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Keywords (separated by '-')	Autism - Affordances - Ecology - Enactivism - Skilled intentionality - Niche construction	
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Ecological-enactive account of autism spectrum disorder

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Abstract

Autism spectrum disorder (ASD) is a psychopathological condition characterized by persistent deficits in social interaction and communication, and restricted, repetitive patterns of behavior and interests. To build an ecological-enactive account of autism, I propose we should endorse the affordance-based approach of the skilled intentionality framework (SIF). In SIF, embodied cognition is understood as skilled engagement with affordances in the sociomaterial environment of the ecological niche by which an individual tends toward the optimal grip. The human eoniche offers a whole landscape of affordances, and situated individuals respond to a field of relevant affordances. An important part of SIF is an ecological-enactive interpretation of the free energy principle and predictive processing. Predictive processing accounts indicate that in ASD too much precision is assigned to prediction errors. Autistic persons depend heavily on current sensory information and less on prior beliefs and cannot attune to stable regularities. To reduce uncertainty, they over-rely on routines, strict habits, and a familiar environment—a predictable ecological niche they construct. I argue that skilled intentionality gives us the framework from which to analyze the autistic field of affordances. Autistic patterns of affordance-related bodily states of action readiness are only sensitive to very specific solicitations in the environment and achieve optimal grip in well-known situations. Autism is to be understood as a disorder of bodily normativity. Taking this approach helps us figure out what neurotypical people can do to attune their environment in order to scaffold the needs of autistic individuals by redesigning the landscape of affordances.

Keywords Autism · Affordances · Ecology · Enactivism · Skilled intentionality · Niche construction

A change in the weather is sufficient to recreate the world and ourselves.

Marcel Proust

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26 1 Introduction

27 Autism spectrum disorder (ASD or simply autism) is a psychopathology (neurodevel-
 28 opmental disorder) which is characterized by deficits in social interaction and social
 29 communication (i.e., deficits in social-emotional reciprocity, nonverbal communica-
 30 tive behaviors) and restricted, repetitive patterns of behavior, interests, or activities (i.e.,
 31 stereotyped or repetitive motor movements, insistence on sameness, highly restricted,
 32 fixated interests, hyper- or hyporeactivity to sensory input) (APA, 2013, p. 50).¹ Leo
 33 Kaner, a child psychiatrist of Austrian-Hungarian origin, is usually lauded as the first
 34 to name the condition in his 1943 paper. Kaner described a specific pattern of behavior
 35 that he observed in a group of 11 children and baptized it “early infantile autism” (from
 36 Greek αὐτός meaning *self*).² Hans Asperger, an Austrian pediatrician, wrote about
 37 older children and adolescents and described “autistic psychopathy” in four boys in
 38 1944. This condition was later called “Asperger syndrome”, but the full acknowledge-
 39 ment only came as late as the fourth edition of the Diagnostic and Statistical Manual of
 40 Mental Disorders (DSM-4) (1994). However, recently, it has been pointed out (Sher &
 41 Gibson, 2021) that the Soviet-Russian child psychiatrist Grunya Efimovna Sukhareva
 42 gave the very first clinical account of autistic children. She published her descrip-
 43 tion of autistic traits of six boys aged between 2 and 14, who spent two years at her
 44 ‘hospital-school’ at the Psychoneurological Department for Children in Moscow, in a
 45 German psychiatry and neurology journal in 1926, two decades before Kanner’s and
 46 Asperger’s seminal papers. The boys whose behavior she recounted today would be
 47 labeled as “high functioning” autistic individuals (those that have higher IQs and less
 48 severe impairments).

49 Autistic children lack interest in people and the social world but have a peculiar
 50 “fascination for objects” (Kanner, 1943). In relation to restricted and repetitive behav-
 51 ior and interests, these behaviors and feelings towards inanimate objects have been
 52 observed in autism since Kanner and Asperger,³ all the way to the DSM-5. These are
 53 the types of autistic behavior I will be concerned with in the present article.

54 Consider a snippet from the case history of a 10-year-old boy Hans R. described
 55 by Bosch (1962/1970) that shows the characteristic behavior and relation to objects
 56 of autistic children:

57 He also showed a particular interest in round or rotatable objects. His mother
 58 had noticed this particular predilection in his third year. At home he had filled a
 59 box with a very varied collection of wheels, and when visitors were present he

¹ The fifth iteration (DSM-5, 2013) differs from the fourth (DSM-IV-TR, 1994) in that it combines pre-
 viously separate categories of autistic disorder, Asperger syndrome, pervasive developmental disorder-not
 otherwise specified (PDD-NOS) and childhood disintegrative disorder—into a single consolidated umbrella
 diagnosis of autism spectrum disorder.

² Viktor Frankl saw autism as a disturbance of affective language and affective contact, and Leo Kanner
 followed in using these formulations by writing in his famous 1943 paper: “During the interview, there was
 no kind of affective contact” (Kanner, 1943, p. 229; Bizzari, 2018).

³ These were described by both Kanner and Asperger, though interpreted differently; Sukhareva describes
 it as “‘a tendency towards automatism’ and that this manifested “as sticking to tasks which had been started
 and as psychic inflexibility with difficulty in adaptation to novelty” (Sukhareva, 1925; cited in Sher &
 Gibson, 2021).

would always say, ‘He wants a wheel.’... But his interest in round or rotatable objects was not just restricted to looking at, handling, or drawing them, for his favorite body movement was also that of spinning round. Rotating played an important part in his rhythmic movements. (Bosch, 1962/1970, pp. 7–8)

In the follow-up examinations, when Hans was between 14 and 16, this was observed:

“The care which he took over manual work with wood, nails, or paper and the importance he attached to having everything in the flat arranged in a particular way had, if anything, increased. He noticed immediately if his mother moved any of his things and complained about it. He also still retained his liking for wheels. At the time he was collecting watch parts, which he would spend hours twisting back and forth, but he also made drawings of them and cut these out.” (Bosch, 1962/1970, p. 13)

What lies at the core of this disorder? There has been a resurgence of interest in philosophical theories of social cognition disturbances in autism spectrum disorder, and a number of models and theories about the nature of autism have been proposed. First came the cognitivist theories, the central coherence model (more attention to details than to global information, Happé, 1999; Happé & Frith, 1996) and the mindblindness theory of Baron-Cohen (1995). The theory of mind position on the psychopathology of autism is that such individuals fail to develop the capacity to mind-read or “mentalize”; they lack the ability to understand mental states and could be called mindblind (Baron-Cohen, 1989; Frith, 2003). There is also the executive function theory (Ozonoff et al., 1991) that autistic individuals do not have control over their actions, as well as the weak central coherence theory (Frith, 2003) regarding the autistic focus on details of information, and problems with integration in perception.

The turn from cognitivist explanations of autism has been taken by phenomenological and 4E approaches to social cognition (Bizzari, 2018; Gallagher, 2004; Gallagher & Varga, 2015; León, 2019; Zahavi, 2005, 2010, 2014; Zahavi & Parnas, 2003). Unlike cognitivist theories, phenomenological theories seek autistic differences already on the pre-reflective level. Those who endorse the phenomenological theories of social cognition maintain that exceptional autistic individuals like Temple Grandine⁴ have learned to depend on explicit mentalizing and inferring from social cues and rule-based knowledge about the behavior of others because they lack a “social sense” and certain capacities of primary intersubjectivity (sense of *being-with-others* provided by intercorporeality, Fuchs, 2020, pp. 330–331; Zahavi, 2014). Fuchs’s phenomenological and enactive theory (2015, 2020) understands autism as a disturbance of intercorporeality and interaffectivity. What lacks is affective attunement, pre-reflective understanding, and engagement with other people. Similarly, ASD was characterized by impairments in connecting to the emotions of others (León, 2019).⁵

⁴ Temple Grandin is a highly intelligent, high-functioning autistic woman who has a PhD in animal science and has published more than 200 scientific articles and autobiographical accounts on her experiences with autism.

⁵ Peter Hobson argued that thinking and feeling are deeply related, and that self-conscious affectivity helps constitute the concept of self (Hobson, 1990). In autism, the abilities for social-emotional relatedness are severely limited (e.g., being unable to identify with the attitudes of others), and this seems to be the source of later deficits in creative symbolic thinking and self-reflective awareness (Hobson, 2018).

97 In her enactivist account, De Jaegher (2013) argues that ASD involves different
98 forms of participatory sense-making.⁶ Maiese (2021) sees autism as entailing maladapt-
99 tive, disordered patterns of sense-making. Predictive coding/processing explanations
100 have also been proposed (Pellicano & Burr, 2012, hypothesizing weak priors in autism;
101 Van de Cruys et al., 2014). Bolis et al., (2017, the dialectical misattunement hypothe-
102 sis⁷) and Schilbach (2016) argue for second-person neuropsychiatry and neuroscience
103 and have built second-person models of autism that are a synthesis of predictive pro-
104 cessing and enactivism. Enactivist/extended approaches to autism are a recent addition
105 to this literature (ASD persons suffer from “style blindness”, Krueger, 2021; Krueger
106 & Maiese, 2018).

107 A detailed account of the ecological aspects of autistic disturbances is still missing
108 in the literature. In addition, I think that an integrative account of autism is much needed
109 at this point. It will bring all these diverse aspects of ASD together and do justice to the
110 experience of autism. The account I develop helps us connect two aspects of autism
111 (two core types of deficits) found in the current DSM-5 diagnostic criteria: social and
112 non-social (how they relate to persons and objects). Current theories of autism usually
113 give explanations only to certain deficits, like social and cognitive ones or repetitive
114 behavior. An integrative account I propose can show how social, cognitive and commu-
115 nication deficits hang together with the differences in phenomenology, embodiment
116 and situatedness of autistic people and, thus, provide a multidimensional explanation.
117 The account offers not just a detailed explanation of mechanisms behind differences
118 in both social and non-social domains and how they are connected but also gives ways
119 in which we can understand those differences in more detail and depth, which can
120 lead to the development of more precise diagnostic criteria. The phenomenology of
121 autism is mostly left out, even in the DSM-5. This account highlights and analyzes
122 previously philosophically unexplored aspects of autistic situatedness while at the
123 same time connecting them to predictive processing problems and phenomenological
124 differences through ecological-enactive terms (such as the bodily normativity and field
125 of relevant affordances).⁸

126 I find that the *ecological-enactive framework* has the synthesizing power required
127 for the task. Thus, I will present an ecological-enactive account of ASD. The remain-
128 der of the paper consists of five sections. Following what was said in the Introduction,
129 in Sect. 2, I urge for a closer philosophical look at the ecological aspects of the autistic
130 spectrum disorder, on the different ways autistic persons relate to their environment.
131 Section 3 introduces and outlines the skilled intentionality framework (SIF) from
132 which I propose to view ASD. This framework brings along with it an affordance-
133 based perspective that synthesizes ecological and enactive approaches to cognition
134 with phenomenology and neuroscientific theories. Section 4 highlights the predictive

⁶ Living beings are actively searching, and engaging the environment for affordances, trying to make sense of it through moving, they enact their world through *sense-making* (Varela et al., 1991; Di Paolo, 2009). *Participatory sense-making* comes from social interactions and relations with other human beings in the shared human reality which is “*interenacted*” (Fuchs, 2018, pp. 26–27; De Jaegher & Di Paolo, 2007).

⁷ In this hypothesis, authors integrate predictive processing with intersubjective approaches and understand ASD as “a cumulative interpersonal mismatch of prediction and interaction styles... with the world and others across multiple timescales” (Bolis et al., 2021, p. 223).

⁸ I am thankful to the anonymous reviewer for pointing out that this needs to be made explicit.

135 processing (PP) framework, in coalition with the free energy principle (FEP), as part
136 of skilled intentionality. SIF boasts an ecological and enactive construal of both pre-
137 dictive processing and the free-energy principle. I show how health and well-being are
138 understood in the ecological-enactive interpretation of PP and FEP. I will then employ
139 various PP theories of ASD to sketch the particular ways in which the precision estima-
140 tion differs in autistics and how this entails their peculiar niche construction. Section 5
141 is dedicated to bringing the findings of such PP theories of autism to bear in the SIF
142 and working out a detailed ecological-enactive account of autistic differences in terms
143 of affordances that includes the autistic lived experience. Finally, tentative suggestions
144 for therapy and inclusion are given in Sect. 6.

145 **2 Integrative framework for ASD: the skilled intentionality**

146 In this paper, I want to hone this aspect of autistic impairments and offer an ecological-
147 enactive account of autism. Highlighting the enactive and ecological perspective on
148 autism could further improve our understanding of the disorder, make diagnostics bet-
149 ter and more precise, and finally, enable the designing of more inclusive environments
150 for ASD persons.

151 The ecological and enactive framework that I want to focus on is the *skilled*
152 *intentionality framework* or the SIF (Rietveld et al., 2018).⁹ I will argue that the
153 skilled intentionality framework should be endorsed to build an integrative, ecological-
154 enactive account of ASD. The potency of this framework lies in the fact that it connects
155 complementary findings from a significant number of scientific disciplines—neuro-
156 dynamic, ecological, affective, and phenomenological levels of analysis of cognition
157 (all aspects of the self-organizing system “brain–body–landscape of affordances.”,
158 both individual and environmental). SIF connects a number of disciplines: ecologi-
159 cal psychology (landscape of affordances; Chemero, 2009; Gibson, 1979; Heft,
160 2001), phenomenology (selective openness to and relevance of affordances, optimal
161 grip), emotion psychology (states of action-readiness along the lines of Frijda, 2007),
162 and embodied neurodynamics (self-organizing affordance-related states of action-
163 readiness). I will explain in the following the key concepts of the framework: landscape
164 and field of affordances, solicitations, optimal grip, etc., that will be applied to ASD
165 later.

166 In the SIF, which brings together the embodied, enactive and ecological pro-
167 grammes, cognition has been understood as skilled engagement with different

⁹ There are not many ecological approaches to psychopathology. Another interesting approach to the ecological side of psychopathological disorders has been advocated by Thomas Fuchs (2007, 2019). He draws from both the phenomenology of the lived body (Merleau-Ponty, 1945/2002) and ecological psychology (Gibson, 1979), bringing concepts like the *phenomenal field* and *lived space* (permeated by *field forces*, towards affordances/valences of the environment). The lived space of a person is its ecological niche (feedback cycles of “responded activity”). The ecological niche can be considered a segment of the environment that is complementary to the dispositions of the individual—objects living and nonliving, with which an individual interacts (Fuchs, 2007, p. 42; 2019, p. 3). The econiche offers different affordances (possibilities for action). Fuchs applied these concepts to psychopathology and psychotherapy in order to institute an ecological approach to psychic disorders and ecological psychotherapy.

168 affordances (possibilities for action) in the sociomaterial environment of the eco-
169 logical niche by which an individual tends toward the optimal grip. Part of SIF is an
170 ecological-enactive interpretation of the free energy principle and predictive process-
171 ing (Bruineberg & Rietveld, 2014). Predictive processing accounts indicate that in
172 ASD, too much precision is assigned to prediction errors (Van Constant et al., 2018a,
173 2018b; de Cruys et al., 2014; Miller et al., 2022). I will put all of these together toward
174 a better understanding of ASD.

175 According to SIF, embodied cognition (both higher and lower forms¹⁰) is skilled
176 engagement with multiple affordances offered by the sociomaterial environment in
177 the context of the human ecological niche.” (Rietveld et al., 2018, p. 49), where
178 affordances are understood as possibilities for action that are provided by the envi-
179 ronment. Members of the same species are situated within the same ecological niche,
180 e.g., the human ecological niche. Human econiche is a rich *landscape of affordances*.
181 These affordances correspond to the abilities available in a particular *form of life*.¹¹
182 Skilled intentionality is thus the skilled responsiveness to a landscape of affordances
183 (essentially relational). It is selective engagement with affordances simultaneously in
184 a concrete situation. The landscape contains all the affordances that are available to
185 a form of life in general (humans).¹² This landscape is fundamentally social. Now, a
186 *field of affordances* can be distinguished from the landscape, and it “reflects the mul-
187 tiplicity of inviting possibilities for action for an individual in a concrete situation”
188 (Rietveld et al., 2018, p. 52; de Haan, 2020, p. 218; de Haan et al., 2013). The field of
189 affordances is an individual “subset” of the whole landscape of affordances.

190 The creators of the SIF introduce several novel phenomenological concepts. First,
191 solicitations are the affordances that are inviting to a situated individual and generate
192 bodily states of action readiness (Rietveld et al., 2018, p. 52). There is a pre-reflective,
193 experiential dimension to them. The field of relevant affordances is the field of solici-
194 tations. Phenomenologically, this responsiveness to many solicitations simultaneously
195 is designated as the “tendency toward optimal grip on a field of relevant affordances”.

196 The central phenomenological concept is that of the *optimal grip* and comes from
197 Merleau-Ponty’s philosophy of life. All living beings have an inherent disequilibrium
198 within the individual-environment system (Merleau-Ponty, 1968/2003). There is a
199 fundamental lack that motivates “compensatory activity” (Merleau-Ponty, 1968/2003,
200 p. 149; Rietveld, 2008, Ch. 7). This disequilibrium is experienced as an “affective ten-
201 sion”. To understand the optimal grip, consider the famous Merleau-Ponty’s example
202 of moving closer to a painting in an art gallery to get to the *optimal* distance from
203 which it is best viewed Merleau-Ponty (1945/2002). That is why the living animal
204 is always selectively open to the landscape of affordances and responsive to relevant
205 affordances (Bruineberg & Rietveld, 2014). Organisms always tend toward an optimal
206 grip in the dynamic coupling of body and world. The individual has to be responsive
207 to solicitations to improve their situation. The core of the SIF can be stated thus:
208 “skilled intentionality means reducing disequilibrium by moving toward an optimal

¹⁰ SIF research program plan is to understand social interaction in terms of skilled intentionality.

¹¹ Rietveld and Kiverstein (2014) follow the Wittgensteinian (1953) notion of affordances. With the form of life, they refer both to the kind of animal (with an ecological niche) and to the sociocultural practices. A form of life is expressed in the stable patterns of behavior of a particular species.

¹² So, their human econiche is broader than the niche Fuchs has in mind (as cited in footnote 8).

grip on multiple relevant affordances simultaneously, that is, on a *field of relevant affordances*” (Rietveld et al., 2018, p. 45).

Proponents of SIF defend an ecological-enactive *model of disability* (Toro et al., 2020), which emphasizes the role of a pragmatically structured sociomaterial environment in constraining and enabling behavior. This model, contrary to medical and social models, focuses on the experience of the lived body of the disabled person. The ecological-enactive approach follows Canguilhem’s (1991/2015) analysis of health and illness to make a distinction between “normal” and “pathological” embodiment.¹³ Toro et al. emphasize that the concept of bodily normativity is very close to the contemporary enactivist notion of *sense-making* and is inspired by the work of Canguilhem and Merleau-Ponty. It refers to “the organism’s evaluative capacity” that guides the organism on how to behave in order to attune to the environment to “achieve dynamic” stability (Toro et al., 2020, p. 6). A healthy person can institute new norms in new situations, and a pathologically embodied cannot adapt to change (2020, p. 8). Canguilhem writes: “more than normal—that is, adapted to the environment and its demands—but normative, capable of following new norms of life” (Canguilhem, 1991, p. 200). Being healthy means being “more than normal”, adopting new norms of bodily normativity to reach dynamic stability in novel situations.

3 Predictive processing and skilled intentionality

3.1 Predictive processing and free energy in SIF

Skilled intentionality framework encompasses the so-called “free energy principle” (FEP or free energy framework) (Friston, 2010, 2011), an “ecological-enactive interpretation of FEP” (Bruineberg & Rietveld, 2014; Bruineberg et al., 2018). Proponents of SIF see the free energy principle as arguing that the brain is a part of a larger coupled system with the environment that, on the basis of its coupling, is constantly reducing misattunement with the environment. There is an inherent tendency toward an optimal grip on a field of relevant affordances. According to SIF this is in connection to the reduction of disequilibrium in the dynamical system “brain–body–landscape of affordances”. Through the organism’s minimization of free-energy, the brain’s internal dynamics are normally adequately attuned to the external dynamics of the environment.” (Bruineberg et al., 2018, p. 2440).

FEP promises to be a unifying theory of biological and cognitive sciences. An organism maintains its organization as an adaptive living system by way of minimizing its information-theoretic free-energy in interactions with its environment (Friston & Stephan, 2007) The minimization is achieved by predicting sensory input or by changing the environment to match what is predicted (*perceptual* and *active inference*, two ways to bring models and the world closer). This is how an organism attunes to its ecological niche. Bruineberg et al. emphasize that FEP is a unifying framework for

¹³ As pointed out by Georges Canguilhem, although some conditions are pathological by common standards, they are experienced and understood as normal by the person who has the condition. Experiential life is norm-instituting or normalizing, and so the pathological is not just something lacking norm, but that which institutes its own normality (Canguilhem, 1991).

247 self-organizing living systems, and predictive coding/processing is about the neural
248 functioning of the brain. Although they usually come together as a package (the free-
249 energy principle is combined with Bayesian predictive-coding by Friston himself),
250 Bruineberg et al. argue they should not be conflated (Bruineberg et al., 2018, p. 2419).

251 Predictive processing (*prediction-error minimization*) is a theory of the brain and
252 its cognitive functions (Clark, 2013; Friston, 2010; Hohwy, 2014). It has recently
253 been used as a theoretical framework for studying mental illness in computational
254 psychiatry. The predictive brain tries to minimize prediction-errors that result from
255 (mis)matching between top-down predictions and bottom-up sensory information.
256 Brain instantiates a hierarchical probabilistic model of the environment called the
257 *generative model*. An agent gives more or less precision to either prior beliefs or current
258 sensory evidence (prediction errors) depending on how reliable (or “precise”) they
259 estimate each to be. Perceptual and active inference should not be distinct strategies
260 for minimizing prediction-error, but as “parts of a single process of readying the
261 organism to act in such a way as to improve its” (Bruineberg et al., 2018, p. 2430).

262 Bruineberg et al. show that, contrary to the orthodox Helmholtzian picture that
263 Hohwy and Clark assume, the brain is not an exemplary scientist and that this under-
264 standing of perception is incompatible with predictive coding under the free-energy
265 principle. The Helmholtzian interpretation of the anticipating brain postulates a strict
266 border separating the organism from the environment. This conflicts with the free
267 energy principle in which the brain is within a larger coupled system with the environ-
268 ment. Bruineberg et al. argue that such internalist and representationalist interpretation
269 is not supported and that an enactivist and ecological interpretation should be endorsed
270 instead. Active inference of FEP is incompatible with *unconscious inference*, which is
271 at the centre of the Helmholtzian view.¹⁴ The structure of the generative model does not
272 have to be representational. The generative model does not provide representation but
273 guides interaction with the environment to make a healthy brain-body-environment
274 system possible. In Bruineberg et al.’s non-representational interpretation, the gener-
275 ative model is viewed as a dynamical system of (patterns of action-readiness; a
276 multiplicity of simultaneous and coupled) states of *action-readiness* that are sensi-
277 tive to environmental affordances (selective openness) accessible in the landscape
278 of affordances (Bruineberg et al., 2018, pp. 2439–2440) (it is “a system of multiple
279 interacting states of action-readiness” 2018, p. 242). The states of action-readiness
280 shape the prominence of solicitations in the environment and allow tending towards
281 the optimal grip.

282 The generative model prepares the agent for actions that improve the grip on affor-
283 dances in a particular situation. States of action-readiness are states of the organism
284 that, according to sensory states and skills/capacities, make it ready to attain a grip
285 on the situation (Bruineberg & Rietveld, 2014; Bruineberg et al., 2018, p. 2421). In a
286 typically developing organism that develops its skills, the generative model becomes
287 more (attuned) to the relevant affordances of the changing environment (growing open-
288 ness). With their concept of the tendency towards an optimal grip, Bayesian notions of
289 precision and uncertainty are reinterpreted as constrained by the free energy principle.

¹⁴ One of the anonymous reviewers has remarked that Helmholtz, in all likelihood, would have been congenial with an enactivist interpretation of unconscious inference, especially when one takes into account his careful considerations of active vision. I thank the reviewer for this comment.

3.2 Healthy attunement

In predictive processing, mental health is understood in terms of the goodness of the agent's generative model. In SIF's non-representational interpretation, the generative model is viewed as a multiplicity of simultaneous and coupled states of action-readiness sensitive to some affordances (selective openness) accessible in the landscape of affordances (Bruineberg et al., 2018). According to the predictive processing framework, we find abnormal beliefs about the world in psychopathology because agents use "suboptimal generative models" (Miller et al., 2022, p. 17).

Now, this needs to be qualified because, technically, there are no suboptimal models from a Bayesian perspective (due to the complete class theorem). Suboptimal here reduces to some prior beliefs within a generative model that are not suitable for the current situation, niche or world-generating sensations. In the case of autism, the priors in question are priors over the precision afforded sensations. Nevertheless, a failure of active inference may lead to aberrant learning and, eventually, generative models, in the wider sense, that are not fit for purpose.¹⁵ To be more precise, it is the agent's behavior that is suboptimal or maladaptive "suboptimal modes of engaging with their environment".¹⁶ I will explain in what ways autistic behavior diverges from healthy attunement in connection to bodily normativity in Sect. 5.

It is argued that *metastable attunement* (Bruineberg et al., 2021; Miller et al., 2022) provides conditions for well-being because agents that balance between order and disorder, known and unknown (to the edge of criticality, attain a balance between stability and instability, they are open, ready to seek new ways, skills. Metastable attunement is a notion that is grounded in ecological dynamics and phenomenology. There is a positive or negative *felt* character of affect if the agent is doing better or worse than expected at error reduction. This dynamical state of being metastably poised is what they call the state of "metastable attunement".¹⁷

"Such an agent will continually make progress in learning, growing and broadening their field of relevant affordances, which will, in turn, increase their confidence in managing unexpected volatility as it arises over the whole of their lives." (Miller et al., 2022, p. 24). This way, the generative model develops and can optimally manage environmental volatility in the long run. Management of volatility is crucial to maintaining a state of well-being of the organism.

Abnormal beliefs can come from *aberrant precision estimation* (Miller et al., 2022, p. 18). Giving too much or too little precision to prediction errors results in abnormal beliefs and a suboptimal generative model. In the case of autism, it is hypothesized that too much precision is assigned to prediction errors and sensory perturbations. Let us discuss in detail the exact way in which autistic generative models are suboptimal.

¹⁵ I thank the anonymous reviewer for pointing out that this needs to be qualified.

¹⁶ Here are two quotes that clarify suboptimality. Schwartenbeck et al. say: "In short, characterising the generative model underlying suboptimal behavior provides a principled approach to understanding the origins of maladaptive behavior as well as the diverse computational phenotypes that present similar 'symptoms'" (2015, p. 116). Corlett and Fletcher point out that: "Psychiatric illness and distress might be considered in terms of a failure to achieve this optimum interaction, and the challenge faced by computational psychiatry is to identify and quantify this suboptimal state" (2014, p. 401).

¹⁷ Recall what being healthy means in terms of bodily normativity, as explained at the end of Sect. 3.

327 4 Predictive processing in ASD: precisely situated individuals

328 4.1 Prediction error minimization in ASD

329 Predictive processing accounts of ASD point to problems in estimating precision
330 (Pellicano & Burr, 2012; Van de Cruys et al., 2014). In this disorder, “too much
331 precision is given to prediction errors relative to prior predictions”, it is claimed, and
332 autistic persons depend heavily on current sensory information and less on prior beliefs
333 (Miller et al., 2022). Autistics give too much weight to novel sensory evidence and
334 cannot attune to stable regularities (Karvelis, et al., 2018; Kirchhoff & Kiverstein,
335 2020; Lawson et al., 2014; Palmer et al., 2017).

336 According to the HIPPEA (“high and inflexible estimation of precision of predic-
337 tion errors”) theory (Van de Cruys et al., 2014), autistics designate atypically high
338 precision to bottom-up prediction errors and have trouble adapting to environmental
339 uncertainties, which leads to a restricted focus in perception and demand for sameness
340 and stereotyped behavior. These are strategies they resort to in order to cope with a
341 significant amount of prediction error in an attempt to make the sensory environment
342 more predictable (Constant et al., 2018a, 2018b, p. 614). In the case of autism, even
343 slight noise will induce learning, which leads to overfitted models that do not general-
344 ize to new inputs. In the vocabulary of predictive processing, autism is characterized
345 by “high and inflexible estimation of precision of prediction errors”.

346 The same demand for predictable sensory experience can be witnessed in Temple
347 Grandin’s case with her sense of touch since she built a mechanical body squeeze
348 machine for these purposes (Edelson et al., 1999; Van De Cruys et al., 2014). According
349 to HIPPEA, “actions that reduce these prediction errors to extreme minima should be
350 preferred (Van De Cruys et al., 2014, p. 660).” Autistic persons have to deal with
351 proprioceptive, interoceptive (related to the sense of self) and exteroceptive prediction
352 errors. In HIPPEA, these atypical behaviors are understood as ways of “regulating
353 excessive amounts of prediction errors”.

354 Concerning that, it has been noticed that these repetitive, *stereotyped* behaviors
355 decrease through development (Richler et al., 2010: cited in Van De Cruys et al., 2014),
356 although the demand for *sameness* even increases (Van De Cruys et al., 2014, p. 660;
357 Constant, Bervoet, et al., 2018, p. 617).¹⁸ This means that exteroceptive prediction
358 errors stay precise, which explains why autistics demand rituals and routine.

359 Vast amounts of stereotyping movements are needed to establish a sense of self.
360 Repetitive, rhythmic movements of the body, like hand-flapping, tapping objects,
361 vocalizations, or rocking movements, are referred to as “self-stimulation” or “self-
362 stims” (Leary & Donnellan, 2012, p. 51), and these could be “effective ways of
363 managing incoming sensory flows” (Krueger, 2021), autistic habits of mind, as they
364 call it. They argue that self-stims have a “norm-governed character”, something that
365 has not been noticed enough. De Jaegher notes that there is evidence that activi-
366 ties related to restricted interests and repetitive behaviors (“autistic sensorimotor and
367 affective particularities”) are related to pleasure and well-being, although they can be
368 socially unacceptable, and interfere with daily life and the social environment. They

¹⁸ “insistence on sameness” (Kanner, 1943).

369 seem to be “beloved activities apparently associated with great positive valence” (Klin
370 et al., 2007, p. 97; cited in De Jaegher, 2013, p. 10). This is witnessed in the qualitative
371 interviews by Mercier et al., (2000; cited in De Jaegher, 2013) on restricted interests.
372 Such activities can have salience and relevance for autistic persons, which should
373 be considered when dealing with them. In that case, there seems to be a possibility
374 of “converting them into acceptable activities” rather than just extinguishing them
375 (Mercier et al., 2000; Krueger & Maiese, 2018, p. 27; Boyd et al., 2012).

376 4.2 Niche construction in ASD

377 An ecological corollary of problematic precision estimation in ASD is a peculiar way
378 autistic individuals construct their econiche. It was proposed that predictive process-
379 ing can be used to model how niche construction influences evolutionary processes
380 (Constant et al., 2018a, 2018b). Niche construction comes from evolutionary biology
381 and designates a process whereby organisms modify their environment and steer their
382 evolutionary path (Laland et al., 2015; Constant et al., 2018a, 2018b, pp. 615–616).
383 In predictive processing, niche construction is viewed as a strategy of organisms for
384 minimizing prediction error through changes in the environment so that it conforms
385 to their expected states. Niche construction, thus, is a form of active inference under
386 the FEP.

387 The ecological niche functions as a meta-learning (“learning what can be learned”,
388 learnable sensory cues) mechanism (Constant et al., 2018a, 2018b, pp. 612–613).
389 It is argued that artifactually supported rituals can regularize behaviors and stabilize
390 expectations, improving predictability (Constant et al., 2018a, 2018b). The child needs
391 to perceive the affordance of things for others and herself in order to be socialized
392 (Constant et al., 2018a, 2018b, p. 619; Gibson, 1979, p. 141). They do not see solici-
393 tations that other people see in the environment; they perceive a small portion of the
394 rich landscape of affordances. Autistics do not join in the so-called *collective niche*
395 *construction*.

396 Precision estimation can be viewed within the context of cultural niche construction
397 (Constant et al., 2018a, 2018b). The ecological niche is a meta-learning mecha-
398 nism. It is argued that *cultural affordances* have a supporting role in estimating the
399 precision of incoming sensory inputs (Kirchhoff, 2018; Constant, Bervoets, 2018,
400 p. 616)—e.g., artifactually supported rituals, like religious ceremonies, increase envi-
401 ronmental predictability.¹⁹ Using the reports and experiences of autistic individuals,
402 Constant, Bervoets, et al. show that there is an “ecological counterpart” to their prob-
403 lems in estimating precision. Because of high and inflexible precision estimation, they
404 over-rely on the precision afforded by the environment. To sum up, due to the atypical
405 processing of prediction errors, autistics develop a learning style that does not attune

¹⁹ The ecological approach of Constant et al. (2018a) is complementary to the dialectical misattunement hypothesis (Bolis et al., 2017), embracing the intersubjectivist turn in cognitive science and autism research, and viewing ASD as a relational disorder, while the original PP theories (HIPPEA) viewed ASD individu-
alistically.

406 to the environment, and this produces a specific kind of scaffolding and behavioral
407 traits in autism (Bervoets & Kristien, 2020).²⁰

408 Constant, Bervoets, et al. use HIPPEA, because of its interpretation of the mecha-
409 nism of meta-learning and the role of actions in meta-learning “to leverage ecological
410 and embodied implications of PP to discuss aspects of the relational self in ASC”
411 (Constant et al., 2018a, 2018b, p. 612). Similarly, Perrykkad and Hohwy (2020) focus
412 on the disturbances of the autistic self based on Bayesian and predictive processing
413 accounts of autism. Both Constant, Bervoets, et al. and Perrykkad & Hohwy assume
414 the PP accounts of the self from cognitive neuroscience—those of Apps and Tsakiris
415 (2014), Limanowski and Blankenburg (2013). Again, for an *ecological and enac-*
416 *tive interpretation* of free energy and the self that follows such ideas, see Kiverstein
417 (2018). Self-model is a model of the agent’s selective engagement with affordances
418 (Kiverstein, 2018, p. 7). Through active inference (cycles of perception and action)
419 the whole organism regulates its own dynamical coupling to the environment so as to
420 sustain its operational closure across multiple levels of the organization (2018, p. 9).
421 Such systems are “self-specifying because of the systematic relation between sensing
422 and moving realized through the perception–action cycle”. They have both perceptual
423 states (sensorimotor integration) and purposive agency. This is not yet enough for
424 mineness (basic form of self-awareness). Kiverstein argues that in addition, we need
425 temporally thick self-models (Friston). Self-models must have temporal thickness for
426 subjectivity. His understanding of mineness supports a *relation theory of the self*,
427 because in an ecological and enactive interpretation of active inference, “the organism
428 and its environment are co-specifying, and co-determining.” (Kiverstein, 2018, p. 3;
429 Gibson, 1979, p. 4), the self and the other are co-determining.

430 5 Bodily normativity and autistic field of affordances

431 Predictive processing accounts indicate that in ASD too much precision is assigned
432 to prediction errors. These accounts of autism offer a detailed explanation, that has
433 ecological implications, on why the autistic self and autistic habits differ from those
434 of neurotypical individuals. According to the HIPPEA theory (Van de Cruys et al.,
435 2014), autistics designate atypically high precision to bottom-up prediction errors and
436 have trouble adapting to environmental uncertainties, leading to a restricted focus in
437 perception and demand for sameness and stereotyped behavior. In order to cope with
438 a great amount of prediction error, they resort to these strategies to make the sensory
439 environment more predictable (Constant et al., 2018a, 2018b, p. 614).

440 Autistics experience complex social environments as foreign and avoid natural
441 sensory niches that cannot be reliably predicted. To reduce uncertainty, they over-
442 rely on routinized behavior, strict habits, sameness, and a familiar environment—a
443 predictable ecological niche they construct. Although such individuals seem to be
444 pathologically embodied, with disordered bodily normativity, some autistic habits are
445 very environmentally responsive and adaptive. Such individuals instantiate suboptimal

²⁰ Van Es and Bervoets (2022), in their recent enactivist take on autism, construe ASD as a *sensorimotor atypicality* (“different autistic embodiment”).

446 generative models that fail to reach higher levels of abstraction and generality. In other
447 words, they build “overfitted” models.

448 In terms of social interactions and social environment, and this a core deficit, autistics
449 fail to respond to social affordances.²¹ In PP, narratives (self-models, sitting at the
450 highest levels of generative models) can generalize to many social contexts. Problems
451 and deficits of social interaction and intersubjectivity in ASD can also be modeled
452 through PP and active inference, for example, as done by the dialectical misattune-
453 ment hypothesis (Bolis et al., 2017). Constant, Bervoets, et al. describe “the other” in
454 ASD as less generalized, which means autistics have an overfitted model for social
455 responses to well-known environmental cues which will be very formalized (Constant
456 et al., 2018a, 2018b, p. 619).

457 I argue that in terms of SIF, autistic patterns of action-readiness pick out particu-
458 lar solicitations in the environment and achieve optimal grip only in well-known
459 situations and specifically constructed ecological niches. They make interventions in
460 the environment with reliable cue-effect relations. Autistic individuals lack the open-
461 ness (pathological embodiment) needed to be responsive to the relevant affordances,
462 pilling up inflexible habits and skills that are rigidly applied without adjustment to
463 the changing environment. Autistic persons favor social environments that increase
464 predictability through ritual behavior and routines. They use environmental cues as
465 scaffolding.

466 Since precision-modulation in autism is fixed and inflexible, when developing their
467 generative models, they will have difficulty gaining abstraction and with the alignment
468 of their model with other people’s models (problems with abstraction and flexibility).
469 In ecological-enactive terms, patterns of action-readiness only pick out very specific
470 solicitations in the environment. Moreover, the agent can only achieve some optimal
471 grip in these situations. When confronted with a different (sociomaterial) environment,
472 they cannot generalize and apply skills that they have acquired but in a very crude and
473 inflexible way.

474 Autistic individuals make interventions in the environment to make it fit their model
475 (active inference), with reliable cue-effect relations, in trying to attain optimal grip.
476 The autistic generative model is such that it does not allow the individual to maintain
477 a robust brain-body-environment system. They make special changes in the environ-
478 ment, organizing their own idiosyncratic affordances (i.e., autistic affordances) in the
479 landscape for their autistic field of relevant affordances. Only specific, very precise
480 affordances stand out for them in the environment, and their field of relevant affor-
481 dances (de Haan et al., 2013; Rietveld et al., 2018) is structured according to their
482 idiosyncratic skills and habits.

483 Autism is to be considered a *relational* disorder, in which there is a common atypical
484 way of “tuning in to the material world” (Constant et al., 2018a, 2018b; on tuning
485 into the intersubjective world see Bolis et al., 2017). If so understood as a relational

²¹ Kiverstein has construed empathy as responsiveness to social affordances. The empathic abilities of ASD persons are diminished, and their empathy is less direct (Kiverstein, 2015, p. 8). Applying his model of empathy to ASD, Kiverstein argues that autistic persons do not orient attention to the aspects of the environment that others see as important (because of “abnormal patterns of gaze fixation”) and thus have difficulty sharing perspectives with others (they are without those states of bodily action readiness that would direct them to shared aspects of the environment).

phenomenon, then the “intervention strategies should be tailored toward the creation of constructive environmental scaffolding” (Krueger & Maiese, 2018; Maiese, 2021, p. 57).

Now, what I want to claim is that if in the enactive approach, autism is understood as disordered sense-making (different forms of participatory sense-making or disordered patterns of sense-making), now, in the terminology of the enactive-ecological approach, autism can be seen as *disordered* (or *different*) *bodily normativity*.

A healthy agent constantly creates new bodily norms to answer environmental challenges by adding new skills and improving old ones. However, due to the aberrant weighting of sensory information, autistic people learn differently. For them, noise induces learning and creates overfitted models (Constant et al., 2018a, 2018b, p. 614). They have difficulties modelling regularities, which influences their bodily normativity, the sum of all skills and capacities. In the terminology of Miller et al. (2022), to be healthy, agents sometimes need to disrupt their habits and allow actions that would lead to a build-up of error and uncertainty. Autistics may only have local success in error reduction, which is not enough for achieving and maintaining the state of metastable attunement.

Autistics develop new skills, but these are very specific and overfitted; such skills are used for particular situations and cannot be generalized to other contexts. The rituals and routines of autistic people, their strict habits constraining the sensory space, map onto DSM-5 non-social criteria of stereotyped behavior and insistence on sameness. The HIPPEA (and related niche construction theories) can explain why stereotyped (self-focused) behavior decreases over time and insistence on sameness (and routines and rituals) persists and even increases. Another consequence is an overreliance on their own ecological niche (sensory environment) to reduce uncertainty.

Bodily normativity includes social skills, given how Toro et al. define it (2020, p. 6). In the social domain, interactions of autistic persons will be “highly formalized, conventional social responses to familiar environmental cues”, with “the other” being “less generalized” (Constant et al., 2018a, 2018b), which means that rituals and routines also reign in the social dimension of their bodily normativity. Interactions and norms in the social domain bear the same “autistic” mark as the material interactions due to the general problem of aberrant precision estimation.

It would be wrong to say that autistic bodily normativity is closed and inflexible; they do develop new skills, though not in the same way as neurotypicals. Autistic people can be pathologically embodied if the sociomaterial environment is inflexible and does not allow the individual to find her own skilled ways. This goes for the construction of their econiche, as well.

There is a cumulative, collective misattunement or lack of synchrony together with different interaction styles of autistic and non-autistic persons,²² meaning that generative models are non-aligned. Autistics more easily attune to the norms of other autistic people.²³ Because of the way autistic social interaction styles are, they attune better to other (autistic) individuals with the same kind of bodily normativity.

²² See footnote 7.

²³ See Bolis et al. (2021) for a study on interpersonal synchrony that corroborates this claim.

528 Autistic people have trouble phenomenally attuning to the norms of neurotypical
529 people (and their norm-regulated cultural practices) (Kirchhoff & Kiverstein, 2020).
530 This is a consequence of their aberrant weighting of sensory information. Due to
531 the problems with precision estimation, the development of bodily normativity of
532 autistic and non-autistic (neurotypical) people take disparate trajectories. What ensues
533 is a mismatch between autistic and non-autistic norms—a mismatch between autistic
534 bodily normativity (as a whole) and neurotypical bodily normativity. Neurotypical
535 people bring with them their “pre-established normativity” (Toro et al., 2020) that
536 conflicts with the skills and habits of autistic persons. Neurotypical people also lack
537 the skills to interact with autistic people. Therefore, the sociomaterial environment
538 should be more flexible to enable autistic people to develop new skills.²⁴

539 The bodily normativity of the ecological-enactive framework is equivalent to enac-
540 tivist sense-making. I think that if we are to stay in the spirit of the ecological-enactive
541 approach, we need to understand the mismatch as something that is present between
542 the bodily normativity of autistic and non-autistic people. No single dimension is dis-
543 ordered; we see differences across biological, psychological, and social domains. The
544 underlying mechanisms of predictive processing put meat on the bones of these basic
545 claims about bodily normativity; they show what is exactly different in the devel-
546 opment and acquisition of bodily norms in autism. The PP part of the SIF account
547 helps us understand why and in what way autistic people have trouble attuning to their
548 sociomaterial environment.

549 The present account’s novelty is viewing autism from the EE perspective through
550 the lens of notions like bodily normativity and the field of affordances. We could
551 summarize that autistic bodily normativity is mostly fixed, inflexible, and with slow
552 development. Based on different types of affordances and how the world and self
553 are modeled in PP, we could make a distinction between forms of bodily normativity
554 that concern the *material*, *social* and *self-related* (toward one’s own body) skilled
555 actions. These are all interconnected, and autistic differences seem to span all domains.
556 Although differences in social normativity are most prominent, they are present in
557 the material and body(self)-related normativity. As it was pointed out, self-related
558 normativity, with stereotyped behavior, can lose its rigidity over time, while strict
559 habits and routines do persist (and multiply) in material and social normativity. How
560 norms and habits are formed and applied in skilled action in autistic persons is markedly
561 different from the skills of non-autistic, neurotypical people.²⁵

562 A closely related notion to bodily normativity is the field of relevant affordances. A
563 field of affordances is the expression of autistic bodily normativity. In psychiatric dis-
564 orders, the person’s field of affordances is altered. “Disordered sense-making discloses
565 an altered field of relevant affordances” (de Haan, 2020, p. 218). There is no before
566 or after autism, and a question could be posed: is autism to be considered a disorder
567 in the first place? In de Haan’s terminology, this would be to claim that sense-making
568 in autism is not just disordered but utterly different sense-making (de Haan, 2020,

²⁴ Corlett and Fletcher, in their discussion on computational psychiatry, recognize that even the smallest changes in information processing can have catastrophic consequences but add that “many junctures exist at which intervention might be possible” (2014, p. 401).

²⁵ I thank the anonymous reviewer for pushing me to flesh out the dynamics of autistic bodily normativity in more detail and to distinguish different forms of bodily normativity.

p. 204). Some think that we can speak of a whole autistic landscape of affordances different from the neurotypical affordance landscape. I find that such a claim is too strong.²⁶

In the end, what needs to be pointed out is the following: autistic persons experience very restricted fields of relevant affordances, a limited range of affordances with which they engage, lacking the openness needed for well-being and healthy attunement to the environment. Three dimensions of the field of affordances have been distinguished (de Haan, 2020; de Haan et al., 2013): width (“broadness of the scope of affordances”), depth (temporal aspect), height (salience of affordances, characterized by their “intensity of the relevance” and “affective salience”). When all said is considered, it appears that autistics have a narrow field, shallow temporal depth,²⁷ with great intensity and affective salience of those affordances that do come up in their field.

6 Concluding remarks

Finally, and based on the discussion so far, I want to put forward some suggestions for a more inclusive landscape of affordances for autistic individuals. How should we help autistics learn new skills and habits and attune in a more robust way to the sociomaterial environment? Could this be done by designing “rich and attractive landscapes of affordances” that promote creativity and learning (so-called “metastable zones” of Bruineberg et al., 2021, p. 12,836) or by providing them with adequate environments that give stability and reduce uncertainty?

Contemplate this field note by psychologist Sophie Boldsen that describes a trip to a museum of rock music (Roskilde, Denmark) by an autistic women’s group.²⁸ The women first move through a funhouse-like sensory space that is filled with loud noises and screams, lights, and mirrors, which are too invasive for the women. One of them is “sitting down on a platform, crouched together and covering her ears with her hands”. Later they come to a large room with a rotating LP record on the floor. They lie down on the rotating LP record, and the music and motion calm them down. “We lie still and

²⁶ In the case that autism can be considered a form of life for itself, then we would be in a position to claim that there is a different autistic landscape of affordances (cf. Catala et al., 2021). It would be a very desolate landscape of affordances. See Chapman (2019), who argues for a Wittgensteinian account of autism as a different form of life. They propose an account of epistemic injustice, epistemic agency, and epistemic disablement in autism based on this ecological-enactive model of disability and enactivist cognitive science. They talk of an autistic landscape of affordances.

²⁷ Let me explain the temporal depth claim a bit further. Temporally thick self-models concern the depth of prior beliefs about the enactable future, namely, prior beliefs about the consequences of committing to this or that plan of action (where prior beliefs are read in a strictly Bayesian sense, e.g., subpersonal). These kinds of prior beliefs are agential and pertain to the self. However, they are still just prior beliefs and will be subverted if held with unduly low precision or (subpersonal) conviction. This is precisely the pathology induced by overly precise sensory precision (i.e., imbuing the likelihood part of the generative model with too much precision). The pathology of precision that accounts for ASD necessarily shrinks the depth or time horizon of any planned interaction with the world (or body), whether these plans are in the interoceptive or prosocial domains. I thank the reviewer for providing valuable comments on the temporal depth of self-models.

²⁸ This is taken from Boldsen’s fieldwork in a social group for adolescents and young adults with autism. This part describes how one of the women, Eva, reacts to the environment of the museum.

596 listen together for a while, and it is like not only the music, but everything has slowed
597 down. Eva smiles. “This is a great sensory reset”, she says. We feel the slow rotations
598 of the LP record and chat a bit more about the music playing” (Boldsen, 2021, p. 32).
599 The LP record helps them attain a “sense of togetherness”, Boldsen explains. These
600 social encounters and interactions are happening within a certain sensory space, and
601 this should be considered. The particular surroundings seem to present a pleasant and
602 appealing landscape of affordances for the group of autistic women.²⁹ Here we can see
603 a clear case of ecological disturbances in autism, but also an example of some of how
604 situating these individuals in an appropriate environment (with positively valenced
605 affordances) can be enabling for autistics, providing less volatile sensory space and
606 even facilitating better social interactions (at least within a group comprised of autistic
607 individuals).

608 Krueger and Maiese note that high-functioning autistic persons enjoy better inter-
609 actions with *other ASD people*. “This is because their interactions with other people
610 with ASD take place within mental institutions governed by ASD-friendly norms
611 and expectations.” (Krueger & Maiese, 2018, p. 29; Kirchhoff & Kiverstein, 2020;
612 Schilbach, 2016). In this regard, and in line with predictive processing theories of
613 autism, both the ecological approach and the dialectical misattunement hypothesis
614 emphasize that autistics are after a decrease of uncertainty in the sensory environment
615 and social interactions. Predictable interactions with others are then favored. It would
616 seem that autistic persons are more easily attuned to other autistics, as their behav-
617 ior is more predictable (see Bolis et al., 2021). Therefore, I think that future autism
618 research should focus more on social interaction between autistics themselves, not just
619 with neurotypical people. Autism research could benefit from the addition of ethno-
620 graphic methods to phenomenological research through which one can investigate
621 social-spatial-temporal fields of interacting bodies, given that all social interactions
622 are situational (Boldsen, 2021; De Jaegher et al., 2017).

623 It seems pertinent that we try to understand the exact nature of the autistic fields
624 of affordances,³⁰ which I have pursued in detail in this article. It is my strong con-
625 tention that understanding the autistic responsiveness to affordances can help us in
626 achieving better and more appropriate designs of attractive landscapes of affordances
627 that promote actions from autistic persons (e.g., through the arrangement of “place-
628 affordances”). Like in the museum example, by restructuring the available affordances
629 in a place, it could be possible to generate behavioral change in these subjects (*field*
630 *of promoted actions*, Reed & Bril, 1996; Bruineberg et al., 2021, pp. 12834–12836).
631 I find that such modifications in the landscape of affordances could enable autistic
632 individuals to adopt new norms of bodily normativity and be more open to engaging
633 with the environment. If autistic repetitive movements, habits, and restricted interests

²⁹ Boldsen utilizes Merleau-Ponty’s phenomenological notion of *milieu* (Merleau-Ponty, 1945/2002, 2010) to clarify how social interaction is not just embodied but also “material and situational”. The *milieu* is described as a *field of forces* (Merleau-Ponty, 2010, p. 346), and “milieu is not merely a material space that contains bodies but a field of potentiality within which body and world emerge” (Boldsen, 2021, p. 35). There is a clear similarity and close connectedness of this notion with phenomenological notions mentioned earlier—Fuchs’s *lived space* (which has field forces towards affordances) and SIF’s *field of affordances*.

³⁰ The skills and habits the agent has developed are what explains why certain affordances in the environment stand out and are inviting for action, and other affordances are not (Bruineberg et al., 2021, pp. 12824–12825).

634 are not something that can be (or should be) eradicated, a suitable ecological design of
635 affordances should accommodate them. In line with the integrative approach to autistic
636 disturbances that I have been defending, it seems that embracing and maintaining
637 meaningful, structured routines and habits could be a way for autistic persons to control
638 their lived experience and a helpful resource for their creativity and well-being.³¹

639 I have proposed to view ASD through the lens of SIF, a framework that integrates
640 insights from phenomenology and ecological-enactive cognitive science. The ecological-enactive
641 approach to ASD, together with the predictive processing paradigm, can show how the sociomaterial
642 environment is to be changed in order to become more attuned to the bodily normativity of autistic
643 persons and even therapeutic so that their disability can be transcended.³² I have presented only a sketch of an
644 ecological-enactive account of autism in terms of affordances, and future work is to be dedicated to
645 properly developing this integrative approach to ASD.

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³¹ Activities like swimming and collage, for an autistic woman Penelope Dunbar. On how structured routine with clear narrative purpose can help autistic individuals, see Delafield-Butt et al. (2022).

³² Following in the ecological and enactive theories of Fuchs (2007, 2019), and the SIF (Rietveld et al., 2018), in other work (Nešić, Subotić & Nurkić, *manuscript*), we discuss social environments that increase predictability through ritual behavior and routines (e.g., religious communities) and which could prove to be beneficial for people with ASD. We argue that a monastic environment can be regarded as providing shelter for autistic individuals, as witnessed in the historical case study of Hildegard of Bingen (c. 1098–1179).

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