HUMAN KINSHIP AND THE REPRODUCTION OF SAMENESS

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Nobody doubts that human kinship has something to do with biology and reproduction and, at the same time, biology and reproduction are clearly insufficient to explain it. The unexplained part of human kinship by the biology of human reproduction is what anthropologists call 'social' kinship. Whereas the biology of human kinship does not seem to differ in any significant way from that of any sexually reproducing species, it is unclear how that social kinship should be accounted for, specifically, how it should be related with its biological counterpart. The purpose of this text is to suggest a possible solution to this time-honored theoretical controversy in anthropology. My approach is based on Hamilton's theory of inclusive fitness and its development and formalization by means of the Price equation. My proposal shall be that it is the concept of sameness that which makes both biological and social kinship amenable to the same type of analysis.

Keywords: altruism; anthropology; collective identity; inclusive fitness; kinship; Price equation

Introduction

Anthropologists have been for a very long time haunted by the paradox of human kinship. Not even the most radical social constructivist would deny that human kinship has something to do with biology and reproduction, and not even the most radical biological determinist would deny that biology is clearly insufficient to explain complexities of human kinship relationships. Everything looks as if human kinship was simultaneously biological and non-biological (Heady 2014), and hence cultural and non-cultural. The biology of human kinship does not seem to differ in any significant way from that of any sexually reproducing species. But what about the non-biological component? How can we relate this non-biological component with the biological side of the relationships? Cultures do seem to reconstruct, reimagine, rethink and re-elaborate the givens of biological kinship in different ways that, nonetheless, do not seem to be totally arbitrary. What is the logic behind these non-arbitrary reconstructions?

Neither is social kinship a spin-off of its biological counterpart nor are the biological facts of human reproduction an arbitrary social construct; as I shall argue, both social and biological kinship should be seen as concrete manifestations of a more abstract process of reproduction that I call the reproduction of sameness. I use the concept of sameness to refer to identity or resemblance between two or more entities as regards one or more particular characteristics. It is a very basic and elementary notion that, it is my contention, lies at the root of kinship. At a very abstract level, sameness can entail the sharing of any characteristic between individual organisms, be this morphological, behavioural or of any other kind. But only the sameness that is capable of *reproducing* itself gives rise to a kinship relation. Thus, to analyze kinship relationships means to analyze the ways in which particular forms of sameness are reproduced. The purpose of this paper is, first, to show what kind of sameness characterizes kinship relations among humans and, secondly, to expose the process of reproduction of that sameness. In this way, I hope to be able to show how the vexed question of the relationship between the social and the biological in the analysis of human kinship dissolves itself as soon as we look at it from a different perspective.

Kinship and Anthropology

There is no need to rehearse here the endless discussions that have taken place within the discipline of social anthropology as to how human kinship should be defined and, specifically, how the non-biological component of human kinship should be understood. One its most characteristic debates was the classical controversy between the so-called ‘descent’ and ‘alliance’ theorists (Dumont 2006) that, somehow, threw into relief the theoretical implications of the discussion. Whereas descent theorists saw human kinship as a kind of social re-elaboration of the biological givens of human reproduction (Gellner 1960; cf. Beattie 1964), for alliance theorists the essence of kinship was not in the biology of human reproduction but in the social act that made it possible, which is a particular marriage or ‘alliance’ system (Lévi-Strauss 1968). Both accepted, however, following an old Durkheimian mantra, that human kinship was a social relationship through and through, and that the biology of human reproduction was totally (or mostly) irrelevant to the study of human kinship systems. Alliance theorists rightly underscored the importance of affinal relationships in the constitution of human kinship; but then they wrongly cut off those relationships from the process of biological reproduction (as if marriage had nothing to do with reproduction, or was only contingently related to it). Similarly, descent theorists might concede the existence of some contingent relationship between ‘biological’ and ‘social’ kinship, which in no way could determine what was seen as the essence of human kinship as a social construct.

Historians of anthropology might speculate as to the reasons why this highly counter-intuitive conclusion held sway over academic social anthropology for so long. For the estrangement of human kinship from the biology of human reproduction turns the problem of the definition of kinship even more unmanageable. If human kinship has nothing to do with biology, what is it? How do we differentiate between kinship from other social relationships? In a slightly different version of this time-honored discussion, and setting aside the nuances of what many would see as a rather Byzantine squabble, some argued that human kinship is based on what is variously defined as the 'genealogical grid,' which comprises the set of parent-child relationships as they happen to be understood in each particular society (see Goodenough 2001; Shapiro 2016; Scheffler 1991). It is unclear, however, how these particularistic culturally constructed bonds can be related with the universal genealogical grid of which they are meant to be a by-product of sorts. Others, by contrast, would reject the alleged universality of genealogical relationships and would even go as far as denying that there is such a thing as 'kinship' as a universal cross-cultural category (Carsten 2000; Needham 1971; Schneider 1984).

More recently, there have been a few brave attempts by social anthropologists at addressing the relationship between the social and the biological in the study of human kinship in light of recent advances in the fields of evolutionary biology and psychology. This paper should be seen as a contribution to the development of this laudable trend. The works of Doug Jones (2000, 2010, 2017) and Dwight Read (2001, 2010, 2012) can be taken as a case in point.[1] Even though there is no space here to engage fully with the details of these authors' respective approaches, a few observations on both of them might help to clarify the sense of my own proposal. Doug Jones's contribution is two-sided. On the one hand, he has deepened the analysis of kinship terminologies, as it was carried out within the tradition of cognitive anthropology, with the application of the more sophisticated linguistic methodology provided by optimality theory. On the other, he has made good use of Hamilton's theory of kin selection in his analysis of group nepotism and ethnicity. Let me point out that what is missing in his conscientious contribution is a stronger theoretical reflection that deals explicitly with the nature of human kinship itself. Dwight Read's approach to kinship as a 'cultural idea system,' by contrast, has certainly deeper theoretical implications. His point is that once the transition between categorization of interaction between subjects based upon the attributes of those subjects, as have been perceived through past experiences, and categorization of interaction between subjects based upon the relationship that links those subjects has taken place, "the basis for social interaction is decoupled from any requirement of biological linkages among the individuals in question" (2012: 163). In other words, the culturally constructed kinship system becomes a culturally evolutionary stable strategy thanks to its own system of reciprocal rights and obligations, totally 'decoupled' from the alleged instinctual drives that originate in the biological process of kin selection. That is undoubtedly true, but my point is to take this argument one step further. Are biological and cultural kinship totally different forms of social interaction of do they have something in common? I am not looking for deterministic connections between one and the other, whatever direction this determinism happens to take place (from biology to culture or vice versa), but for a more abstract level of which both biological and cultural kinship can be seen as manifestations.

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[1] See also Holland (2012) for another way of bringing together evolutionary biology and, remarkably, the Schneiderian cultural analysis of kinship.

The text that follows will put forward a possible solution to this theoretical controversy. My approach is based on Hamilton's theory of inclusive fitness and its development and formalization by means of the Price equation.

Hamilton's Rule

Very few within the discipline of the social anthropology of kinship have made use of Hamilton's theory and even fewer (with some notable exception) have ever employed the Price equation. Hamilton's rule was meant to be an explanation for non-reciprocal altruistic behaviour in nature from a Darwinian perspective. How could natural selection favor such behaviours? Only if the costs generated by the altruistic act are lower than the benefits thus produced times the coefficient of relatedness that links the altruistic individual to the beneficiary of the altruistic act ($C < Br$). The criticism normally leveled against the application of Hamilton's rule to the study of human kinship is that it is only effective with very close kin (i.e., parents, children and siblings), for it crucially depends on the coefficient of relatedness, which drops very rapidly for relatives outside the nuclear family (0.25 between uncles/aunts and nephews, 0.125 between first cousins, 0.03125 between second cousins, etc.). But human kinship systems go well beyond that. To put a well-trodden example, in classificatory kinship terminologies, ego will use the same kinship term to refer to her brother, to her mother's sister's son (first cousin), and to her mother's mother's sister's daughter's son (second cousin). But ego's coefficient of relatedness with these relatives is 0.5 for the brother, 0.125 for the first cousin and 0.03125 for the second cousin! And in the majority of human societies with these terminologies (most tribal societies), this is not just a linguistic quibble, for different rights and obligations may obtain between people who call themselves by different kin terms.[2]

Similar examples of divergence between 'biological' and 'social' kinship could be endlessly piled up (see Sahlins 2011; cf. Alvard 2011). The problem seems to be in the very concept of coefficient of relatedness. What does that coefficient actually measure and why should that be relevant in the explanation of non-reciprocal altruistic acts? Of course, it is not the amount of genes shared between relatives. If Ego has a coefficient of relatedness of 0.5 with her full siblings, this does not mean that Ego shares half of her genotype with them, for the percentage of genes that she is likely to share with any one member of the human species taken at random is around 99.9. A coefficient of relatedness could be defined as the expected fraction of genes identical by descent in a relative (Hamilton 1964: 3), which is equal to the probability that any mutation in a common ancestor's genotype (i.e., the genes that make that ancestor different from all the rest, let's call them 'singular' genes) will also appear in the genotype of that ancestor's descendants. From another point of view, however, the coefficient of relatedness should be rather seen as a regression coefficient: the expected number of copies of a gene in B given the number of copies

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[2] In this paper, I shall make cursory references to classificatory kinship terminologies as illustrations of my argument. But the purpose of this paper is not to provide in any way a thorough analysis of the complexities of kinship and cognition entailed in this type of enquiry.

in A (over and above the mean expected for the population). Note that, unlike a fraction or a probability, the coefficient of relatedness as a regression coefficient can be less than zero (in a finite population).

My proposal is to consider the coefficient of relatedness as a measure of the degree of 'sameness' between two or more individuals. The continuity of any perishable structure through time, be this a living organism, a social system or a set of ideas, depends upon its ability to produce copies of itself, that is, to replicate its 'sameness'. This is precisely what accounts for the performance of non-reciprocal altruistic acts, for if that non-reciprocal altruistic act is done upon someone who is 'the same' as me, the benefits to be derived from it accrue to me, but *only in so far as* the beneficiary is the same as me.[3] The need of any perishable structure to produce copies of itself can be seen as a teleological explanation of altruistic behaviour that does not depend on any particular criterion of sameness — the structure has to produce copies of itself in whatever way we understand that the copies are 'the same as' the original. But the existence of a biologically inherited predisposition to behave altruistically towards relatives appears as an explanation in terms of effective causes: it is a particular set of genes that 'cause' altruistic behaviour. Now we need a very specific criterion of sameness, which is that provided by the coefficient of relatedness, according to Hamilton's rule. We can see that with a very simple example. If there has been no inbreeding, the probability of having any singular gene of my genotype in a child of my own is .5. But suppose that thanks to my non-reciprocal altruistic act in favor of my full sister I do not have a child of my own (C) whereas she has two additional children (B). The probability of having my singular genes in the following generation is .4375, a bit less than if I had had my own child. Thus, if my sister has three children instead of two, the probability of having my singular genes in the following generation would be .5781, consequently, that generation would be 7.81 percentage points more similar to me than if I had had my own child. Similarity is taken here as the probability that a singular genotype sequence will appear in two or more individuals.

The Price Equation

But could similarity not be seen from another point of view? Let us move now to the Price equation (Price 1970). This is a very clever mathematical tool that explains the conditions under which a particular character can spread within a community. The Price equation is not an abstract model of the evolutionary process (that concrete manifestations might approach to different degrees), but a restatement of the evolutionary dynamics using a mathematical language. The underlying logic of the Price equation is in fact extremely simple. Suppose I want to know if the average height of the people of a particular community will increase. My simplifying assumption for explaining the Price equation is to assume height is precisely determined by two factors: inheritance and environment, and it is not affected by any other factor. Inheritance means that tall

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[3] Technically speaking, benefits do not 'accrue to me,' for these are fitness benefits, i.e., changes in the probability of a trait being reproduced in the next generation. The benefits do not 'accrue to me' insofar as the other individual is 'the same as me'; if anything, they accrue to the gene, which happens to be shared between the two carriers.

people have equally tall children and vice versa. Environment means that, under certain circumstances, children might be taller than their parents (because of better food, etc.) or, conversely, children might be shorter than their parents (because of inadequate food, etc.). The Price equation has two terms: the covariance and the expected value:

$$\bar{w}\Delta\bar{x} = Cov\left(w_i,\ x_i\right) + E(w_i\Delta x_i). \tag{1}$$

This is the standard notation of the Price equation, where $\bar{w}$ is the average fitness of the members of the community (the average number of children per head), $\Delta\bar{x}$ stands for change in the average amount of the trait in the population from one generation to the next, w_i and x_i stand for the fertility of each person of the community and their height respectively. The first term in the Price equation is the covariance (*Cov*) between fitness and the variable of interest. Covariance is another mathematical tool that measures the relationship between two random variables, i.e., their tendency to increase in value together and to decrease in value together. Because of my inheritance assumption, if tall people have more children than the shorter ones, the average height of the community will increase. Therefore, in my example, the first term will be the covariance between people's fertility or fitness and their height, which will be positive. The second term, the expected value (*E*), measures the effect of any factor influencing evolution other than fitness difference. In my example, I have assumed, for simplicity, that children might be taller or shorter than their parents due only to environmental factors.

Suppose now that the character we want to analyze is the propensity to do non-reciprocal altruistic actions. I shall make use to this effect of the equations developed by Henrich (2004) in his analysis of cultural group selection and cooperation (though my interpretation is going to be slightly different from his). Again, our initial assumption is that non-reciprocal altruism is caused is by an inheritable factor and an environmental factor. Here is where a particular characteristic of the Price equation becomes relevant. And that is that the units of equation (1) do not need to be individuals but they can be groups of individuals. This makes no difference when what we are studying is height, for living in group full of tall or short people does not by itself alter one's biological fitness. But it does make a difference when the character we are looking at is the propensity to do non-reciprocal altruistic acts, for any one's biological fitness is likely to increase (or decrease) thanks to the non-reciprocal altruistic acts of his or her neighbors (or lack thereof).

Let us say that our community is a village divided into several neighborhoods (no need for these to be kin groups). The sub-index *i* of equation (1) stands now for each one of those particular neighborhoods. Consequently, the covariance terms measures now the relationship between the average fertility of the members of each particular neighborhood and their average propensity to be altruistic. And the same applies to the second term, the expected value. But now we realize that if the children of a particular neighborhood are on average, say, more altruistic than their parents, that might not have been caused by any environmental factor, but it could be due to the fact altruists in that neighborhood have more children than non-altruists. In other words, what we saw at the level of the whole village in the first equation (when we were not taking neighborhoods into account) appears again at the level of each particular neighborhood. This is what is known as the 'recursive application' of the Price equation:

$$\bar{w}\Delta\bar{x} = Cov\left(w_i,\ x_i\right) + E_i(Cov\left(w_{ji},\ x_{ji}\right) + E(w_{ji}\Delta x_{ji})). \qquad (2)$$

The double indexes of equation (2) stand now for fitness or proclivity to altruism of individual *j* member of neighborhood *i* (e.g., w_{12} means fitness of individual *1* of neighborhood *2*, etc.). To make things simpler, let us suppose that propensity to altruism is a purely inheritable characteristic, therefore $\Delta x_{ji} = 0$, which means that children are exactly as inclined to perform non-reciprocal altruistic acts as their parents. Then equation (2) simplifies to:

$$\bar{w}\Delta\bar{x} = Cov\left(w_i,\ x_i\right) + E_i(Cov\left(w_{ji},\ x_{ji}\right)). \qquad (3)$$

We have two covariances here: that between biological fitness and propensity to altruism between communities (first term) and that between biological fitness and propensity to altruism between individuals within each community (second term). To compare the two terms of this equation it is advisable to transform the covariances into partial regression coefficients. The reason for that is because the actual number that a covariance gives rise to depends not only on the relationship between the two variables under scrutiny but also on the variations in the value of each of those variables. Otherwise stated, if the first covariance, for instance, which is that between communities, gives rise to a very high positive value, that might be either because communities with a lot of altruists do have more children or because the difference between the average propensity to altruism of those communities is also very high, that is to say, the *variance* between communities as regards their propensity to altruism is high. As we shall see, this distinction between variance between and within communities as regards their propensity to altruism and the regression coefficient between propensity to altruism and biological fitness is going to be especially relevant. Equation (3) transformed into partial regression coefficients is

$$\bar{w}\Delta\bar{x} = \beta_{w_i x_i} Var\left(x_i\right) + E(\beta_{w_{ji} x_{ji}} Var\left(x_{ji}\right)). \qquad (4)$$

The immediate conclusion that we can draw from equation (4) is that whereas the first regression coefficient, $\beta_{w_i x_i}$, which is that between communities, is likely to be positive, for we can a priori surmise that communities with a lot of altruistic individuals, i.e., communities whose members tend to help each other on a regular basis, will have more children than those with selfish individuals; by contrast, the second coefficient, $\beta_{w_{ji}\, x_{ji}}$, which is that between individuals within each community, is likely to be negative, for altruists surrounded by selfish individuals are likely to have less children than their more selfish neighbors who take advantage of their altruistic behaviour. Now is when the variances between and within communities become relevant. Notice that if variance between communities, $Var\left(x_i\right)$, is very high, which means that altruists will tend to live in communities with other altruists and selfish individuals in communities with other selfish individuals, then the *covariance* between propensity to altruism and biological fitness between communities will also be high. Likewise, if the variance within communities, $Var\left(x_{ji}\right)$, is very low for the very same reason, i.e., altruists and selfish individuals tend to live in separate communities, the *negative* covariance between propensity to altruism and biological fitness between individuals will also be very low. Therefore, if the positive term, $\beta_{w_i x_i} Var\left(x_i\right)$, is likely to be higher than the negative term, $E(\beta_{w_{ji} x_{ji}} Var\left(x_{ji}\right))$, the average propensity to altruistic behaviour in the whole village, $\bar{w}\Delta\bar{x}$, will increase.

Reproducing Cultural Kinship

This was the argument put forward by Henrich in the above-mentioned article to defend the possibility of cultural group selection. For if cultural groups tend to differentiate themselves more rapidly than biological groups, whatever characteristic that those cultural groups have that makes them increase their fitness, such as the rule according to which all the members of the group should help each other, will spread because selection takes place at the level of the group and not at the level of the individual members of the group. In other words, if the group is sufficiently uniform (variance within the group is low) and there are differences between groups as regards one particular characteristic or behaviour that happens to be adaptive (variance between groups is high), the group behaves almost like an organism and its members would be equivalent to the (genetically identical) cells of that organism, and hence natural selection acts upon groups instead of upon individuals in the same way as it acts upon bodies instead of upon the individual cells of those bodies (Wilson 1975).

Figures 1 and 2 are meant to be an illustration of this process. In figure 1 we see three heterogeneous groups, so variance is bigger within groups than between groups. In figure 2, by con-

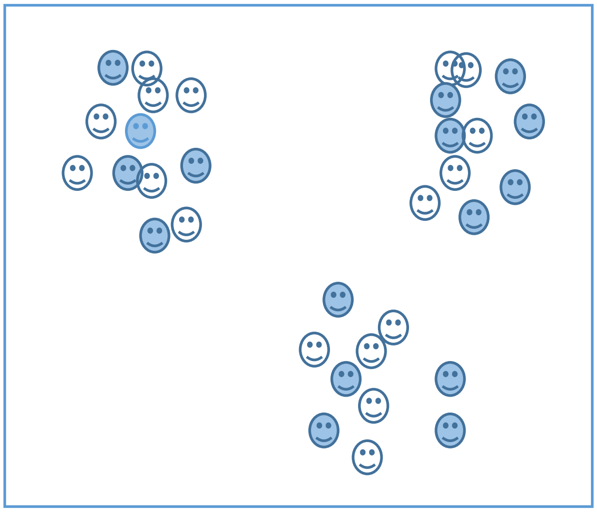

Figure 1: The groups are heterogeneous: there is more sameness between groups than within groups: $Var\left(x_i\right) < Var\left(x_{ji}\right)$. Selective pressures will operate on individuals.

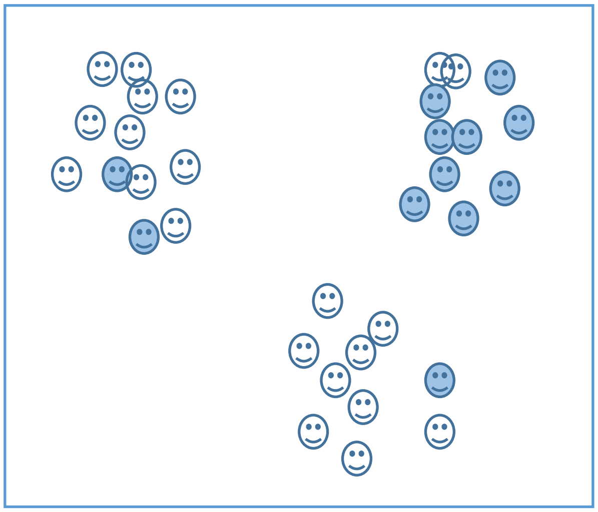

Figure 2: The groups are homogeneous: there is more sameness within groups than between groups: $Var\left(x_i\right) > Var\left(x_{ji}\right)$. Selective pressures will operate on groups.

trast, we see the opposite situation: three homogenous groups in which variance is bigger between groups than within groups. Variance can be taken the inverse of what I have defined here as sameness. But the mere existence of sameness between individuals does not by itself turn those individuals into kin to each other. It is the reproduction of sameness that creates kinship. This can be done in two different ways: by having children, who are going to be 'the same' as their parents, or by helping someone else to have children when this someone else has some degree of sameness with helper — this is what we define, from the individual point of view, as an altruistic act. The recursive application of the Price equation tells us that when sameness is reproduced by means of altruistic acts, groups of 'same' individuals (who, therefore, reproduce themselves altruistically by helping each other) will enjoy a selective advantage over those who do not have the same degree of sameness. But what the Price equation does not tell us is what that sameness consists in.

In the Hamilton's rule we have a very particular criterion of sameness, the coefficient of relatedness. In our initial example of the Price equation it was height, but it could have been anything (such as green beards, etc.). However, the character that makes the recursive application of the Price equation relevant cannot be any character, such as height, but it has to be one in which the composition of one's group as regards that particular character has a direct bearing on the individual's fitness. In Hamilton's theory, the coefficient of relatedness meets this requirement as an appropriate criterion of sameness in so far as it can be causally related to the performance of altruistic acts. However, as I shall argue below, sameness should not be seen only in genetic terms.

Let us go back to the Hamilton's rule now. In fact, we can derive the Hamilton's rule from equation (4) (cf. Queller 1992). The first term is positive, it stands for the benefits (B) of altruistic behaviour, that is, an increase in the group fitness thanks to the non-reciprocal altruistic acts of the members of the group. The variance between groups, $Var(x_i)$, can be taken as a proxy for the coefficient of relatedness (r), since high variance means that groups are uniform (individuals are similar to each other within each group) and vice versa, low variance means that groups are heterogeneous (individuals are different from each other within each group). And the second term stands for the costs, the negative term, which is that the proclivity to altruism of each individual decreases that individual's fitness (-C). Similarly, variance within groups, $Var\left(x_{ji}\right)$, can be taken as a proxy for an inverse coefficient of relatedness (1/r), since the high variance means now that individuals within each group are different from each other and vice versa. Therefore, equation (4) is easily transformed into:

$$\bar{w}\Delta\bar{x} = \mathrm{Br} - \mathrm{C}. \tag{5}$$

From this we get Hamilton's rule, for if $\bar{w}\Delta\bar{x} > 0$, then $0 < \mathrm{Br} - \mathrm{C}$, therefore $\mathrm{C} < \mathrm{Br}$.

Remember the example of someone helping his full sister thanks to which she obtains three children whereas the helper has none, yet according to Hamilton's rule, the helper's share of the gene pool will go up to 57.81 percent in the following generation. Suppose now that the helper makes a mistake and helps someone who pretends to be his sister while she is not (or perhaps he calls her 'sister' while she is a distant parallel cousin). If the coefficient of relatedness between helper and fake sister is very low, then the helper does not increase his degree of sameness in the following generation. So we must conclude that helper's propensity to do non-reciprocal altruistic acts will not propagate because his *genes* do not propagate. But why should sameness be seen exclusively in genetic terms? Or, stated otherwise, why should non-reciprocal altruism be caused only by a biologically inherited proclivity? In a classificatory kinship terminology, for instance, in a bifurcate merging terminological system, all the people in my parents' generation are either my 'fathers' and 'mothers' or 'uncles' and 'aunts', in my generation there are either 'siblings' or 'cousins' and, correspondingly, in the following generation they are either 'sons' and 'daughters' or 'nephews' and 'nieces.' But the actual coefficient of relatedness that links me with all those relatives (fathers, mothers, brothers, sisters, sons, daughters, etc.) can be very low, equivalent to that which links me with any member of the human species taken at random. And yet, if I help any of my classificatory same-sex siblings to have children of their own, even though my share of the gene pool will not raise in any way, my degree of 'cultural' sameness in the following generation will have increased in 50 percent instead of 25 percent, since in this kinship system the children of my classificatory same-sex siblings are classified as 'my children.'[4]

Someone might think in a classificatory kinship terminology (or in any human kinship system for that matter) one is actually 'cheating' nature. I might believe the children of my classificatory same-sex sibling are my children, but this is simply not true, it is just a 'cultural' belief. I have not increased my share of the gene pool by having those children and, therefore, Hamilton's rule cannot be applied. Not at all! Hamilton's rule is perfectly applicable to this situation. The above developments of the Price equation have showed that group selection is possible as long as variance between groups in relation to a character that happens to be adaptive is bigger than variance within groups. But, as Price himself pointed out (1970: 520), the equation is agnostic as to how the transmission of that character from one generation to the next does actually take place. Our assumption in the above paragraphs was that the rule of non-reciprocal altruistic behaviour was transmitted by inheritance: altruistic parents had altruistic children. But, in the case of humans, that inheritance does not need to be biological. It could be cultural inheritance: parents *teach* their children to be altruistic (Richerson and Boyd 2006).[5] The only condition that has to be satisfied for successful reproduction of this behaviour is that the beneficiaries of altruistic acts

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[4] A very similar argument was put forward by Queller (1985), when he proposed that a 'coefficient of synergy' could play a very similar role to that of relatedness.

[5] The study of cultural evolution, i.e., the application of Neo-Darwinian explanatory models to cultural history, has become one of the most thriving fields of research in the behavioural sciences. It all began with the pioneering works by Cavalli-Sforza and Feldman (1982) and Boyd and Richerson (1985), and it has continued to produce a plethora of high-quality researches (e.g., Henrich 2015; Lewens 2015; Mesoudi et al. 2006; Mesoudi 2011; Salazar 2019). Out of all this copious literature, it is perhaps that which deals with multilevel selection and, specifically, cultural group selection (Henrich 2004; Richerson et al. 2016; Wilson 1975, 2002) that is more directly relevant to my argument. Despite the high productivity that characterizes participants in this field of study, a comprehensive and theoretically ambitious account of the cultural evolution of kinship systems is still lacking.

are also themselves altruists, in other words, that in my neighborhood everybody is as altruist as I am. Hence equation (4) with $Var\left(x_{ji}\right) = 0$, is simplified to

$$\bar{w}\Delta\bar{x} = \beta_{w_i x_i} Var\left(x_i\right) = Cov\left(w_i,\ x_i\right)\ . \tag{6}$$

The spread of non-reciprocal altruistic behaviours depends only on the covariance between the propensity to altruism and … biological fitness? If it is cultural inheritance that which determines the transmission of altruistic behaviours, then w_i stands not for biological fitness but for cultural fitness. I need 'cultural' children rather than biological children in order to spread altruistic behaviour. In the example we saw above, I can define the children of my classificatory same-sex sibling as my 'cultural' children. But in actual fact anyone can be my 'cultural child' as long as I can claim some degree of 'sameness' with him or her, specifically, as I have just pointed out, as long as my cultural children are being taught to be altruistic to each other in the same way as by biological children do so instinctively. Note that when $Var\left(x_{ji}\right) = 0$ the degree of sameness between altruists and beneficiaries of altruistic acts is equal to 1. Hence with a 'fake' coefficient of relatedness (which is what measures the degree of sameness between individuals) equal to 1, non-reciprocal altruistic behaviour will spread as long as the benefits produced are bigger than the costs (B/C > 1). 'Cultural children' or 'fake coefficient of relatedness' are just other words for what anthropologists used to call 'social' kinship.

Cultural Kinship as an Evolutionary Stable Strategy

To sum up, why is kinship relevant both in the natural world and in the social world? To restate the argument: any living organism can reproduce its identity, its 'sameness', in two different ways: either by having a child of its own or by helping someone who is already the same as, or similar to, it to have a child of its own. The underlying assumption is that in both cases the new resulting individual will proceed in the same way in due course. This underlying assumption applies equally to the sameness derived from Hamilton's coefficient of relatedness, let us call it 'biological sameness', as to the cultural sameness to be derived from a culturally constructed kinship system. As Robert Paul (2015: 86) has perceptively argued, symbolic systems can create kin on the basis of shared symbolic substance; and as Webb Keane has pointed out, from a different point of view, resemblance is always underdetermined, for it always depends 'on some degree of conventionality' (Keane 2003: 405).

But what could make any individual be altruistic towards those who are the same as him or her, be this biologically or symbolically? For such behaviour to become what in evolutionary game theory is known as an Evolutionary Stable Strategy (ESS) (Maynard Smith 1982) it has to comply with Hamilton's rule: its costs have to be smaller than the benefits it produces times the coefficient of relatedness linking altruist and beneficiary. Thus, even though the actual cause in Tinbergen's sense (1963) that produces altruistic acts is irrelevant, there has to be an effective cause anyway, otherwise nobody would behave altruistically to begin with. The same thing can be seen if we look at it from the point of view of the Price equation. Altruistic individuals will not replicate successfully if they are not surrounded by other altruistic individuals. But for this to be the case, they have to *be* altruists in the first place. A community of green-bearded men will not reproduce more successfully than their blue-bearded enemies, no matter how uniform the green-bearded community happens to be, unless the gene for green-beards goes along with a predisposition to help other green-bearded fellows.

Two very important corollaries should be derived from this. First, in the absence of that predisposition and when Hamilton's rule obtains, the green-bearded community of selfish individuals becomes an evolutionary unstable entity (practically equivalent, in the long run, to a body full of cancerous cells); stated otherwise, wherever Hamilton's rule is met, selfishness becomes an evolutionary *unstable* strategy. I shall return to this. Secondly, that predisposition does not need to be caused by a 'gene'. Suppose that green-bearded parents *teach* their children to behave altruistically to other green-bearded individuals. In this case, having a green beard appears clearly as an arbitrary sign of one's proclivity to behave altruistically. And the result of this cultural determination will be exactly the same as that of its biological counterpart — the successful replication of non-reciprocal altruistic behaviours. Thus, by replicating a particular identity or 'sameness' I am replicating at the same time the very act that made that replication possible. This applies to all living organisms, human and non-human. The only peculiarity of humans lies in the ways in which that 'sameness' can be created. In addition to biological sameness humans can also create all sorts of different kinds of 'cultural' sameness. Social kinship is one of them.

But what about if some green-bearded parents decide not to teach their children to behave altruistically towards the other green-bearded individuals? Their children will receive the altruistic help of other green-bearded subjects at no cost. Following this green-bearded egoistical strategy, those children would outperform the green-bearded altruists because they would receive help from the altruists without providing anything in return. Under these conditions, the green-bearded altruistic strategy would not be an ESS. This is the so-called 'free-rider' problem. There are two ways in which this problem can be dealt with. One is the solution provided by the recursive application of the Price equation. If the benefits obtained by the green-bearded selfish individuals in interaction with their green-bearded altruistic neighbors is smaller than the benefits obtained by the green-bearded altruistic groups in interaction with green-bearded selfish groups, then it is these latter that will be outperformed by the first and altruism among green-bearded individuals will become an ESS. This argument has been developed by the advocates of cultural group selection (see note 5). In a nutshell, their point is that if a particular form of cultural behaviour provides selective advantage to a group this will out reproduce its competitors *together with* the particular cultural form responsible for its success. Furthermore, a process of culture-gene coevolution will favor the replication of those genetically determined predispositions that favor the adoption of the successful cultural form (Richerson et al. 2016). The second solution would consist in strategies to spot and ostracize the free-riders.

In biological kinship, when altruism is caused by some genetically determined propensity, a free-rider is the one who pretends to be a relative without actually being so. Among non-human animals, different strategies of kin recognition, such as odor or behavioral clues, have been identified by ethologists to this effect (see Frank 1998: 104-106). In the case of humans, exclusive sexual access among marriage partners, male sexual jealousy and even matrilineal descent (Hartung 1985) can equally be considered as kin recognition strategies. For social kinship, the free-rider would not only be the one who pretends to be kin, for all social relatives are in fact 'pretending' to be kin, but the one who does not comply with his or her culturally prescribed kinship obligations. Note that in a classificatory system of relationships, if I (male) help my classificatory brother to have a child of his own I have already replicated my identity in the following generation, for that child will be also 'my' child even if neither my classificatory brother nor his (biological) progeny do likewise. However, if my altruistic behaviour fails to be replicated, because of a defective cultural indoctrination on my brother and his children, then social kinship will turn out to be an evolutionary unstable strategy.

Conclusion

In this paper, I have tried to bring together the insights provided by evolutionary biologists on kin selection, specifically in what concerns Hamilton's rule and the Price equation, and the knowledge on human kinship relationships delivered by social anthropologists, in particular as regards the all too apparent and pervasive, but systematic, divergence between biogenetic relations and culturally constructed kinship bonds. It is true that on the side of evolutionary theorists, several authors, such as George Price, David Queller and Steven Frank, amongst others, had already intimated the possibility that Hamilton's coefficient of relatedness might not be seen in strictly or exclusively genetic terms. But none of them actually engaged with the copious social anthropological literature that was precisely pointing in that direction. My proposal has been that it is the concept of sameness that which makes both biological and social kinship amenable to the same type of analysis.

In very simple terms, my argument could be stated thus: If we think of altruism as assistance directed from an Ego to an Alter, then this is likely to be self-sustaining if the criterion that qualifies someone as an appropriate recipient of help is one that applies both to Alter (viewed from Ego's standpoint) and to Ego (seen from Alter's point of view) — provided of course that the expected pay-off to both individuals in their role as Alter, is greater than the cost in their role as Ego (see Read 2012: 163-169). A criterion of this kind can always be expressed as a statement of something that Ego and Alter have in common — so that the strategy can always be phrased, and understood by those adopting it, as the reproduction and perpetuation of whatever makes the two of them 'the same'. Kinship is not just being the same as someone else. Kinship is the *reproduction* of this sameness. Altruistic acts towards kin (or, if you prefer, Meyer Fortes's axiom of 'amity') is the way that reproduction can be achieved.

There are some interesting implications of this concept of sameness for the analysis of human cooperation in general and collective identities. For a very long time evolutionary theorists have been wondering about the alleged peculiarity of the human species: unlike what seems to be the case among non-human social animals, altruistic cooperation in humans takes place, in all human societies, between unrelated individuals. How is that possible, especially in simple societies wherein there is no supra-individual coercive power to force their members to behave altruistically towards each other? If we think about kin selection and the relatedness coefficient upon it is based as a concrete manifestation of this more general process that I call the reproduction of sameness, we can easily conclude that other forms of sameness, in addition to genetic identity by descent, could fulfill the same function. As we have seen, this is how the social identities provided by a culturally constructed kinship system can be analyzed. But not only this, aside from kin groups, humans can create different kinds of collective social identities in which the notion of sameness, be this sameness religious, ethnic, national, political, etc., operates in a very similar way (cf. Jones 2017). The point to be emphasized in all those distinct social identities is not so much the particular bonds that they create but their reproducibility.

Acknowledgements

I would like to thank Joan Bestard, three anonymous reviewers and the editor of this journal, Dwight Read, for their comments on an earlier draft.

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