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CULTURE AND TRANSITIONS IN INDIVIDUALITY

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Several biologists and philosophers have been arguing, for a while now, that a Darwinian evolutionary dynamics might take place not only in the distribution of phenotypic traits in a particular kind of population, but also in the very dimensions that are used to track those, bringing about new kinds of populations, given certain special circumstances. These “major” evolutionary transitions have sometimes been described as transitions in *individuality*. In this depiction, natural selection (maybe combined with other causes) often brings about new kinds of individuals, whose evolutionary dynamics takes place in a novel way. This topic became a big concern since the groundbreaking works of Buss (1987), Maynard-Smith and Szathmáry (1997), and Michod (1999). Godfrey-Smith’s 2009 book follows this trend by emphasizing that “evolutionary processes are themselves evolutionary products” (2009, 15). One of the chief thesis he puts forth, by pushing population thinking even further, is that a transition in individuality is fully accomplished when a new, “paradigmatic”, Darwinian population emerges. In collective entities, where there are nested populations embodied in one individual, the higher and the lower level populations follow different evolutionary paths during a major transition: the latter ones usually change their Darwinian status from a “paradigmatic” to a “marginal” one. This process of “de-Darwinization” of the lower level populations - as Godfrey-Smith describes the evolutionary transition taking place at that level (Ibid., 100) -, can be tracked by significant changes in the values of a set of parameters that describe their evolutionary dynamics or “evolvability” (Ibid., 41). The process of de-Darwinization of the populations of cells that make up multicellular organisms is a well-known case. In this paper, I want to investigate whether it is fruitful to describe the role that culture begins to play at some point in the Hominin lineage - arguably that of the emergence of a new inheritance system on top of the genetic inheritance system and coevolving with it -, as being a transition in individuality.

1. Representing Darwinian Dynamics

Godfrey-Smith criticizes, in his book, previous attempts to give an abstract “summary” of the essential elements that are required for describing evolution in Darwinian terms (2009, 17). His way to open a new trail in what he calls the

“classical approach” is to start with a “minimal concept” of a Darwinian population - which just requires that there be variation in the traits of individuals in a population that affect their reproduction and that part of this variation be heritable.¹

The ‘minimal concept’ - associated with a “kind of change”, evolution by natural selection - is permissive and includes much more than the paradigmatic cases of Darwinian populations (Godfrey-Smith, 2011, 67). To avoid the pitfalls of those attempts in the classical tradition, he aims to describe not only the purportedly paradigmatic cases of Darwinian populations, but also go into the marginal cases, that don’t have all the features of the former ones. The particular way a kind of population located in this spectrum evolves depends on further features that are not specified by the minimal concept, requiring new parameters to describe its dynamics. In other words, the minimal concept provides just a “set up” and has to be complemented with “middle-level” theories or models to take into account the diversity of living beings and, more generally, of systems whose dynamics can be fruitfully described in populational-Darwinian terms (Ibid., 39; cf. 31).

Starting with the minimal concept as a scaffolding, Godfrey-Smith proposes a “spatial” representation in which the chief features of Darwinian populations, concerning their evolvability, are quantified in order to tell paradigmatic from marginal cases. This representation is also used to depict evolutionary transitions as well, as being trajectories in that space. Different kinds of Darwinian populations, associated with different kinds of individuals, are located in different places in the *Darwinian hyperspace* (as I will, henceforth, be calling this representation) given the values these populations score in a set of parameters that are briefly described below:

H - fidelity in inheritance

C - continuity²

S - relationship between fitness and intrinsic properties

V - abundance of variation

α - reproductive competition³

Besides those, Godfrey-Smith emphasizes the relevance of three reproduction-related parameters (see Figure 1), summing up an eight-dimensional hyperspace:

B - bottleneck

G - reproductive specialization of the parts in a collective entity⁴

I - overall integration of the collective entity

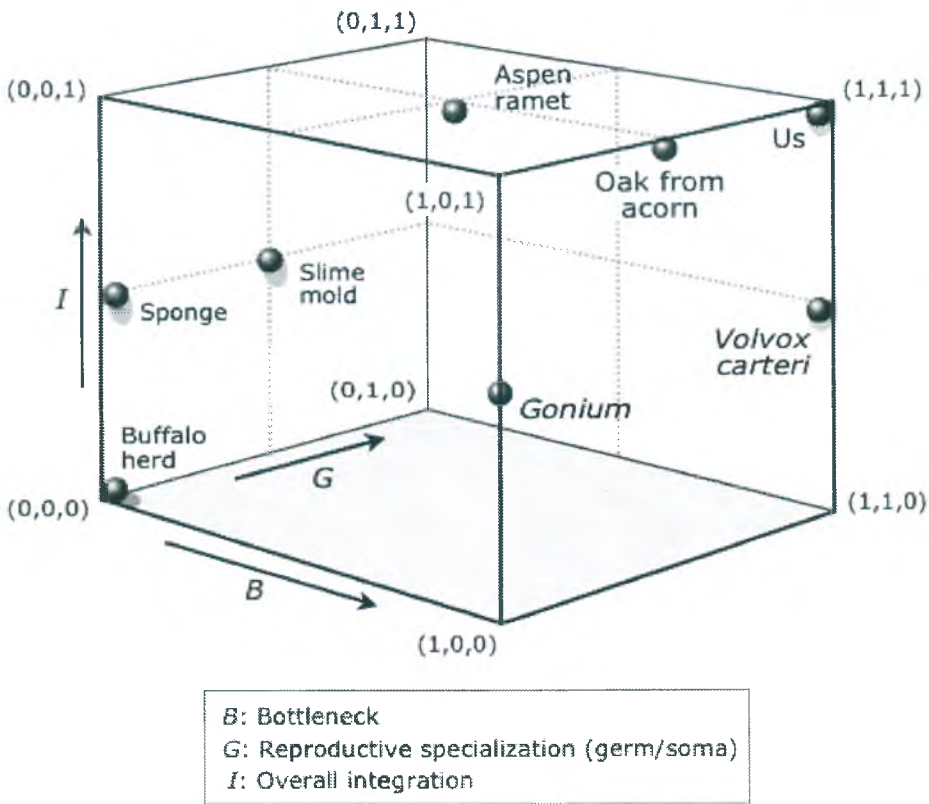


Figure 1: The Darwinian hyperspace with just three dimensions representing the reproduction-related parameters B, G and I. Several organisms are located in this space given their coordinates along these dimensions (From Godfrey-Smith, 2009, p. 95).

In the framework proposed by Godfrey-Smith, Darwinian populations have ontological priority, so to speak, vis-à-vis Darwinian individuals: “...the population-level concept comes first” (2009, 6). Therefore, any attempt to apply those parameters to track possible transitions in individuality associated with cultural change has first to address the question about what kinds of Darwinian populations might exist in this domain. This is the main topic of the next section. Afterwards, I will evaluate if it is fruitful to apply Godfrey-Smith’s representation for telling paradigmatic from marginal Darwinian populations in cultural evolution.⁵

2. Darwinian Populations in the Cultural Domain

Godfrey-Smith argues that there are “several ways” in which *Darwinian* populations can be represented in the cultural realm (2009, 151). He distinguishes

two “options” I will be naming in this paper ‘BP’ and ‘CP’. They are first presented in an ‘individualistic’ way (BP_i and CP_i). Godfrey-Smith suggests that there are also group-level descriptions (BP_g and CP_g) of Darwinian populations in this domain (see Table 1): “... we have two cross-cutting distinctions, one concerning the type of thing that makes up the population, and hence the associated notion of reproduction, and the other concerning the level at which the population exists” (Godfrey-Smith, 2009, 151).

Level \ Type of thing	Individualistic	Group-level
BP (biological)	BP_i - agents having cultural phenotypes	BP_g - groups having cultural phenotypes
CP (cultural)	CP_i - cultural variants (memes)	CP_g - cultural variants' bundles (memeplexes)

Table 1- Darwinian populations in the cultural realm

Individualistic descriptions

BP_i) In this option, the population is made up of “ordinary biological individuals” with different *cultural phenotypes*. Reproduction in this case is ordinary biological reproduction:

“When people reproduce, their offspring often resemble the parents with respect to these features, as a consequence of teaching and imitation (...) It is not a *new* application of the theory, in fact, but an ordinary one” (Godfrey-Smith, 2009, 150).

As far as inheritance is concerned, in the BP_i case we have just vertical transmission of cultural variants (or memes, if you like), through teaching and imitation.⁶

CP_i) In the second individualistic option, cultural variants themselves make up a (Darwinian) population. In the previous BP_i option, the population is made up by *the bearers* of cultural variants. Here, cultural variants themselves make up the focal population and there is replication of cultural variants. I will come back later to the modality of reproduction associated with a CP_i -like population.

Group-level descriptions

The “two options” previously described are individualistic in character but Godfrey-Smith makes explicit that there are group-level populations, as well, of biological and cultural “types of things”:

“It could be argued that human groups have cultural phenotypes that are transmitted to offspring groups (...), or that group-level cultural variants

themselves (such as forms of political organization) may make up a pool of reproducing entities” (Godfrey-Smith, 2009, 151).

We end up with four kinds of populations in the cultural realm: at an ‘individualistic’ level, the populations are either composed of biological individuals (agents, for short) with cultural phenotypes (BP_i) or made up by the cultural variants themselves (CP_i). At the group-level, either groups of agents with different cultural phenotypes (cultural groups, for short) make up the population (BP_g), or bundles of cultural variants (something akin to what memeticists call “memplexes”) themselves constitute the population (CP_g).

One might ask whether the kinds of Darwinian populations in each of the four cases (BP_i , BP_g , CP_i , CP_g), admitting individualistic and group-level descriptions, are paradigmatic or marginal. To address this question we should locate each case in the proposed Darwinian hyperspace.

In the following, I will focus on the BP_g case. The chief question I want to address is whether this group-level population is paradigmatically Darwinian or just marginal.

After presenting the BP_g option, Godfrey-Smith mentions Henrich and Boyd’s 1998 paper on the role played by a conformist bias in human evolution. I highlight this reference here because this transmission bias will be discussed at length in this paper.

The BP_g kind of Darwinian population is central to Richerson and Boyd’s theory of human evolution, a particular brand of gene-culture coevolution theories. My bet is that their “dual inheritance” theory helps to shed light on some of the topics Godfrey-Smith addresses in his book, related to cultural evolution. And the other way around: Godfrey-Smith’s way to represent transitions in individuality as trajectories in an abstract Darwinian hyperspace helps to develop further some aspects of Richerson and Boyd’s theory.⁷

3. How is BP_g Located in The Darwinian Hyperspace?

Taking for granted the conceptual framework presented above, I want to put forth once more the chief questions I will be addressing in this paper: Might human groups with different cultural phenotypes be Darwinian individuals? Do we have in BP_g a paradigmatic or a marginal Darwinian population?

To tackle these questions, we must apply Godfrey-Smith’s procedure, that is, we must locate the BP_g population in the Darwinian hyperspace, by roughly indicating its *coordinates* along the eight dimensions presented above. This is a much bigger project than I will be able to accomplish in this paper. I will focus here on just a few of those parameters (and point to some relationships between them) and look at how cultural groups fare in these dimensions of the Darwinian hyperspace.

De-Darwinization in BP_g

The parameter V measures the *abundance of variation* in a population. How much variation, and of what kind, is required to fuel an evolutionary dynamics at the level of *groups* of a BP_g type? Since we are dealing here with collective entities, we have to look also at how the population *inside* each group fares regarding the V parameter. In the human case, at least, the relevant lower level population is made up of agents exchanging cultural information in a social network. How abundant is the variation at this lower level, compared to the variation we find in the population of cultural groups?

If we take as a model the already mentioned case of multicellularity, there is a suppression of variation at the lower level population of cells that make up the organism: they are very similar in their intrinsic, genotypic properties.⁸

In the case of collectives, Godfrey-Smith describes an evolutionary transition as a combination of processes taking place simultaneously in nested populations, at several levels, that constitute the new individual. The evolutionary trajectory that represents the emergence of a new paradigmatic Darwinian population at the level of *collectives* in the hyperspace, and the simultaneous trajectory taken by the population of *members* of these collectives run in opposite directions.

Using Godfrey-Smith's expression, those members are "de-Darwinized" in different aspects, including V . In other words, in a major transition, the lower level population usually changes its status from paradigmatic to marginal when the transition concludes.

Reasoning the same way in the case of a population of *agents* making up a cultural group, we should expect that this population is, to some extent, de-Darwinized in the transition towards a paradigmatic Darwinian population of cultural *groups*.

If we focus on the parameter V , when an evolutionary transition is achieved the population of group-member agents displays less variation (in the agent's intrinsic properties), compared to the population of cultural groups.⁹

Why should we expect de-Darwinization of the lower level population when it comes to group-level phenomena? There is always the risk of subversion, by free-riders, of the cooperation and division of labor that maintains the integrity of the group (Godfrey-Smith, 2009, 101; 123). Therefore, mechanisms for leveling the fitness of altruists, on the one hand, and the fitness of selfish agents, on the other hand, have to be put in place for cooperation to be preserved.

Furthermore, variation at the group-level should be enhanced and kept (despite migration etc.) for group selection to have strength, at the same time that (behavioral) variation inside the groups has to be suppressed.

What is at stake is the intensity of selection at the cultural group-level, which arguably has been non-negligible in human evolution at least. In Richerson and Boyd's dual inheritance theory for human evolution, psychological biases like conformism play a central role in suppressing variation inside each cultural group, at the same time that these biases increase variation between these groups and

maintain this variation along the time. These processes, going on simultaneously at both levels, would achieve a transition towards a Darwinian population of groups with different cultural phenotypes (BP_g).¹⁰

We are touching here upon the problem of the evolution of cooperation, also discussed by Godfrey-Smith (2009, p. 115;163-4). What would be the analogues, in the cultural domain, of the ways of avoiding subversion we find in the biological domain?

We know that just kin selection and reciprocal altruism are not enough to support cooperation in groups whose members are not genetically-related and/or in large groups.¹¹ Richerson and Boyd point, therefore, to other mechanisms of “variation suppression” (to use Godfrey-Smith’s expression): moralistic aggression and symbolic markers. Through these mechanisms, cultural groups score higher values in the parameter V and selection at the group-level becomes stronger. By the same token, cultural groups achieve a tight integration, that is, they score higher values in Godfrey-Smith’s parameter I .¹²

How could those mechanisms for promoting cooperation in human groups have evolved? Even though this question will not be thoroughly addressed in this paper, I will say a few other things on the role of transmission biases in the next section.¹³

4. Rules for Updating Behavior and Darwinian Populations

In the chapter on “Cultural evolution” of his 2009 book Godfrey-Smith engages himself in modeling the dynamics of a population of behaviors when a particular rule, among several possibilities, is followed by the agents for updating their behavior (2009,159-60). He investigates, especially, the evolutionary implications of the following rules that might be used in this context: ‘imitate your best neighbor’ (IBN), ‘copy the common’ and ‘best response’.

An agent that follows the IBN rule looks around his or her neighbors (in a local interaction) and compare their behaviors for their payoffs; the agent then chooses to imitate the behavior that gets effectively the highest payoff. A best response rule is “smarter” than IBN since the agent not only looks around for her neighbors actual behaviors but is able to find out what would have been the most appropriate behavior given their circumstances. The agent embraces the behavior that, in Godfrey-Smith words, “would have been the most appropriate overall response to the behaviors produced by the individual’s neighbors on the previous time-step” (2009,157).

The ‘copy the common’ rule is a kind of conformist rule: the agent imitates the behavior that is more common among those to which it is exposed.

Godfrey-Smith argues that IBN can support a Darwinian dynamics in the population of behaviors, but not the ‘copy the common’ rule. His argument is based on two assumptions:

- 1) IBN is success-driven but not conformism. After all, in the first case the agent imitates the behavior that gets the highest payoff among those to which it is exposed. An agent that conforms is not, for whatever reason, in a position to evaluate the payoffs of the behaviors to which it is exposed, since the most common behavior is not necessarily the fitter one given the circumstances.¹⁴ If we accept this assumption, IBN would be a “smarter” rule than the copy the common rule.
- 2) If the agents in the population follow the ‘copy the common’ rule, then we can’t expect a Darwinian dynamics in the population of behaviors, since the behaviors that are imitated by the agents do not have single ‘parent’ behaviors. This rule does not give rise, therefore, to a lineage of behaviors: “... any given behavior will not have a single ‘parent’ behavior on the previous time-step” (Godfrey-Smith, *ibid.*, 157).

He argues that if the IBN rule is followed instead by the agents,

“A particular instance of a behavior might, through successive events of imitation, be the ancestor of a branching tree of descendant behaviors, spreading through the population. Each behavioral instance is transitory, but if successful it may be causally responsible for other behaviors of the same kind. Behaviors themselves in this system are replicators” (*Ibid.*, 157).

Godfrey-Smith concludes, assuming (1) and (2), that a conformist rule cannot give rise to a Darwinian change in the pool of behaviors themselves (*Ibid.*, 160).

In what follows, I will object to the first assumption of the argument reconstructed above. I will not address the second assumption, since I have not much to say about reproduction and inheritance in this paper, despite their indisputable relevance in demarcating different kinds of populational dynamics.

Another perspective on behavior updating rules

In his discussion of various rules for updating behavior, Godfrey-Smith is clearly focusing just on what I have called the CP_i case (see Table 1), that is, on the effects of following a particular rule in the dynamics of a population of behaviors (or, else, on the population of cultural variants that cause these behaviors). There is, however, another perspective that can be taken into account when addressing the evolutionary effects of following these rules, by changing the focus to the BP_g case instead. What is now at stake is the evolutionary dynamics of a population of *groups* with different cultural phenotypes, whenever a particular rule is followed by the *members* of those groups.

So that groups with different cultural phenotypes make up a (less marginal) Darwinian population, the agents that are members of these groups should follow a conformist rule, contrary to Godfrey-Smith’s own expectations. I anticipated the argument supporting this thesis in the last section: a conformist rule leads to higher values of V for the population of cultural groups.

Furthermore, I suspect that the effects of the IBN rule on the dynamics of behaviors *internal* to a particular cultural group might endanger its cohesion, which is not the case if the copy the common rule is embraced by the agents.¹⁵ In other words, an IBN rule might lead to higher values of V in the population of *group-member* behaviors, whereas the copy the common rule obviously favors a lower V for this population.

At the same time, I argued before that a conformist rule for updating behavior conveys higher values of the parameter V for the population of *groups* (that is, this population becomes more diversified as far as culture is concerned). As a consequence, they become more isolated from each other, since cultural variation builds up barriers for migration (language is very effective in this regard). In addition, this situation enhances the strength of selection at the group-level, as I had the opportunity to emphasize before.

In other words, following a copy the common rule de-Darwinizes the group-member's population, as far as the abundance of behavioral variation is concerned.¹⁶ A conformist bias - and maybe other biases too, besides enforcement mechanisms such as moralistic aggression -, might also reduce reproductive competition among the members of a particular group: this population scores a lower value in the parameter α .¹⁷ Therefore, we have the conditions for a more cooperative interaction between the members of a particular cultural group. Competition switches from the level of group-members to the group-level population, where V is higher. By the same token, we should also expect a stronger selection at the cultural group-level whenever a conformist bias shapes social learning at the lower level of group-members.

Godfrey-Smith (2009, p. 157-8) makes it clear that models which address behavior updating rules, such as those built by Skirms, are attempts to simulate the conditions under which cooperation could have evolved. The group-level BP_g point of view I am suggesting in this section, points to a scenario in which a conformist bias is one of the chief elements that favored the evolution of cooperation in human cultural groups. Richerson and Boyd, among others, offered reconstructions along these lines, as I mentioned before.

Concerning the issue of the evolution of rules for updating behaviors, Godfrey-Smith says in passing:

“So evolution can build agents who use social experience to influence their choices in a number of ways. It is a striking fact that some of these ways, including IBN, can generate a new Darwinian population in the pool of behaviors themselves. But evolution may or may not build such agents. And it may build them initially and then build something beyond them - suppose biological evolution produced a sequence of successively “smarter” rules in a population: first copy-the-common, then IBN, then a best-response rule. The pool of behaviors is initially non-Darwinian, becomes Darwinian, and then becomes non-Darwinian again” (Ibid., 160).

Godfrey-Smith does not develop this scenario further in his book, but I want to point out that it refers, again, to the CP_i case (see Table1).

My focus on the BP_g case points, instead, to a more constrained scenario, in which the evolution of a copy the common rule (arguably in the Hominin lineage) is much more probable than the evolution of other rules, given the environmental conditions that prevailed during the Pleistocene (Boyd & Richerson, 2005). I would guess also that an IBN rule has a higher cost for the agent in those environmental conditions.¹⁸

From the point of view I am taking here, a conformist rule might be success-driven, after all, and it can be shown that it is able to support, actually, a Darwinian dynamics at the biological *group*-level population (BP_g).

There is a large amount of literature on the role conformism might have played in Hominin groups and on the conditions under which it might have evolved.¹⁹ According to several models built by Richerson and Boyd, among others, the evolution of imitation as a social learning modality is closely related to the evolution of a conformist rule for updating behaviors (the equivalent to what Godfrey-Smith calls a ‘copy the common’ rule). Social learning by imitation enhances the fitness of the agent when certain environmental conditions prevail: those conditions in which the environment is neither too unstable – which would favor, instead, individual learning – nor very stable – which would favor an innate behavior. These models give plausibility to a scenario in which a conformist transmission bias and high-fidelity imitation evolved in the very same environmental conditions. Therefore, a conformist bias has been probably selected for at the group-level, and one of its effects was a de-Darwinization of the lower level population, as I argued above.²⁰

Conclusion

The arguments presented in the previous sections – inspired by some of the theses defended by dual inheritance theorists –, suggest that a population of groups with different cultural phenotypes might be more paradigmatically Darwinian than Godfrey-Smith is willing to acknowledge in his 2009 book. It is true, however, that the points I make in this paper are restricted to just a few dimensions of the Darwinian hyperspace. The BP_g -like population might (still) be a marginal one, as far as other dimensions of this hyperspace are taken into account, especially those quantified by the reproduction-related parameters. Godfrey-Smith is explicit about what is at stake here:

“Darwinian language is often applied to social groups and communities in such a way that the focus is on persistence of a group as contrasted with extinction, or growth as opposed to shrinkage (...) In this book I treat Darwinian processes involving growth and persistence without reproduction as marginal cases (...) So “cultural group selection” of a

significant kind requires differential reproduction, not just differential persistence, even though the border between these is vague” (Ibid., 151-2; cf. 118-9).

Taking this stance, Godfrey-Smith is skeptical about the possibility of talking about reproduction in the case of cultural groups. My intuition, instead, is that it might be fruitful to come up with modalities of reproduction suitable to cultural groups, such as persistence. This strategy is compatible with the “permissive attitude” (2009, 91) he embraces along the book in other hard cases and concerning other parameters of the Darwinian hyperspace.²¹

Further work has to be done to argue more forcefully in favor of the thesis that the emergence of cultural groups in the Hominin lineage might have been a transition in individuality. This is an speculative scenario, albeit plausible, suggested by Godfrey-Smith’s novel approach to the issue of transitions. It is an empirical matter how far we have been going along any of those possible evolutionary paths.²²

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Notas

¹ Godfrey-Smith (2009, p. 6). In other passages of the book, he requires also, on top of those requirements of the minimal concept, that the population be "a collection of causally connected individual things" (Ibid., p. 39). I am grateful to Tiago Leal for calling my attention to this point. Godfrey-Smith criticizes the "replicator approach" proposed by Dawkins and Hull among others, and takes the "classical approach", embraced for instance by Lewontin, as the starting point of his own proposal of an abstract representation for a Darwinian populational dynamics, that might be applied to different kinds of systems, not restricted to the biological realm (Godfrey-Smith, 2009, p. 31-6).

² The meaning of the parameter C can be grasped by using the idea of a *fitness landscape*. If it is *rugged*, small variations in the system's properties lead to big variations in fitness. This situation corresponds to a *low* value of the parameter C ; in a landscape like this, the population can be easily trapped in a local fitness *peak* and not be able to cross a valley and to evolve towards a higher fitness *peak* on the landscape. The way the population might possibly evolve is, in this case, not Continuous, being as a result more susceptible to drift.

³ The parameter α measures the degree in which the reproductive success of one individual in a population affects the reproductive success of another one in the same population.

⁴ The parameter G is modeled on the Germ/Soma reproductive specialization in multicellular organisms.

⁵ This paper is part of a larger project in which I am attempting to figure out how fruitful might be to apply the whole set of parameters of Godfrey-Smith's Darwinian hyperspace to track a possible transition in individuality that could have happened in the Hominin lineage, associated with cultural change.

⁶ I prefer to use the expression 'cultural variants' that is more neutral, not committing myself to the properties usually attributed to memes.

⁷ Boyd and Richerson share with Godfrey-Smith, furthermore, some more general points of view that invite the kind of approximation between their work I am exploring in this paper. First of all, they agree in pointing to population thinking as the most central aspect of Darwinism. They are also suspicious about the replicator approach (especially in the cultural domain) and argue that replicators are not necessary for evolution by natural selection to take place. They all embrace also a multilevel approach to natural selection.

⁸ The lower level populations in multicellular organisms, taken as a model for a collective entity, have also other features I will not be fully addressing in this paper: a) there is a *division of labor* between somatic and reproductive parts (cells, in this case); b) the latter are *sequestered* very early in the development of the organism and, therefore, are shielded from the evolutionary activity that happens in the population of somatic cells during the life of the organism; c) there is often a *bottleneck* in the modality of reproduction they instantiate; in the clear-cut cases, the development starts with a single cell, a condition that scores the highest value in the parameter ($B = 1$), and this is the reason why the population is quite uniform in their intrinsic properties (genotypic, in the multicellularity case).

⁹ One might ask what would be *intrinsic* properties in BP_5 -like populations (at the low and high levels). This is relevant for the definition of the parameter S , as described by Godfrey-Smith (see above). This issue is not my focus in this paper and I will just offer some crude intuitions here. At the level of groups

with different cultural phenotypes, we would expect, in an evolutionary transition, that these groups score higher values in the parameter S as well, that is, that their fitness becomes (more) related to their intrinsic properties (in other words, that their fitness Supervenes on the latter properties when the transition concludes). Maybe, it is better to say that group-level intrinsic properties *emerge* in an evolutionary transition (the same for fitness as a property at this level). It is plausible, therefore, to consider those cultural variants that distinguish a group phenotype from that of another group as being *intrinsic* properties of that group. If conformism and other biases are in place - as well as moral aggression and other mechanisms for suppressing cultural variation -, we have, as a consequence, a fairly uniform population at the level of the group-members' population. In a transition, we expect that the fitness of a *group-member* will be increasingly dependent on the fitness of the cultural group, what can possibly be interpreted as a suppression of S at the level of the group-member's population (since location in a particular group can be interpreted as an extrinsic property of a group-member). Much more has to be done to establish fruitful relations between S , V , H and the reproduction-related parameters for each level in an BP_g -like collective entity.

¹⁰ Besides the conformist bias, Boyd and Richerson argue for the relevance of other transmission biases in the transmission of cultural variants: the model bias and the content bias. We discuss at length the role these biases play in their theory in Abrantes & Almeida, 2011.

¹¹ Richerson & Boyd, 2005; Abrantes & Almeida, 2011. Cf. Godfrey-Smith, 115.

¹² The former discussion suggests that through moral aggression each group "takes control over the lives and activities of [cultural agents, in this case], especially with respect to their reproduction" (2009, 124). This is one of the ways, pointed out by Godfrey-Smith, in which lower level populations in collectives are de-Darwinized (in their reproductive output also). I am not sure whether he would accept this interpretation of the quoted passage in the context of BP_g -like populations.

¹³ The emphasis Godfrey-Smith puts on integration (the parameter I) in his account of the requirements for a paradigmatic darwinian population, can contribute to develop further dual inheritance theories. In my view, Hodgson and Knudsen (2010, p. 163-4) rightly point out that a concern with social structure is lacking in Richerson and Boyd's theory, for instance, and that we need more than psychological biases to deal adequately with the problem of the evolution of cooperation in human social groups. For an in depth discussion of the issue of cooperation, in the context of dual inheritance theory, see Abrantes & Almeida, 2011.

¹⁴ I will put aside, for now, the issue of the psychological requirements for being able to do this kind of appraisal.

¹⁵ Another point that can be made is that "smarter" rules such as IBN and the best response rule presuppose that the agent is able to appraise which of her neighbors' behaviors has the best payoff under the prevailing environmental conditions. Very often, however, an agent is not able to do this - to appraise whether a particular behavior, to which it is exposed, is adaptive or not - and the best bet is to imitate the most common behavior in the group. An alternative would be for the agent to rely on individual learning, which can be a very risky strategy if, for whatever reason, the environment is informationally translucent for the agent. For the distinction between informationally opaque, transparent and translucent environments, see Sterelny, 2003.

¹⁶ Possibly we might also have a de-Darwinization not only regarding V , but also in reproduction-related parameters as well, for the group-member's population. At the same time, a transition towards a more paradigmatic population at the cultural group-level is taking place, as far as the latter parameters are concerned. To argue thoroughly for this thesis is beyond the scope of this paper.

¹⁷ One might ask about what is being reproduced here. The CP_i and CP_g cases correspond to populations of cultural variants, therefore the latter are the entities being reproduced. Given Godfrey-Smith's distinctions between different kinds of reproducers, it would seem straightforward to classify this kind of reproduction using the categories of formal and scaffolded reproducers, but he is not clear about it (2009, p. 79, 154-5; cf. Dennett, 2011). It is even more complicated to conceive the modality of reproduction involved in the BP_g case. Godfrey-Smith claims that there is no clear-cut

(paradigmatic) reproduction in this case, which implies that we can't attribute to cultural groups the status of full individuals. I will argue against this claim at the end of the paper.

¹⁸ Besides the point I made before concerning the effects on the parameter V of following the IBN rule, my intuition is that, compared to the conformist rule, the costs of following the IBN rule are higher: we have to consider the cost of the psychological machinery required for the evaluation of the payoffs and, in addition, to take into account the (cost of) risk of imitating a behavior that is not the most adaptive, given the environment in which the population has been living (refer also to the point I made in footnote 15 concerning informationally translucent environments). This is a situation in which intuition can mislead and mathematical modeling is indispensable to compare the various scenarios.

¹⁹ Henrich & Boyd, 1998; Boyd & Richerson, 2005; Abrantes & Almeida, 2011. Hodgson & Knudsen argue for a replicator approach on tackling this issue (2010, esp. 140, 159-165). I emphasized at the beginning of the paper the reasons why Godfrey-Smith rejects this approach (see also 2009, p. 110-11).

²⁰ Another possible scenario would be one in which a conformist bias coevolved with a capacity for high-fidelity imitation. We discuss some of those models in Abrantes & Almeida, 2011; Abrantes, 2011.

²¹ Refer also to the above footnotes 12 and 17. For an argument along a similar line, see Dennett, 2011.

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