who is influenced by the early cybernetics debates. These debates also influence Francisco Varela and Humberto Maturana, who develop the idea of autopoiesis, that I mentioned before, as the defining feature of the living. Autopoietic Enactivists do not share all premises of the Autopoiesis theme, but their ideas developed into what is known as Enactivism today.

In spite of this shared intellectual history and the shared interest in an evolutionarily inspired, naturalistic conception of cognition, there are major differences between Sterelny and Autopoietic Enactivism. One crucial difference concerns their method.[64] The Enactivist Di Paolo links the historical origin of his field to Maurice Merleau-Ponty's phenomenological claim that subject and world project each other.[65] This means that subject and world are not ready-made entities that interact, but they constitute each other: the subject is constituted in relation to the world, while the world only has meaning in relation to the phenomenological aspects, the lived experience of the subject. Here the qualitative texture of an organism for which things matter becomes central, what leads to a methodological focus on cognition as lived experience. This view does not neglect the functional domain completely, but emphasizes the lived experience of an organism. Here the inside perspective is crucial for understanding value, it is the way the bacterium experiences things as positive or negative. Sterelny, on the other hand, has a mechanistic approach, in which phenomenality is considered, but it is secondary and stays in the background.[66] His focus is the organisation of organisms and how these organise behavioural responses towards stimuli, in view of the organism's survival. Other final goals, like pleasure, may come in later, but this is the framework at the level of detection systems. Hence, in Sterelny's framework phenomenality is reduced to this functional role. This is a third-person perspective, since it is possible only

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[64] Another difference is the focus of their investigations. Autopoietic Enactivism concentrates on the earliest stages of living systems and groups, especially on the difference between the non-living and the living domain. In contrast, Sterelny concentrates, even in "Thought in a hostile world", on later evolutionary stages. He includes earlier evolutionary stages only if needed to better understand human cognition.

[65] Cf. Di Paolo 2018, p. 71; cf. Merleau-Ponty 1945/2012, p. 454.

[66] He discusses the function of phenomenal experience as only one of a variety of valuative mechanisms. Cf. Sterelny 2003, pp. 78–81.

from the external view of a scientist to determine value in terms of the contribution of an object in relation to life-functions. This is not accessible to the bacterium, surely not explicitly, but in the malfunctioning case not even implicitly. Trehalose in this setup is nothing but noise, a malfunction of the sensory system. In Sterelny's framework, valuation is what is functionally adaptive. While the functionalist view is explanatory in that it connects value to effects, a purely phenomenological view is descriptive: things are perceived as positive or negative, that is all there is to it. In terms of goal-directedness we might say that the maladaptive bacterium is in its structure not only directed towards survival, but also towards trehalose.

Here one might object that the apparent contradiction arises from conflating the individual and the species level. One needs to keep in mind that both approaches, including the functionalist framework, are centered around individual and not species-specific goals. The evolutionary process is considered for explaining why specific goals have evolved, but it is still a concern about the goals of the individual entity: the functionalist is concerned about the goal-directedness of a particular bacterium and its metabolic need. In the case of the maladapted bacterium it is a functional need for sucrose.

From the first-person perspective the malfunctioning of the bacterium cannot be explained properly because in the bacteriums enacted world sucrose does not play any role. Survival and sucrose are completely outside of this valuative dimension. Contrary, for the third-person view only sucrose is valuable, and trehalose is pure noise, since survival is seen as the only final goal of the organism. This suggests that both dimensions, the third- and first-person, provide together a more complete framework for what valuation is.

In combination the two distinctions between, on the one hand, instrumental and final goals, and on the other hand third- and first-person valuation map onto a two-by-two matrix (table 3.1).

The table summarizes how instrumental and final goals are portrayed differently from a first- and third-person perspective. There are gradual transitions between the instrumental and final goal level possible via decoupling processes. As mentioned earlier, Elżanowski (2024), for example, explicates the decoupling process of pleasure in correlation with survival, as a

Table 3.1: Cross-classification of goals by perspective and goal-type

	Third-person perspective (functional)	First-person perspective (enacted)
Instrumental Goals	• Sucrose molecule as metabolic goal for trehalose-sensitive bacterium • Survival in relation to final goal of pleasure • Physical objects, behaviour or goals in detection, response breadth or decoupled representation systems	• Sucrose molecule for sucrose-sensitive bacterium • Pleasure in relation to survival • Trehalose for trehalose-sensitive bacterium
Final goals	• Survival • Pleasure as evolutionary function	• Trehalose for maladapted bacterium • Pleasure as final goal, independent of survival • (Political, religious) Ideals

first-person instrumental goal towards pleasure as an independent, final goal. But there is also a link between the third- and first-person perspective. What may start as a third-person, functional goal only, like searching and eating only the reddest apples, can lead to a first-person, enacted goal.

4 Conclusion

My aim in this thesis was to investigate the origin, biological development and logical structure of valuation. I argued that valuation has a basic logical structure in the form of a subject valuing an object in relation to some goal (S-O-G). This basic, unchanging structure allowed us to track the specific changes in content and evolutionary structure of valuation of living beings along biological evolution.

The framework I presented here, in combining Heylighen's and Sterelny's accounts, is helpful for providing an analysis of the development for cognitive complexity regarding valuation. This analysis allowed to analyse the development for behavioural control in living beings along the three evolutionary steps of: i) detection systems, which valuate implicitly entities that matter in coming closer to their goals of survival and reproduction; ii) response breadth systems, which can additionally valuate behaviours; and iii) decoupled representation systems, which are capable of valuing goals. Within this framework, along the developmental dimension of response breadth, decoupling processes set in, which create new final goals. This creates a link between the two valuative dimensions of instrumental and final goals. I advocate that in future research the reasons for the value of final goals should be analysed further.

Yet, when tested against a simple thought experiment, the case of the malfunctioning bacterium, the functionalist perspective appears incomplete. Autopoietic Enactivism explicates a further aspect of valuation, in which organisms actively enact worlds of significance via sense-making. Within this first-person perspective even maladapted goal-directed behaviour is evidence of valuation. This new differentiation between functionalist, third-person valuation and enacted, first-person valuation helps, in combination with the final/instrumental goal distinction, to clarify what the basic aspects of valuation are. The S-O-G framework proved robust enough to hold the duality of functional valuation and sense-making. This results in a layered account, which describes valuation as both functional and enacted. Goals, motivated by needs, are the backbone of this framework of valuation. Within this setup, choices reshape and extend the dimension of final goals. Choice thereby is dependent on goals, but capable of transforming instrumental into final goals. Valuation is a product of evolutionary selection but is also an ongoing decoupling process that enlarges our response breadth.

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