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Ecological-Enactive Cognition as engaging with a field of relevant affordances: The Skilled Intentionality Framework (SIF)

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Introduction

The topic of this Oxford Handbook is '4E Cognition': cognition as embodied, embedded, enactive and extended. However, one important 'E' is missing: an E for *ecological*. In this chapter we will sketch an Ecological-Enactive approach to cognition that presents a framework for bringing together the embodied/enactive program (Chemero 2009; Thompson 2007) with the ecological program originally developed by James Gibson, in which affordances are central (e.g. Gibson 1979). We call this framework The Skilled Intentionality Framework.

The Skilled Intentionality Framework (SIF) is a philosophical approach to understanding the situated and affective embodied mind. It is a new conceptual framework for the field of 4E cognitive science that focuses on skilled action and builds upon an enriched notion of affordances, which we have recently argued for in *Ecological Psychology* (Rietveld and Kiverstein 2014). We define Skilled Intentionality as the selective engagement with multiple affordances simultaneously in a concrete situation (Rietveld, De Haan, and Denys 2013; Bruineberg and Rietveld 2014; Kiverstein and Rietveld 2015; Van Dijk and Rietveld 2017). The Skilled Intentionality Framework clarifies how complementary insights on affordance responsiveness from philosophy/phenomenology, ecological psychology, emotion psychology and neurodynamics hang together in an intertwined way. The long-term ambition of the SIF research program is to understand the entire spectrum of skilled human action[1], including social interaction, creativity, imagination, planning, and language-use in terms of Skilled Intentionality.

By 'affordances' we mean the possibilities for action provided to us by the environment (Gibson 1979; Chemero 2003; Chemero 2009; Michaels 2003; Reed 1996; Costall 1995; Heft 2001; Rietveld and

[1] The words "action" and "skill" should be understood in a very broad sense in this chapter. For example, just like Alva Noë (2012) we even see perception as something we do, and can do more or less skillfully.

Kiverstein 2014). Structuring and scaffolding our skilled activities, affordances are crucial for understanding the embodied mind. Grasping a glass, riding a bike or improving an architectural design, for instance, can all be seen as a skilled individual's immediate responsiveness to affordances. An individual can respond to affordances thanks to abilities. In the relational approach to affordances developed in this chapter, the possession of the relevant ability is seen as necessary for being able to act on an affordance. Someone who does not have the ability to read English cannot be responsive to the possibility this sentence offers of being read. Humans typically acquire their abilities thanks to a history of interactions in socio-cultural practices (Rietveld 2008a). For example, architects acquire their skills thanks to their being selected for education in specialized architecture academies, their traineeships in architecture firms and repeated interactions with builders, other architects, and clients for the projects they realize.

Both humans and animals respond to affordances in a context-sensitive way. To an earthworm, for instance, a leaf affords plugging its burrow and thus regulating the humidity of its immediate surroundings. Such a context-sensitive engagement with this affordance is important for the condition of its skin (Darwin 1881). In a similar way the environment offers all sorts of possibilities for humans, including possibilities for social interaction. For example, given a certain context, the sad face of a friend can invite a consoling gesture, a person waiting in a queue at a coffee machine can invite a conversation, and an extended hand can invite a handshake. Crucially, skilled responsiveness to affordances is not only encountered in everyday skilled activities, but also in activities that are traditionally characterized as 'higher' cognition. Skills are crucial for knowledgeable action. For example, through her interaction with a patient, a skilled psychiatrist could intuitively, without explicit reflection, diagnose the patient with depression, based on pale complexion, red eyes, rigid and slow movements, disturbed language, pace of thinking, way of dressing, smell and specific use of words. The prototypical example that we will use in this article to theorize the role of affordances in 'higher cognition' is the design process of architects, which involves *both unreflective and reflective* episodes (Rietveld 2008a; Rietveld and Kiverstein 2014; Rietveld and Brouwers 2016; Van Dijk and Rietveld 2017).

Unlike for example Dreyfus' work on skilled action (Dreyfus 2002b; Dreyfus 2002a; Dreyfus 2006) or Hutto and Myin's early work on basic minds (2012) in enaction, the richer notion of affordances we have developed includes possibilities for long-term planning, possibilities for reflection, possibilities for creative imagination, possibilities for social interaction, and possibilities for language use (Rietveld and Kiverstein 2014; Rietveld and Brouwers 2016; Van Dijk and Rietveld 2017). The Skilled Intentionality Framework (SIF) dissolves the dichotomy between 'lower cognition' and 'higher cognition' by interpreting affordances for the latter types of skilled activities as *just more affordances* available in our human ecological niche (left part of figure 1) and responsiveness to them as just a manifestation of Skilled Intentionality in context. Moreover, a key aspect of so-called 'higher' cognition regards the way in which persons are oriented towards the possible. The concept of Skilled Intentionality as multiple simultaneous states of *action readiness* for engagement with affordances entails orientation towards and preparation for possibilities for future action, which is a situated form of anticipation.

Skilled action is paradigmatic for embodied/enactive cognition (Rietveld 2008a/c) and is investigated by different scientific traditions. The notions of affordances and affordance responsiveness are

becoming central in various disciplines studying skilled action, including philosophy/phenomenology (Abramova and Slors 2015; Noë 2012; Kiverstein and Miller 2015; Van Dijk and Withagen 2016; Ramstead, Veissière and Kirmayer 2016), sports/ecological psychology (Hristovski, Davids, and Araújo 2009; Chow et al. 2011; Withagen, Araújo and De Poel 2017), affective science (Frijda, Ridderinkhof, and Rietveld 2014), and neuroscience (Friston et al. 2012; Schilbach et al. 2013; Dotov 2014; Dotov et al. 2010; Kirchhoff 2015; Jelic 2016; Pezzulo and Cisek 2016). For example, *affordance-related states of action readiness* are central to understanding both emotions (Frijda, Ridderinkhof, and Rietveld 2014; cf. Frijda 2005) and the neurodynamics of skilled action (Bruineberg and Rietveld 2014). We will see below that these varying perspectives on skilled action can be understood as describing the same phenomenon of Skilled Intentionality from different yet complementary points of view. Ultimately we will need all of them for a solid understanding of skilled action in context (for more on this integrative methodology based on complementarity of different scientific fields see Klaassen, Rietveld, and Topal 2010; Rietveld 2008a; Rietveld 2008c; Van Dijk and Rietveld 2017).

In short, the Skilled Intentionality Framework (SIF) aspires to do justice to the complex phenomenon of embodied cognition as skilled engagement with multiple affordances by integrating perspectives at different levels of analysis: ecological psychology, phenomenology, emotion psychology and neurosciences. The aim of this chapter is to summarize the distinctive Amsterdam SIF approach to skilled action in context, which can be characterized as *Ecological-Enactive* Cognition.

In a series of papers, we have shown that the tendency towards a grip on multiple affordances simultaneously is something that is found at each of these levels of analysis and thus provides a way of conceptually bridging them (Bruineberg and Rietveld 2014; Rietveld and Kiverstein 2014; Rietveld and Brouwers 2016; Bruineberg, Kiverstein and Rietveld 2016). It will be seen below how our concept of affordance-related states of action readiness in particular is able to facilitate crossings between these levels of skilled action in context.

SIF acknowledges that different fields of study like ecological psychology, phenomenology, affective science, and neurodynamics approach the same phenomenon over different timescales. For instance, what from a phenomenological perspective is described in philosophy as the experienced invitation of an affordance (i.e. a solicitation, Dreyfus and Kelly 2007; Rietveld 2008a), can be measured (and analyzed) as a state of "action readiness" in emotion psychology and (affective) neuroscience (Frijda 1986; Frijda 2007; Rietveld 2008b; Bruineberg and Rietveld 2014; Van Dijk and Rietveld 2017). In the coming three sections, we will show how the notion of Skilled Intentionality returns in particular ways at various levels of analysis and timescales of the integrated individual-environment system (figure 1). The first section describes Skilled Intentionality at the ecological level (*left part* of figure 1), i.e. the ecological niche that forms the context in which individuals are situated. We will discuss how our rich definition of affordances relates to different kinds of skilled activities, including social interaction, language use and reflection. This situates the skilled individual in the context of a rich *landscape of affordances* that is shared with the other individuals inhabiting the same ecological niche.

The second section describes Skilled Intentionality at the phenomenological level of analysis (depicted in the *middle* of figure 1). We discuss how a particular individual can be *selectively open* to this landscape, responding only to the *relevant* affordances in the particular situation. An individual can be solicited or drawn to act on relevant affordances and doing so will change her surroundings. This relevance of affordances relates to a disequilibrium within a self-organizing individual-environment system (the whole of figure 1). We will explain below - using Merleau-Ponty's phenomenology of life - that such a disequilibrium is inherent to all living beings (Merleau-Ponty 1968/2003.). This disequilibrium develops dynamically as a result of material changes in the context/situation (left dynamic, figure 1) and changes of states of the active individual (right dynamic, figure 1). Crucially, Skilled Intentionality means reducing disequilibrium by moving towards an optimal grip on multiple relevant affordances simultaneously, that is on a *field of relevant affordances*.[2] At the embodied neurodynamic level, which is discussed in section three (and depicted in the *right* of figure 1), Skilled Intentionality is understood as expressing a process of self-organization of multiple affordance-related states of action-readiness. Due to the fact that we analyze the same self-organizing system from these different perspectives in the different sections, some amount of reiteration is inevitable.

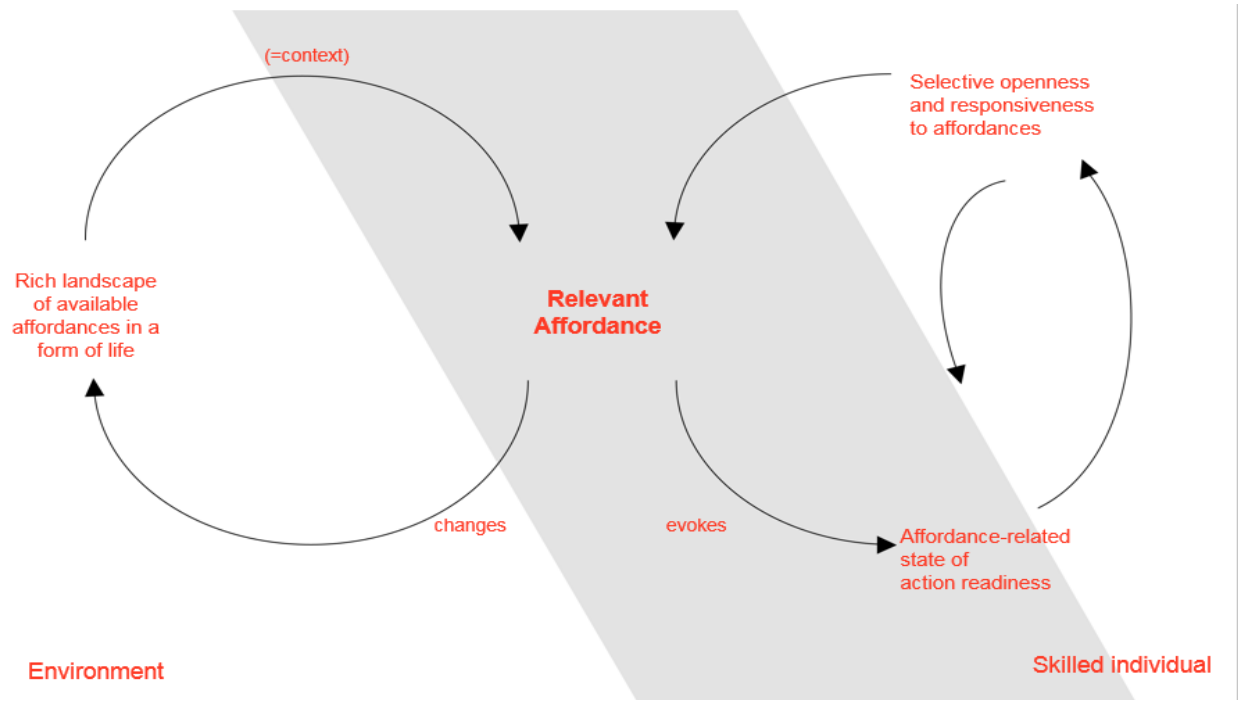

Figure 1: The Skilled Intentionality Framework is a philosophical framework for understanding skilled action in context that integrates perspectives of various disciplines: ecological psychology (landscape of affordances), phenomenology (selective openness to and relevance of affordances), emotion psychology (states of action readiness, along the lines of Frijda 2007) and embodied neurodynamics (self-organizing affordance-related states of action readiness). Adapted from (Bruineberg and Rietveld 2014).

[2] Our synonym for the field of relevant affordances is the field of solicitations. Thanks to Shaun Gallagher for urging us to make this explicit.

1. SIF's rich and resourceful landscape of affordances & 'higher' cognition

The SIF builds not just upon own work in different fields of embodied/enactive cognitive science (philosophy, emotion psychology, psychiatry, and radical embodied cognitive neuroscience) but also on decades of research on affordances in the tradition of ecological psychology (Gibson 1979; Heft 2001; Reed 1996; Chemero 2003; Withagen et al. 2012; Withagen et al. 2017). Starting from this latter tradition we have argued that the first question to ask about an affordance is what the ecological niche is in which it is embedded or "nested" (Rietveld and Kiverstein 2014). This allows us to stay close to Gibson's idea of the primacy of the ecological niche for understanding the kind of animal one is interested in. In recent philosophical work we (Rietveld and Kiverstein 2014) have refined Chemero's (2003) definition of affordances, using Wittgenstein (1953), to show that affordances always have to be understood in the context of an ecological niche that implies the form of life of a certain kind of animal. Therefore, we define an affordance as a relation between (a) an aspect of the (sociomaterial) environment and (b) an ability *available in a 'form of life'* (Wittgenstein 1953).

A form of life is a kind of animal with a certain way of life and ecological niche. A form of life refers to a certain kind of practice: coordinated patterns of behavior of multiple individuals. The main reason we prefer the use of the Wittgensteinian notion of a form of life is because, at least in certain contexts, it is important to acknowledge the fact that within the human form of life there are many different socio-cultural practices (e.g. communities of English language speakers, builders, academics and architects, etc.). The notion 'form of life' can refer both to a socio-cultural practice and to a species (e.g. lions, earthworms, humans). The form of life of a certain kind of animal or a socio-cultural practice is manifested in relatively stable patterns of behavior, generated by the coordinated activities of many individuals over time.[3] As such a form of life is independent of any particular individual. A novice typically acquires his or her skill within an already existing form of life. Just like Wittgensteinian norms (Wittgenstein 1953; Rietveld 2008a), affordances continue to exist when an individual dies, because they are not related to a particular individual but to an entire practice; to a form of life (Rietveld and Kiverstein 2014; Van Dijk and Rietveld 2017). Affordances are just as deeply social as e.g. the norms of spelling are, because they are by definition related to (abilities available in) a practice in SIF.

The variety (cf. Roepstorff, Niewöhner, and Beck 2010; Roepstorff 2008) that is manifested in both relata of the definition, i.e. in both the sociomaterial environment and in available abilities in a form of life, allows us to see the human ecological niche as a rich and resourceful *landscape of affordances* (Rietveld and Kiverstein 2014). The variety in the environmental structure, which is one relatum of our definition, was outlined by Gibson (1979) already: different surfaces afford locomotion and support; substances afford nutrition and manufacture; objects afford many kinds of manipulation; animals afford each other all sorts

[3] Here we have to be very concise so we refer readers interested in the work that the notion of a form of life does to another paper in which we explained this relation between the form of life and affordances as Gibson conceived of them (Rietveld and Kiverstein 2014; see also the discussion of Wittgensteinian "blind rule-following" in Rietveld 2008a).

of interactions (sexual, playful, fighting, cooperating, communicating, predatory, nurturing, etc., see Gibson 1979).

Following an important development in the social sciences, we have suggested that in the human case the material environment is best understood as a *sociomaterial* environment (Mol 2002; Orlikowski 2007; Suchman 2007) because of "the intertwinement of the material and the social in practice" (Rietveld and Brouwers 2016; Rietveld and Kiverstein 2014; Van Dijk and Rietveld 2017). With the second relatum (of abilities available in a form of life) in our definition of affordances we go beyond Chemero's (2003, 2009) original and influential relational definition and are able to clarify how an affordance-based account of skilled action can do justice to the "whole spectrum of social significance" in the human form of life (Gibson 1979, pp.127-8). The human form of life encapsulates many different socio-cultural practices, which in turn entail and include many different abilities (and tools) (Wittgenstein 1953; Varela 1999). This move, which we have argued for elsewhere (Rietveld and Kiverstein 2014; Kiverstein and Rietveld 2015; Rietveld and Brouwers 2016; Van Dijk and Rietveld 2017), broadens the notion of affordances and, crucially, opens it up to include affordances for activities that people would traditionally classify as forms of 'higher' cognition. For example, the ability to make correct epistemic judgments is part of the human form of life. So a particular sociomaterial aspect of the environment, say the letters typed here, can afford - in the context of our form of life - not just reading, copying or photographing them but also making a correct explicit color judgment.

1.a. The fundamentally social character of the SIF's landscape of affordances

According to our Wittgensteinian definition of affordances, affordances are relative to the abilities available in a form of life (Rietveld and Kiverstein 2014). Because abilities thrive in particular social situations embedded in a socio-cultural practice, it follows from our definition that the human landscape of affordances is thoroughly social.[4] Novices also acquire their abilities in these situations in practice (Rietveld 2008a). Examples of forms of life within the overarching human form of life are builders, English language users, concert-pianists and academics. A human individual typically belongs to multiple partially overlapping forms of life. The notion of a form of life is central in the Wittgensteinan account of *situated normativity* that we have developed to do justice to the normative aspect of embodied/enactive cognition (Rietveld 2008a). Socio-cultural practices (i.e. forms of life) provide a frame for understanding the normative aspect of embodied/enactive cognition in a way that individual action or dyadic moments of social interactions fail to do (Rietveld 2008a). In other words, the forms of life provide the right level of analysis for understanding Wittgensteinian normativity and, as we saw above, affordances.

Situated normativity is crucial for understanding skilled 'higher' cognition (for example of an architect correcting the design of a door) both in its linguistic and non-linguistic forms (Klaassen, Rietveld,

[4] This has important consequences for the field of social cognitive neuroscience (Schilbach et al. 2013) and thinking about the socially extended mind (Krueger 2013) that we do not have space to go into here.

and Topal 2010; Kiverstein and Rietveld 2015; Rietveld and Kiverstein 2014).[5] This normative aspect of such skillful action is about distinguishing between correct and incorrect or better and worse in the context of a particular situation in a form of life. By placing Wittgenstein's notion of a form of life at the heart of SIF's definition of affordances, we give Skilled Intentionality the normativity that is necessary for dealing with the whole spectrum of human social significance. Given the abilities available in our socio-cultural practice, it is for example possible to state correctly that, independently of a particular individual's actual perception of it, but not independently of the form of life (i.e. our practice), the color of the letters on my computer screen is black. Or, to give an example that involves another socio-cultural practice, it is possible to judge correctly that the word "black" in this context affords being translated into Dutch by using the word "zwart".

Recent work in embodied and enactive cognition has been right to emphasize the importance of social interactions and that social cognition fundamentally encompasses the bodily and affective aspects of these social interactions (e.g. Schilbach et al. 2013). Although social interactions are extremely important for understanding both our everyday life and possible disorders of it, it is key to take into account that they take place within a broader context. Crucially, it is not just the *moment* of interaction that is social, but, rather, our *whole landscape* of available affordances reflects the abilities that originate in our socio-cultural practices (Rietveld, De Haan, and Denys 2013). This foundational character of the social follows from our definition of affordances as relations between aspects of the (sociomaterial) environment and abilities available in *a form of life; in a practice.*

1.b. On 'higher' cognition: The landscape of affordances includes affordances for 'higher' cognition

As has been noted rightly by Alva Noë (2012) in his criticism of Hubert Dreyfus' work, we should avoid "over-intellectualizing the intellect". In recent ethnographic work we (Rietveld and Brouwers 2016) have shown how in architectural design, which is a typical form of 'higher' cognition, architects tend towards a grip on affordances in their situation. The following fragment from that paper shows how this tendency dissolves the distinction between 'lower' and 'higher' cognition by making engagement with affordances central to the way architects do, for example, problem solving and long-term planning:

> "Continuously adjusting their creations [in the design process] the architects seek insight into how they can advance the architectural art installation. They particularly do so through switching between different ways of visualizing the design, thus keeping the design 'moving', as they, repeatedly discontent with a new result, over and over again evaluate the different ways in which the design could be made. […] After spending several days optimizing the sculpture's rear wheel, AM and RR still experience discontent with its design and continue their search. They study the sketched design-

[5] Separating the linguistic from the non-linguistic might actually turn out to be artificial given the above-mentioned intertwinement of the social and the material in human practices, i.e. the sociomaterial nature of our environment.

possibilities for some moments before RR decides that he has to see the design in 3D: "I cannot see it well in this way, I want to see it in 3D." […] They immediately switch from the design as visualized on paper to the design as visualized in 3D in the CAD computer program. […] The process resembles a kind of situation-specific improvisation in which they "join forces" (Ingold 2013) with the available affordances. They experiment by actively manipulating aspects of the design, thus finding out what the design affords (cf. Charbonneau, 2013, p. 592) and which of these possibilities they *experience* as improvements of the overall design. In this manner they explore various adjustments. In the episode we highlight here RR is also unhappy with the 3D visualization as drawn in the CAD program. He concludes that it doesn't look good and that, in order to get insight into how this detail should be designed, they again need to visualize it differently - this time as a cardboard model. In such practices of switching between various visualizing forms the design evolves and takes shape. The architects move towards an optimal grip on their design." (Rietveld and Brouwers 2016, pp. 12-13).

Affordances in that real-life case include for example possibilities for making a sketch, making a 3D-visualization, making an architectural model in cardboard, possibilities for reflection[6], and elsewhere in that paper even possibilities for communicating with a physically distant collaborator (Rietveld and Brouwers 2016). This kind of ethnographic work situated in real life practices fits in well with our Gibsonian and Wittgensteinian approach. It is also important because, as explained in the introduction, it is often assumed that the increasingly influential paradigm of embodied/enactive cognitive science (Chemero 2009; Thompson 2007; Varela, Thompson, and Rosch 1991) has sensible things to say about so-called 'lower' cognition, such as grasping a glass or riding a bike, but not about 'higher' cognition, such as using creative imagination, comforting a sad friend or seeking the right word in writing a sentence. (We have made a first attempt to show how our approach can deal with these latter two linguistic cases in Klaassen, Rietveld and Topal 2010). Similarly, it is assumed that embodied/enactive cognition can deal only with the immediately present environment but not with the absent or the abstract, such as a plan for a new building or the concerns of an absent (or better: spatially distant) collaborator (Rietveld and Brouwers 2016; Clark and Toribio 1994; Clark 1999; Noë 2012; Degenaar and Myin 2014; Di Paolo, De Jaegher, and Rohde 2010; Van Dijk and Withagen 2016). In our Skilled Intentionality Framework these problematic divides between 'higher' and 'lower' cognition dissolve, because we are able to understand human 'higher' cognition along the same lines as skilled 'lower' cognition: both are seen as forms of *skilled engagement with affordances offered by the sociomaterial environment in the context of the human ecological niche*.

Our improved definition of affordances made this move possible. It follows from our definition of affordances that a given aspect of the sociomaterial environment can offer a broad range of affordances, dependent on the abilities available in the form of life. These abilities include linguistic abilities, such as for example the ability to point out things about the world with words, to orient someone attention to an aspect

[6] Reflecting is just one of the abilities available in our human form of life, See Section 4 of Rietveld (2013) for a short discussion of different kinds of possibilities for reflection.

of the environment, and to use words for naming things (in the context of a form of life). The ability to state things is very important because you can do all sort of things with it in all sorts of practices. However, the abilities in our form of life are obviously far more diverse than just linguistic abilities. The following example of a towel in a bathroom (cf. Wittgenstein 1969, OC 510-511) makes this centrality of the whole spectrum of abilities clear, by showing how in the context of our form of life this aspect of the sociomaterial environment (i.e. the towel) offers multiple possibilities for action, such as:

a) hanging it on a hook;
b) getting perceptual access to aspects of the towel;
c) grasping and taking hold of the towel;
d) stating correctly "that is a towel";
e) drying my hands;
f) judging correctly "that the towel is grey";
g) reflecting on sustainability of the material of which it is made, and many more.

So, in the context of our human form of life, just this one aspect of the sociomaterial environment offers many affordances. All affordances together contribute to the richness of *the landscape of affordances* of the human form of life in which individuals are situated (see the left part of figure 1). However with this towel example it is crucial to keep in mind that people typically act in the context of a sociomaterial practice. While engaged in a sociomaterial practice it is the landscape of affordances that forms the context of an agent's actions.

In our framework it is abilities acquired in such a form of life that allow individuals to engage with affordances adequately, and, crucially, this includes affordances for what others have called 'higher' cognition. The possession of a skill allows an individual to coordinate actions with the sociomaterial practice in which the skill was acquired; to join forces with its affordances. Engaging with different affordances will require different abilities.

From the perspective of SIF, the possibility to perceive something is also afforded by an aspect of the sociomaterial environment. Gaining perceptual access to the world is a skilled activity (Noë 2012). Perceiving something[7] is just one of the many things we can do skillfully. Where Noë has argued that we use skills to get access to the world, our ethnographic observations suggest that skilled individuals tend towards an optimal grip on the landscape of affordances available in a form of life (Rietveld and Brouwers 2016). From a (complementary) phenomenological perspective this is best characterized as tending towards a grip on a field of sollicitations. Note that such an understanding radically undermines any separation

[7] Also for Gibson things afford multiple activities including perceiving what they really are after one has acquired the right skills: "If the affordances of a thing are perceived correctly, we say that it looks like what it *is*. But we must, of course, *learn* to see what things really are — for example, that the innocent-looking leaf is really a nettle or that the helpful-sounding politician is really a demagogue. And this can be very difficult." (Gibson 1979, p.142; see Rietveld and Kiverstein 2014).

between perception and action and makes responsiveness to affordances a more basic notion than perception. The phenomenon that we characterize as "responsiveness to an affordance for perceptual access to an aspect of the environment" offers an affordance-based way of talking about perception. This is useful for certain purposes because in many situations states of action readiness related to affordances for perceptual access compete at a bodily level with states of action readiness related to affordances for doing other things. In our framework perception is really just one of the many things people do, like in the towel example above where the possibility of drying one's hands is on equal footing with the possibility of getting perceptual access to aspects of the towel.

Moreover, SIF shifts the focus away from sensorimotor skills (which dominate embodied/enactive cognitive science at the moment) to *all skills* available in the human form of life. Once we possess the necessary skills, we can take hold of affordances for 'higher' cognition, such as reflecting, judging or naming something, in a similar way as we take hold of affordances for very mundane activities, such as drying our hands:

> If I say 'Of course I know that that's a towel' I am making an utterance. […] For me it is an immediate utterance. […] It is just like directly *taking hold* of something, as I take hold of my towel without having doubts. And yet this direct taking-hold corresponds to a sureness, not to a knowing. But don't I take hold of a thing's name like that, too? (Wittgenstein, OC 510-511, our italics).

Unlike the work of Dreyfus (2002b) and Hutto and Myin (2012, see Kiverstein and Rietveld 2015), the reach of Skilled Intentionality is not limited to non-linguistic activities. A skilled speaker of language can just as easily engage with the affordance for stating correctly "that is a towel" as with the affordance for drying her hands offered by the towel. SIF broadens the scope of human abilities beyond (non-linguistic) sensorimotor skills.

Skilled Intentionality is skilled responsiveness to the *rich* landscape of affordances. This landscape in which we situate the embodied mind includes for example possibilities for social interaction in practice (affordances related to the abilities of architects, conductors of orchestras, and psychiatrists for instance), possibilities for language use, as well as affordances for making correct explicit epistemic judgments (Rietveld and Kiverstein 2014). An important part of the SIF research program for the coming years is observing, describing, analyzing and understanding these different affordances for forms of 'higher' cognition in the context of different real-life socio-cultural practices.

2. A situated individual's selective openness and responsiveness to relevant affordances

The immense variety of affordances available in the landscape of affordances of a form of life raises the question how, in a given situation, an individual can be selectively open to this landscape. How and why is an individual selectively responsive to only the *relevant* affordances out of all these available possibilities for action? And how do affordances solicit a particular course of action in a given situation? We distinguish *affordances* from *solicitations* (Rietveld and Kiverstein 2014; Rietveld 2008a). *Solicitations* (Dreyfus and Kelly 2007) are the affordances that show up as relevant to a situated individual, and generate bodily states of action readiness. As argued above, affordances should be understood as flowing from the form of life as a whole rather than being merely an individual matter. The right level of analysis for affordances is the form of life, and for solicitations it is an individual in a concrete situation.

Our focus in this section will be on how relevance arises for the situated individual. We will first show how for living beings relevance originates from the tendency towards a relative equilibrium in the individual-environment system. Being an inviting or relevant possibility for action, a solicitation is the pre-reflective experiential equivalent of a bodily action readiness moving towards this optimum. With this operationalization, SIF calls attention to the close relation between skilled action and consciousness or lived experience (the invitational character of affordances). Next to 'solicitation', this section will introduce two other phenomenological notions, which help the reader to see why we understand Skilled Intentionality as coordination with multiple affordances simultaneously. While the landscape of affordances comprises the affordances available to a form of life, the *field of relevant affordances* reflects the multiplicity of inviting possibilities for action for an individual in a concrete situation. So the field of *relevant* affordances is a field of solicitations. From a phenomenological perspective, the situated individual's integrated responsiveness to multiple solicitations simultaneously can be characterized as a *tendency towards optimal grip* on a field of relevant affordances.

We will start by explaining the phenomenon of being drawn by one relevant affordance and then go on to discuss engagement with multiple relevant affordances.

2.a Relevance and the tendency towards an optimal grip

Within the Skilled Intentionality Framework we are careful not to presuppose goals, tasks or aims of some mysterious origin as the source of relevance, but instead see the emergence of the soliciting character of affordances as the result of a process of self-organization. Merleau-Ponty's (Merleau-Ponty 1968/2003) philosophy of life helps us to see that the environment always already solicits something to the active individual. Merleau-Ponty observes that, as complex biological systems, living organisms are always simultaneously "in a state of relative equilibrium and in a state of disequilibrium" (p.149). Crucially, this

inherent disequilibrium "inspires or motivates self-organized compensatory activity" (Merleau-Ponty 1968/2003, p.149; Rietveld 2008c, chapter 7). This happens for example, when the organism repairs its tissue damage, or restores its glucose level by eating (Rietveld 2008c; Kiverstein and Rietveld 2015). This inherent disequilibrium of the living animal (to the right in figure 1) is the source of a lack that can never be compensated for and will always give rise to selective openness to the landscape of affordances and responsiveness to relevant affordances (middle of figure 1) (Rietveld 2008a; Bruineberg and Rietveld 2014). Due to this lack, the material environment is always encountered as a world of value or significance, of affordances having affective allure. To use the words of enactive philosopher of emotions Giovanna Colombetti (2014): living beings have a "fundamental lack of indifference". Due to this source of primordial affectivity, all living beings are affective beings and there will always be a field of significant affordances soliciting the human being.

So, due to this inherent disequilibrium, this inevitable lack, humans and other living beings are concern-ful systems of possible actions and actually never manage to realize an optimal grip on their situation. They can only *tend towards* an optimal grip in the dynamic coupling of world and active body. (The need for the tendency towards an optimal grip will become clear below.) Our grip on the situation can only be a local optimum because our existence as a whole has "a problem", an absence, which is "not a lack of this or that" (Merleau-Ponty 1968/2003, pp.155-156).

Solicitations are fundamentally related to the individual's need to re-establish this relative equilibrium.[8] We might say that a skilled individual can be "moved to improve" its situation by being responsive to solicitations (Rietveld 2008a). The inviting or soliciting character of affordances can be characterized phenomenologically by the idea that an individual is being "drawn" (Dreyfus and Kelly 2007) to affordances that she cares about and is able to act on.[9] Such a description emphasizes the invitational or soliciting character of the environment. Merleau-Ponty describes this in the following example of the tendency towards an optimal grip:

> For each object, as for each picture in an art gallery, there is an optimal distance from which it *requires* to be seen […]. (Merleau-Ponty 1945/2002, p.352, our italics).

Standing too close to a painting might make us for example lose grip on the overall composition, in so far as it impedes the "appearance" of the object. On the other hand, standing too far away may make the colors

[8] "The stability of the organism is a stability endlessly reconquered and compromised." (Merleau-Ponty 1968/2003, p.150).

[9] For an affordance to stand out as relevant, the individual also has to possess the necessary ability or skill (see section 1). So not only what one cares about but also what one *can do* in the context of a practice is reflected by a solicitation (Rietveld 2008b; Merleau-Ponty 1945/2002). With the exception of some very basic innate abilities, these skills are acquired in socio-cultural practice in our human case. What one is able to do develops also dynamically during the course of a day: when one is very tired one may not be able to pick up an available affordance.

blend in such a way that we cannot grasp the texture of the brush-strokes[10]. Note the deliberate use of the word 'grip', which brings a sense of actively maintaining oneself in relation to one's situation. In other words, there seems to be an optimum or equilibrium in the individual-environment relation that structures the individual's experience of (not) having grip. Accordingly, an individual's lived experience and the dynamically developing state of (dis)equilibrium of the living being can be seen as two sides of the same coin.

This notion of optimum can easily be misunderstood. We (Bruineberg and Rietveld 2014) have recently explained the tendency towards an optimal grip using empirical work from ecological dynamical systems theory, which will be described in section 3. One of these studies on boxing (Hristovski, Davids, and Araújo 2009) showed that in boxing there actually is an optimal distance from the heavy bag that is used in training. This optimum is a kind of relative equilibrium in the individual-environment relationship that allows the boxer to be ready to respond to multiple affordances simultaneously and rapidly switch from making one kind of punch (say a jab) to making another (a hook or an uppercut).[11] Our technical term for such a optimal position in which rapid switching is possible is the "metastable zone".

Metastability is a property of coupled dynamical systems in which over time the tendency to integrate and segregate coexist (Kelso 2012). Empirical work suggests that expert athletes make use of these metastable regimes to achieve functional performance outcomes (Seifert et al. 2014). Using these zones makes sense because there he or she is able best to join forces with the multiplicity of affordances (possible punches) that the situation affords. Crucially, we expect that the tendency towards an optimal grip can be formalized in terms of the tendency towards an "optimal metastable zone" (Bruineberg and Rietveld 2014) (see section 3). As will have become clear above, this optimal metastable zone can only be a relative equilibrium.

Above we also mentioned the link between affectivity and the inherent disequilibrium of living beings. The tendency towards optimal grip characterizes the internal relation between affectivity and adequate performance in a way that is well described in Dreyfus' work on skilled action:

> According to Merleau-Ponty, […] absorbed, skillful coping […] is experienced as a steady flow of skillful activity in response to one's sense of the situation. Part of that experience is a sense that when one's situation deviates from some *optimal* body-environment relationship, one's activity takes one closer to that optimum and thereby relieves the 'tension' of the deviation. One does not need to know, nor can one normally express, what that optimum is. (Dreyfus 2002b, p.378).

[10] Note that both relevant affordances and grip vary with respect to the skills of the individual (an art-historian will look in a different way than a child) as well as with the current concerns of the individual.

[11] Switching has been understood by Wheeler (2008) as intra-context sensitivity to relevance, which he explained dynamically. He distinguishes it from outer-context sensitivity to relevance. In earlier work we have criticized this distinction by Wheeler and shown that in reality relevance sensitivity is actually related to the field of relevant affordances as a whole (Rietveld 2012).

Disequilibrium, sub-optimality or a lack of adequate grip can be experienced as an affective tension that needs to be reduced (cf. Rietveld 2008a/c). In an informative example, Wittgenstein (1978) describes this integrated engaged responsiveness and lived affective experience. A door is appreciated as too low in its current context by an expert architect. The dissatisfied architect immediately and skillfully joins forces with one of the affordances offered by this aspect of the material environment: with the solicitation to increase the height of the door. In his working on improving the door, the architect expresses a basic form of normativity, in the sense that he distinguishes better from worse or correct from incorrect in the context of the particular situation. As mentioned above, we have called this normative aspect of being moved to improve in skilled action "situated normativity" (Rietveld 2008a). The architect's discontent - directed at the door in its context - and, related to that disequilibrium the solicitation of the relevant affordance, shows how lived affective experience and context-sensitive performance are two sides of the same coin in Skilled Intentionality. Even without explicitly verbalizing a judgement or articulating any feelings, the architect's (facial/bodily) expression can show how he appreciates the situation. And, inversely, his action aimed at changing the design of the door is an expression of his discontent. Therefore affectivity is a central aspect of selective responsiveness to relevant affordances.[12] The notion of action readiness from emotion psychology can shed further light on this, as we will see in the next section.

2b. Bodily action readiness links emotion and ecological psychology with phenomenology

A core concept from the field of emotion psychology (Frijda 1986, 2007) is central in SIF: action readiness. The phenomenological observation that relevant affordances evoke or solicit bodily action readiness enables us to show how the perspectives of ecological psychology (Gibson 1979; Chemero 2009; Reed 1996; Heft 2001) and emotion psychology (Frijda 1986, 2007) converge: relevant affordances are bodily potentiating. The notion of action readiness was introduced by emotion psychologist Nico Frijda and identified as typical for a spectrum of emotions (Frijda 1986, 2007). States of action readiness characterize affective states in ways that reflect the strivings of organisms to modify its relation to the environment.

Action readiness is a bodily phenomenon in between overt action and ability, a form of action preparation. States of action readiness can be observed, measured and analyzed. Emotions, and states of action readiness, in particular, reflect a tendency of the individual to modify the relation between herself and the environment in a way that is in line with what matters to her. Relevant affordances move us, affect and solicit us as they get us ready to act. Often they move us to improve our situation, as we have seen above. Affective tension and action readiness are two sides of the same coin. Affective tension is not necessarily felt phenomenologically.

[12] Note it is possible that it turns out, for example, that an important governmental regulation blocks the architect's plan. In that case the architect will typically experience discontent again and see other action possibilities that would allow him to deal with the situation.

For action control it is important that multiple states of action readiness can *self-organize* into a macro level pattern of preparation for action (Bruineberg and Rietveld 2014; Lewis and Todd 2005). It is this characteristic of states of action readiness that allows SIF to avoid presupposing goals of mysterious origin and make self-organization central instead. Frijda and colleagues write in this regard that "[m]ultiple states of action readiness may interact in generating action, by reinforcing or attenuating each other, thereby yielding […] control." (Frijda, Ridderinkhof, and Rietveld 2014). Below we will show that due to this process of self-organization, multiple states of action readiness fuse in a way that is similar to mixed emotions like nostalgia (which for example might reflect both sadness and happiness).[13]

The tendency towards an optimal grip we pre-reflectively experience when a relevant affordance (i.e. a solicitation) shows up, is related to the readiness of the affordance-related ability (Rietveld 2008a; Bruineberg and Rietveld 2014). Importantly, the notion of *relevant affordance-related states of action readiness* links the phenomenological level (pre-reflectively experienced solicitation) to the ecological level of analysis (relevant *affordance*-related action readiness). It makes explicit how the disequilibrium in the individual-environment relation makes a particular affordance stand out as soliciting and drives bodily action readiness (bottom right of figure 1).

2.c From engagement with a single relevant affordance to a field of multiple relevant affordances

With the exception of the boxing example, up until now, our discussion in this section focused mostly on the soliciting character of one single affordance. However, Skilled Intentionality as we encounter it in our real-life practices implies responsiveness to *multiple* affordances *simultaneously*. The situated individual responds in an integrated way to what we call a *field of relevant affordances* (Rietveld 2012). This phenomenological notion describes how the affordances that a situated individual simultaneously responds to are related. When an expert boxer is training on a heavy bag for example (Hristovski, Davids, and Araújo 2009), the field of relevant affordances reflects the integrated readiness for multiple kinds of punches (left or right jab, hook and uppercut for example), as well as drinking water. In a field of affordances we understand the various relevant affordances to provide the *context* for one another. Accordingly, the SIF provides a very simple, yet elegant understanding of situational context as the multiple relevant affordances that are in play and of context-sensitivity as selective openness to a multiplicity of relevant affordances simultaneously. So in the SIF, context turns out to be "just more affordances" (Rietveld 2012).

[13] "Simultaneous [states of action readiness, ER] can be expected to interact. They in fact have to interact, since they have to share output channels: action provisions, attention resources, logistic support resources, and so forth. The interactions are required for coordinating the multiple emotions' calls for action. Such coordinations lead to motive states, actions, and feelings that differ from those that would have become manifest when each emerged in isolation. Together, they result in mixed emotions or mixed feelings. […] True mixed feelings are observed in nostalgia, consisting of pain moderated by the happiness that was, together with pleasure moderated by the regret that it had gone. […] But what happens when multiple kinds of action readiness [interact depends, ER] upon their relative strengths." (Frijda, Ridderinkhof, and Rietveld 2014, p.5)

A situated individual's field of relevant affordances should be distinguished from the landscape of affordances available in a form of life. The landscape of affordances is not dependent on the abilities of a particular individual, but on the abilities available in the form of life as a whole; in the entire ecological niche or socio-cultural practice. This locates the landscape of affordances at the proper level of analysis for dealing with normativity, as mentioned above. Take for example the norms of spelling in a language: what today counts as a correct way to write a word is not dependent on any particular individual but on the community or practice as a whole. The landscape of affordances should thus be seen as independent of particular individuals.[14]

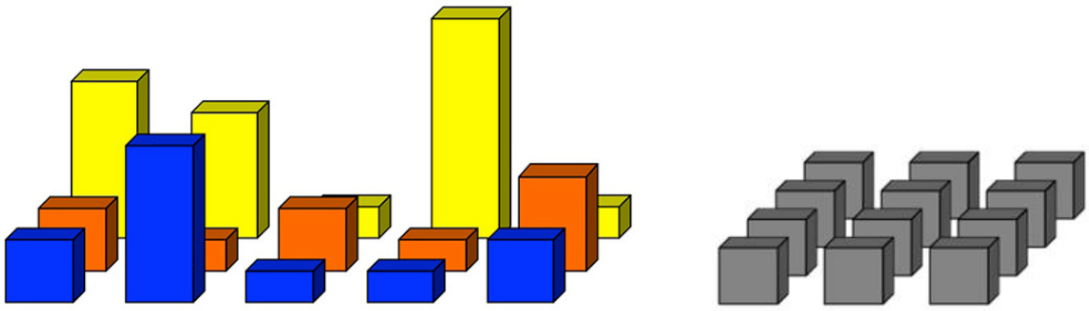

Figure 2. A sketch of the field of relevant affordances at a certain point in time for a normal person (left) and a depressed person (right). The height of the columns refers to the relevance or strength of attractiveness of the different solicitations. The width, depicted as the amount of columns that are placed next to each other horizontally, reflects the scope of affordances the individual is engaging with. The depth of the field reflects the temporal dimension, namely the anticipatory character of engagement with relevant affordances. In other words, one is not only ready for the affordances one is engaging with now, but also for possibilities for action one might engage with in the future (just as the skilled boxer who is performing a right jab now, is already poised for performing a left hook and right uppercut next). It is a dynamic field: dynamics in the landscape of affordances (e.g. in the material environment) and dynamics of the instability on the side of the individual can both lead to a restructuring of the field.

The structure of the situated individual's field of affordances is sketched in a very rudimentary and schematic way in figure 2a. The first dimension of this figure, namely the width of the field, reflects the amount of affordances the individual is simultaneously responsive to. The height of the columns (the second dimension) indicates the relevance or strength of attraction of the different solicitations. We say that these solicitations "stand out" as relevant (against the background of other affordances in the situation); they have affective allure (Rietveld 2008a). The last dimension, namely the depth of the field, reflects the anticipatory

[14] Or more precisely, relatively independent because an individual is herself also part of the sociomaterial environment and her activities contribute over time to maintaining the patterned practice of the form of life (see Van Dijk and Rietveld, 2017).

character of affordance responsiveness. This is the action preparation aspect of engagement with affordances. It regards one's readiness for what one can do next. For instance, while reading this chapter you might already experience pre-reflectively a sense of excited anticipation for tonight's dinner with your best friend. Observe, by way of contrast, figure 2b, which depicts the field of relevant affordances of a person suffering from depression. To this person every solicitation is equally unattractive. The scope of possibilities for action is diminished and at this moment it seems like there will be no improvement in the future. For example, the possibility of meeting up with a friend now or in the future is experienced as lacking affective allure. In other words, depression results in the deactivation of the soliciting field of relevant affordances that normally drives individuals towards an optimal grip on their situation (Rietveld, De Haan, and Denys 2013; De Haan et al. 2013; De Haan et al. 2015). On this basis it can be said that depression entails a breakdown of a key aspect of everyday skillful action.

The depth-dimension of the field of relevant affordances is crucial, because our current actions are often performed while reckoning with future possibilities for action that exist "on the horizon". For example, a study in ice-climbing showed that the climbers anticipated not only the next step, but the entire route ahead (Seifert et al. 2014). Since action readiness is a situation-dependent bodily phenomenon in between overt action and ability, it is a useful notion for understanding such action preparation or anticipation (Rietveld 2008a; Bruineberg and Rietveld 2014). Anticipation of the trajectory of affordances ahead is about developing a bodily readiness for what you can do next.

There is an interesting link with work on spatial experience in enactivism (Jelic 2016; Rietveld 2016; Rietveld, Rietveld, Mackic, Van Waalwijk van Doorn, and Bervoets 2015; Bruineberg and Rietveld 2014). Like the heavy bag for a boxer with the relevant punching skills, places we are familiar with generate a multiplicity of states of action readiness simultaneously. In this way, arriving at a particular *place* or "behavior setting" (Barker 1968; Heft 2001), like a party, swimming pool, climbing wall, or construction site, pre-structures our field of relevant affordances readiness. For example, at a swimming pool we are ready for encountering people in bathing suits, but not at a construction site. We speak of "place affordances" because places are aspects of the sociomaterial environment that offer possibilities for actin and can generate a multiplicity of states of action readiness. Accordingly, places can put constraints on the structure of our field of relevant affordances over a somewhat longer timescale (see section 3).

The field of relevant affordances is a highly dynamic structure. Relevant affordances move the individual, but are also "consumed" in the process of acting on them when the individual-environment relation is changed and other affordances come to stand out as relevant (Bruineberg and Rietveld 2014). An example of this would be a boxing situation in which the state of the material environment changes rapidly due to the fluctuating movements of the heavy bag. Every now and then the boxer switches unreflectively between affordances; from jab to hook to uppercut and back. Crucially, like in the ice-climbing example, these switches are not independent of each other: the individual is responsive to the entire field of relevant affordances (Rietveld 2012). At a dance party, for example, I might quickly finish the conversation when I hear the first notes of a popular song, but I would refrain from dancing if my friend were to say for example that "something terrible happened". In the field of relevant affordances, the possibility of asking what

happened shapes the context of the possibility to dance (Klaassen, Rietveld and Topal 2010). To put it more generally, what is at the foreground and what is at the background shifts continuously (Rietveld, De Haan, and Denys 2013). This means that the field of relevant affordances depicted in figure 2 represents a snapshot of the continuously changing field of relevant affordances.

The field of relevant affordances is a *dynamical* phenomenon, as mentioned above. Changes in this field of solicitations can originate in the individual and her actions, but also in the sociomaterial environment. Change often results from the individual's current concerns (i.e. needs, interests and preferences), which are related to its field of solicitations. These current concerns in turn depend on the individual's inherent disequilibrium in the situation. For example, drinking another beer makes the possibility of going to the toilet more urgent.

A change in the landscape might also change the field of relevant affordances by putting constraints on what is possible and appropriate. An example of this would be the way in which the optimal metastable zone (of distance) for conversation with a friend at a party changes when the noise levels in the room increase. When the volume of the music is turned up I need to speak louder, but at a certain music volume I cannot make myself heard and it is appropriate to stand closer to my friend. So in this case, a change in the environment changed the fields of relevant affordances of both myself and my friend. It changed what is appropriate and what counts as optimal grip. This example illustrates again how we are skillfully attuned to the context, i.e. to the available affordances.

In sum, at the level of the situated individual Skilled Intentionality is characterized as an integrated response to the field of relevant affordances *as a whole*. Using ethnographic research methods we investigated this phenomenon in a complex architectural design practice (Rietveld and Brouwers 2016). When tending towards an optimal grip on this integrated field of solicitations the individual can improve the situation in line with what matters to him or her.

3. Tendency towards an optimal grip as reduction of disequilibrium in a brain-body-environment system & the Friston connection

In the previous section it was shown that the situated individual's field of relevant affordances is continuously restructured. Changes of the field of relevant affordances result from (a) the agent's actions that modify the environment, (b) from the agent-independent dynamics of the situated individual's physical environment, which is *in flux* (Ingold 2000, 2013), but follow also from (c) an ongoing dynamic within the individual's body and brain (e.g. Freeman 2000; Merleau-Ponty 1968/2003). In recent years, changes in body and brain gained a lot of attention in research on what is called 'the anticipating brain' (see e.g. Friston 2010, 2011; Allen and Friston, 2016; Allen and Gallagher 2016; Kiebel, Daunizeau, and Friston 2008; Cisek 2007; Cisek and Kalaska 2010; Pezzulo and Cisek 2016). These popular ideas in neurodynamics are contextualized in the SIF by connecting them to relevant findings from the fields of ecological psychology and phenomenology via the notion of states of action readiness (which we discussed in the previous sections) and by drawing on principles of the study of complex and dynamical systems (Bruineberg and Rietveld 2014; Kelso 2012; Friston 2011; Tschacher and Haken 2007).

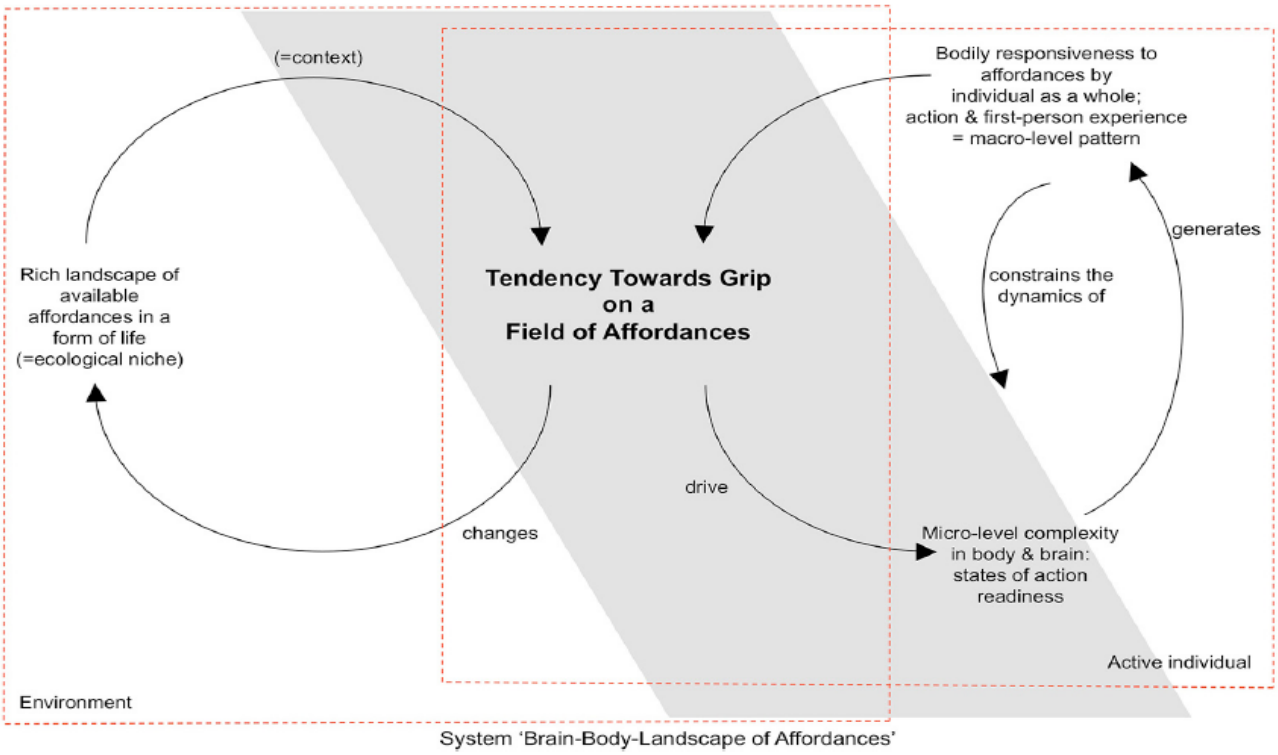

Figure 3: Sketch of the Skilled Intentionality Framework. Adapted from (Bruineberg and Rietveld 2014).

3.a Reduction of disequilibrium as the individual's most basic concern

In the SIF the tendency towards an optimal grip on a field of relevant affordances is connected to the reduction of disequilibrium in the dynamical system 'brain-body-landscape of affordances' (depicted schematically in figure 3). The skilled individual is situated at a specific location in the landscape of

affordances (say at a party or a swimming pool) and is selectively open and responsive to solicitations that reduce its state of *dis-equilibrium*. In a more technical paper (Bruineberg and Rietveld 2014), we characterized the reduction of dis-equilibrium within the brain-body-environment system as reduction of *dis-attunement* between the two dynamics depicted in figure 3, namely the internal dynamics (of multiple interacting and self-organizing affordance-related states of action-readiness of the individual) and the external dynamics (of the dynamically changing landscape of affordances) (cf. Dotov 2014; Kirchhoff 2015; Malafouris 2014).

Doing so, we incorporated the work of Karl Friston on the so-called 'Free Energy Principle' (FEP) (Friston 2010, 2011) into the SIF.[15] Friston takes an important philosophical stance when he calls his FEP enactive. The SIF takes this very seriously by developing and integrating an Ecological-Enactive interpretation of FEP. On our (Bruineberg and Rietveld 2014; Bruineberg, Kiverstein, and Rietveld 2016) interpretation, Friston's Free Energy Principle applied to living organisms is about improving the individual's grip on the environment.[16] Crucially, Friston argues that you can predict the structure of the embodied brain from the structure of the environment (Friston 2011; Friston 2013b).[17] It is precisely due to the fact that the structure of the individual's body reflects the structure of the ecological niche of the individual, that she can stay attuned to it by being selectively open to affordances.

This fits in with the way in which the SIF explains how the field of solicitations and the individual co-evolve during skilled action (and over a very long timescale during skill acquisition). According to the SIF, the multiple simultaneous states of action readiness that are generated are related to relevant affordances of the specific place and practice in which the individual is situated (see paragraphs 2b and 2c). Therefore, the SIF highlights the relevance of investigating the region of the landscape of affordances in which the individual is involved (e.g. by analyzing involvement in the sociomaterial practice over longer periods of time, see Brouwers and Rietveld 2016) and the structure of the resulting field of solicitations (including relevant place affordances and the current abilities of the individual) to learn something about the activity of the brain and body, and vice versa (Bruineberg and Rietveld 2014).

In line with the discussion of the tendency towards an optimal grip in section 2 above, reduction of disequilibrium within the system brain-body-landscape of affordances is seen in our SIF approach as a basic and continuous concern that drives the individual's selective openness to relevant affordances. This can for instance be observed in the improvement of energy levels by eating or by sleeping, but also in more complex improvements of a person's situation in the context of socio-cultural practices, such as a discontented architect reducing a dis-equilibrium by improving the design of a door (in its context). Making the door higher reduces the architect's discontent and the disequilibrium of the situation. Continuously, the

[15] Although Friston's language might sound too cognitivist to some to be united with enactive/embodied cognition, we have shown that it is possible to give a more charitable ecological and enactive/embodied interpretation of his work (Bruineberg and Rietveld 2014; Bruineberg, Kiverstein and Rietveld 2016; Allen and Friston 2016). It is good to keep in mind that together with Walter Freeman (e.g. 2000) Karl Friston (e.g. 1997) is one of the world's main pioneers of neurodynamics and the metastable brain (see Rietveld 2008b for how this links up with Varela's and Kelso's ideas).

[16] From this perspective Free Energy can be seen a measure of the individual's grip in terms of attunement of internal and external dynamics.

[17] By means of example, think of the way the skills, muscular body and style of movement of a dancer reflect the practice she participates in. Similarly, the brain has become adapted to this niche over time.

individual's readinesses of skills and her behavior are geared towards a re-establishment of relative equilibrium (Rietveld 2008a/c; Bruineberg and Rietveld 2014). By generating responsiveness to solicitations, which are the (pre-reflective) experience of states of action readiness for resolving a suboptimality or disequilibrium in the individual-environment relation, this basic concern for reduction of disequilibrium moves the skilled individual to improve his or her situation.

Although disequilibrium is continuously reduced by an individual's Skilled Intentionality, complete stability will never follow as long as the organism is living (Merleau-Ponty 1968/2003). We have stated in section 2 that this is why we talk about a *tendency* towards an optimal grip. Any movement towards optimal grip on the situation can only bring relative equilibrium, but will not lead to a fully stable state of the system individual-environment. Crucially, it is in virtue of this intrinsic instability or disequilibrium that affordances get their relevance, multiple states of action readiness are generated, and an organism can respond flexibly to the environment and maintain its structural organization.

3.b Interacting states of action readiness

Skilled intentionality, understood as the tendency towards optimal grip on a field of relevant affordances, typically describes the change of an individual's situation as responsiveness to multiple solicitations simultaneously (see section 2). Above we have mentioned that multiple affordance-related states of action readiness interact to generate a coordinated engagement with multiple affordances simultaneously, which makes it possible to understand integration of different states of action readiness (Frijda, Ridderinkhof, and Rietveld 2014) as well as the capacity to switch rapidly from doing one thing to doing another (Hristovski et al. 2009; Rietveld 2012, 2008b/c). In a sense the SIF generalizes some of the insights gained in the fields of emotion psychology and ecological dynamical systems theory. Research on self-organization and so-called "coupled pattern generators" which produce rhythmic patterns in robot locomotion (see Beer and Chiel 1993), provides a paradigm for understanding this interaction or coordination of states of action readiness (Bruineberg and Rietveld 2014). When a pattern generator oscillates at a particular frequency it can influence the frequency of other coupled pattern generators. Crucially, slower dynamics on longer timescales enslave or entrain the faster oscillations (cf. Dotov 2014). This mechanism of enslavement is also hypothesized to be the mechanism that leads neuronal populations to synchronize transiently (Freeman 2000; Varela et al. 2001; Friston 1997; Bruineberg and Rietveld 2014). This fits with what we know from complex systems theory that describes how macro-level patterns typically constrain the movements of the micro-level parts, whilst at the same time being generated by these parts (Tschacher and Haken 2007). We observe that these principles of self-organization hold for states of action readiness as well (Bruineberg and Rietveld 2014; Kiebel Daunizeau, and Friston 2008), which can be seen at different levels of organization in brain and body and are central in the SIF. In the right part of figure 3 we depicted how coordination of multiple microlevel patterns of action readiness generates a macrolevel pattern of action readiness which constrains the dynamics of these microlevel patterns. In this way, self-organization of multiple affordance-related states of action readiness generates a macrolevel pattern of selective openness by the individual to

the field of solicitations as a whole. Continuously, the individual's readiness of skills and her behavior are geared towards a re-establishment of equilibrium in the system brain-body-landscape of affordances.

Dotov (2014) suggests what this might mean for understanding neural activity: brain activity at the microscopic level (e.g. neural activity evoked by the detection of a relevant affordance) contributes to behavior but these (microscopic) neural dynamics can perhaps best be understood as enslaved (Dotov 2014; Kelso 2012; Tschacher and Haken 2007) by the slower (macroscopic) dynamics of the larger dynamical system, i.e. of what we call the system 'individual-landscape of affordances'. More research is needed to understand better how microscopic neural activity of certain brain areas is enslaved by the dynamics of the brain as a whole, which is in turn constrained by the dynamics of the macroscopic system 'individual-landscape of affordances'. This kind of research will benefit from keeping in mind that the brain is not only embedded in a body but also situated in a place (Heft 2001; Rietveld and Kiverstein 2014).

The relation between affordances and bodily (including neural) action preparation connects to our discussion on place-affordances and anticipation in the previous section. Behavior settings like libraries, walls for ice climbing, and restaurants have a certain stability over a somewhat longer and slower timescale. We might say that place-affordances (e.g. the aspect of the sociomaterial environment that we call a library) generate patterns of action readiness over a longer timescale that can enslave or entrain faster affordance related states of action readiness. As such a place affordance pre-structures which states of action-readiness can be adopted, contributing to the situated individual's tendency towards an optimal grip on the situation embedded in the broader practice. In other words, this is a form of affordance-responsiveness that unfolds over a somewhat longer timescale. States of action readiness related to place affordances are high up in the hierarchical, or, better, nested cascade of constraining states of action readiness. Similarly, anticipation of affordances on the horizon of the field of solicitations can influence our current affordance-responsiveness (Van Dijk and Rietveld, 2017). The action possibility to have dinner with one's best friend tonight can, for example, increase one's focus on the most relevant affordances so that one will finish working in time.

In the previous section, we explained that it is when we are well attuned to the dynamically changing landscape of affordances, that we have the possibility to switch rapidly from doing one thing to doing another (Rietveld 2012). Being able to flexibly switch activities is described by the phenomenon of *hypergrip* on a field of relevant affordances (Bruineberg and Rietveld 2014). This notion of hypergrip is another expression for being in a (relatively) optimal metastable zone. We encountered a possible example of this above: for a skilled boxer the zone of optimal metastable distance might solicit moving toward, because in this zone he or she is simultaneously ready for multiple relevant action opportunities and for flexibly switching between them in line with environmental fluctuations, like the sometimes very fast movements of a boxing bag (for another real-life example see Rietveld and Brouwers, 2016). This phenomenon of tending towards an optimal metastable zone is potentially so important that it is worth taking a second look at the empirical study on optimal movement pattern variability in boxing (Hristovski, Davids, and Araújo 2009). At a critical distance of 0.6 (the distance to the punch bag scaled by the arm length), boxers "could

flexibly switch between any of the boxing action modes" (Chow et al. 2011; Hristovski, Davids, and Araújo 2009). At this distance the boxing bag 'invited' (cf. Withagen, De Poel, Araújo, and Pepping 2012; Withagen, Araújo, and De Poel 2017) a wider variety of punches (left and right uppercuts, hooks and jabs) than it would at other distances.

This boxing study and ethnographic observations of expertise in the practice of architecture indicate that we can describe optimal grip on a field of relevant affordances at a different level of analysis as optimal *metastable* attunement to the field of affordances (Bruineberg and Rietveld 2014; Rietveld and Brouwers 2016). Metastable attunement is a technical term for the ease with which a system can switch to another state (Kelso 2012; Bruineberg and Rietveld 2014) and the study of it in the brain-body-environment system as a whole provides a paradigm for understanding hypergrip. In the relative equilibrium of an optimal metastable zone, a self-organizing system as the 'brain-body-landscape of affordances' can adopt a great number of states with only the slightest change (perturbation) in the environment (e.g. a random movement of the boxing bag) or the individual's internal state (the individual is also in motion, think for example of the many interacting patterns of bodily action readiness). Note that the affordances the individual has a readiness for, are not endless, but limited to the relevant affordances given the agent's abilities and state of dis-equilibrium. A small disruption like a random movement of the heavy bag can drive the system to settle on a new form of organization, which impacts the individual's phenomenology. The solicitation and related action readiness that gave rise to the movement are 'consumed' in the process, making other solicitations stand out next (Bruineberg and Rietveld 2014). A new macrolevel pattern of selective openness to the landscape of affordances arises (right dynamic in figure 3). As such, hypergrip on a field of relevant affordances is functional with respect to both the demands of the environment and the basic concern of the organism of tending towards an optimal grip on affordances in the situation.

Conclusion

The landscape of affordances in the human form of life is very rich and forms the context in which we should situate Ecological-Enactive Cognition. In this chapter we have made skills for engaging with these affordances central to dissolve the distinction between 'lower' and 'higher' cognition. The long-term ambition of the Amsterdam SIF-research program is to explore if the whole spectrum of things people do skillfully, including social interaction, language-use and other forms of 'higher' cognition, can be understood in terms of Skilled Intentionality, which is the selective engagement with multiple affordances simultaneously. Both poles of our new Wittgensteinian interpretation of Gibson's (1979) notion of affordances (Rietveld and Kiverstein 2014; Chemero 2009), as relations between (a) aspects of the sociomaterial environment in flux, and (b) abilities available in a 'form of life' (Wittgenstein 1953), manifest an enormous variety. It is this definition that allows us to see the human ecological niche as a rich and resourceful landscape of affordances (Rietveld and Kiverstein 2014). The definition of affordances also

makes it possible to deal with situated normativity because, just like Wittgensteinian normativity, affordances are always to be understood as related to a particular form of life. This practice-based normativity (Rietveld 2008a) is crucial for dealing with certain kinds of higher cognition, e.g. the possibility of making correct epistemic judgments. In the human form of life the social dimension is implicated in a fundamental way as shaping and sustaining this landscape of affordances. The SIF-approach shows that abilities are embedded in and acquired through participation in a socio-cultural practice (Rietveld 2008a; Rietveld and Kiverstein 2014). Also the other relatum of an affordance, the environment, is defined as sociomaterial from the start (Rietveld and Brouwers 2016; Van Dijk and Rietveld 2017). Moreover, the SIF-approach distinguishes itself from more purely philosophical work in embodied/enactive cognition (e.g. Noë, 2012) in that it is able to link complementary findings established in different scientific disciplines in one integrative conceptual framework. The SIF integrates the neurodynamic, the ecological/contextual, the affective, and the personal/phenomenological levels of analysis, by showing how these perspectives on cognition describe different aspects of one self-organizing system that includes both the individual and its sociomaterial environment: the self-organizing system 'brain-body-landscape of affordances'. Re-establishment of equilibrium through reduction of dis-attunement between the internal dynamics (a hierarchy of interacting states of action readiness at multiple timescales, or, in other words: a nested cascade of constraining states of action readiness) and external dynamics (the dynamically changing landscape of affordances) is the individual's primary and ongoing concern. This primary and ongoing concern can phenomenologically be described as a tendency towards an optimal grip on the various relevant affordances encountered in a particular situation. In this process of skilled responsiveness to affordances the sociomaterial environment is typically transformed as well. Moving towards an optimal grip on the field of solicitations implies reducing tension or discontent by engaging one's skills to join forces with multiple relevant affordances.

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