

Concern with Relative Position and Productive Social Cooperation

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Early draft still missing some reference, etc.
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ABSTRACT:

Humans have a strong concern with relative position, not only with absolute gains. This is likely to shape productive social cooperations that produce goods that in part are valuable for the relative position they confer, and is likely to have done so also among our ancestors. This paper therefore examines the interaction between productive social cooperation and concern for relative position, modelled as a Stag Hunt between players who prefer relative to absolute gains. It argues for the plausibility of a two-way relationship. Concern for relative position complicates social cooperation, and if these complications are overcome, sets the terms on which players are willing to cooperate, thus shaping the form of social cooperation and the resulting division of benefits. Individuals and groups who manage to cooperate on these terms, are at an advantage, the more so the better the terms they get. Over evolutionary time this will have reinforced both concern for relative position, but also dispositions to equal sharing and sentiments of egalitarian fairness. The paper thus sheds light both on the implications of concern for relative position for productive social cooperation, and the origins of inequality and egalitarian fairness.

Keywords: relative position; stag hunt; social cooperation; envy; origin of inequality;
distributive egalitarianism

Introduction

Humans have a strong concern not only with improving their situation in absolute terms with respect to the goods needed to live and flourish, but also with their relative position. This concern shapes human interactions, and is likely to have shaped productive social cooperation also among our ancestors, as the goods that establish relative position are typically produced in cooperation. Such cooperation itself, as well as the dividing up of the benefits it results in, are therefore prime areas where concern for relative position will have shaped individuals' motivations and actions. This paper therefore examines the interactions between concern for relative position and productive social cooperation. It aims to map how concern for relative position influences preferences for social cooperation and the forms such cooperation can take, as well as feedback effects on concern for relative position itself, and related motivations such as sentiments of egalitarian fairness.

To do so it uses a simple model where players prefer relative gains to absolute gains, and productive social cooperation is modelled as a Stag Hunt or a series of situations derived from this game. The paper argues that concern for relative position complicates productive social cooperation, but assuming these complications can be overcome, it suggests a two-way interaction between concern for relative position and the forms productive social cooperation can take. Concern for relative position sets the terms on which productive social cooperation can take place, and is thus likely to have implications for what forms of social cooperation and distributions of the benefits of cooperation come about. In general, it favours equal distributions, unless circumstances that give some players significant bargaining power are in place, and concern for relative position also influences what these are. In reverse, the benefits of participating in such cooperations reinforce both concern for relative position, which motivates people to demand a higher share of the fruits of cooperation, and dispositions to sharing equally and sentiments of egalitarian fairness, which make it easier for such

cooperations to come about and remain stable over time. Thus, the argument sheds light both on the origins of inequality and egalitarian fairness, as well as the basis of social cooperation in society, or the ‘social contract’, if you will. While social cooperation modelled as a Stag Hunt in isolation has been studied extensively, this is one of the first attempts to study the interaction of productive social cooperation and concern for relative position (see also Bilancini and Boncinelli 2022).¹

The argument will proceed as follows: Section 1 provides the theoretical background for the argument. It explains the adaptiveness of concern with relative position and the rationale for studying concern for relative position and productive social cooperation together, and how I model this. Section 2 analyses Stag Hunt with concern for relative position. Section 3 discusses the implications of concern for relative position on the distribution of the benefits of cooperation for individual cooperative ventures, and its implications for the origins of both dispositions to equal sharing and inequality. Section 4 discusses implications of concern for relative position in the larger context of general social cooperation, and its importance for the development of sentiments of egalitarian fairness in particular.

1 Theoretical Background: Scarcity, Cooperation, Competition and Bargaining

This section provides the theoretical background for the analysis that follows. It provides an explanation of human concern with relative position, and explains why the analysis focuses on the implications of concern for relative position on human cooperation analysed as a Stag Hunt.

¹ And on the interaction of productive social cooperation and bargaining over the fruits of cooperation, see Wagner (2012).

People care not just about what they have themselves, but also about what others have, and how they compare, i.e. their relative position. This observation should be familiar enough from everyday life, and finds strong support in scientific studies.² A particularly salient instance of this is competition for status. There is some evidence that people value status for its own sake, and not only instrumentally (Huberman, Loch, and Öncüler 2004).

A plausible evolutionary explanation of this concern with status and relative position is that it is instrumentally valuable for accessing certain important, but scarce resources (Hill and Buss 2008, 60–62). Hence, concern for relative position is very likely to have been adaptive. The same holds for envy, the emotion closely associated with this concern (Hill and Buss 2008, 60–62). The most important scarce resource throughout the history of our species is plausibly reproductive mates with what evolutionary psychologists call ‘high mate value’ (e.g. Buss 2016, 11; Hill and Buss 2008, 60–61). Other very scarce, significant resources in the ancestral environment include high status, power, and food in hard times. Position in the distribution of all of the three latter will have mattered for access to the former, as well as the survival rate of one’s offspring. Hence, we can imagine that those of our ancestors who were more concerned with relative position would be inclined to acquire more food, status, and power, and that all of this increased their chances of successful reproduction. In such circumstances, it is quite plausible that, as Heffetz and Frank put it, ‘[a]cquiring more status (...) could have led to sufficiently valuable rewards often enough that the most expedient option was a nervous system that cared about it for its own sake’ (Heffetz and Frank 2011, 84).

When theorizing about the evolutionary origins of concern for relative position, what matters is of course how this trait was adaptive in the ancestral environment. However, it is interesting to note that the trait under discussion is also instrumentally rational for the same or

² For examples of studies that support this in different ways, see e.g. Alpizar, Carlsson and Johannson-Stenman (2005), Heffetz (2011), Frank, Levine and Dijk (2014), Frank (1985a; 1985b; 2020).

perhaps even stronger reasons today, despite the radically different economic circumstances of contemporary developed economies. While some goods, such as food, are no longer subject to scarcity in the way this was the case in the ancestral environment. However, desirable life partners remain scarce, and the psychology of human mating is the psychology that evolved in the ancestral environment. Moreover, Hirsch (1976) describes how, perhaps counterintuitively, the modern economy may be more strongly characterized by competition for scarce goods than what was the case only a century ago. Hirsch observes that as both population and human wants have expanded, we have come to desire more goods that are scarce and for which supply does not expand with demand, such as attractive jobs, urban property, and leisure land (Hirsch 1976). The result is that access to these goods is typically determined by one's relative position in the distribution of income and wealth or some other means of competition for relative position, such as education (Hirsch 1976, esp. pp. 2-10, 27-54, 65-67). Thus, while the focus of this paper is the implications of concern for relative position in the ancestral environment, it may be worth keeping in mind that we are here in this case discussing a trait that may not only have been adaptive, but which may also remain a rational concern in many circumstances in modern economies (Hirsch 1976, 10, 102-4, 111-14; Frank 1985a, 5-6, 137-40; 2008, 1781-82, 1785-86; 2020, 136-38).

This paper is concerned with the implications of concern with relative position for productive social cooperation. Interactions that allow mutually beneficial social cooperation of the kind I am interested in are often modelled as a Stag Hunt.³ Skyrms (2004, chap. 1) also argues that Stag Hunt is the most suitable model for studying general social cooperation. As in the story told by Rousseau (1987, 62) in his 'Discourse on the Origins of Inequality', players in a Stag Hunt have a choice between cooperating to hunt stag, or hunting hare on their own. Hunting stag is more valuable, but only successful when both players choose to

³ On Stag Hunt, see Skyrms (2004).

cooperate, whereas hunting hare can be done successfully on one’s own. This is illustrated in Table 1.

Table 1. Stag Hunt

		Player 2	
		Hunt Stag	Hunt Hare
Player 1	Hunt Stag	10, 10	0, 4
	Hunt Hare	4, 0	4, 4

Hence, the Stag Hunt has two Nash equilibria, one optimal and one suboptimal. It is therefore useful for analyzing situations where cooperation creates a surplus from which everyone may potentially benefit, rather than situations where one benefits the most by defecting from cooperation, as is the case in the more frequently studied Prisoner’s Dilemma. It thus allows us to focus on other barriers to potentially mutually beneficial cooperation than defection. The barrier Stag Hunt is most often used to study is the *risk* a player runs by hunting stag instead of hunting hare, but here, I will use the game, and derived situations, to study concern for relative position as a potential barrier to and influence on productive social cooperation.

I agree with Wagner (2012, 82) and Bilancini and Boncinelli (2022, 57) that productive social cooperation should not only be studied in isolation. Productive social cooperation produces resources that enter into other social dynamics, and the fact that this is the case has implications for whether and when one chooses to cooperate productively in the first place. Studying productive cooperation in light of such other concerns take us at least somewhat closer to realistic situations that our ancestors may have faced (Wagner 2012, 92). Wagner (2012) studies productive social cooperation in conjunction with bargaining over division of the fruits of cooperation using a compound game that combines Stag Hunt and Nash Demand game.

Bilancini and Boncinelli (2022) study a context very similar to the one that interests me here, namely the interaction of social cooperation and social competition, by using a game that combines Stag Hunt with a tournament with rewards to the highest ranked players. Their focus is on studying the evolution of conventions of cooperation or non-cooperation. They find that hunting stag wins out when competition is harsh (only a few at the top are rewarded), whereas hunting hare wins out when competition is mild (a larger share is rewarded). The intuition behind this result is easy to grasp: when competition is harsh, one has to cooperate, and hope the other will do the same, or one is guaranteed to miss out on the reward. When more people are rewarded, the maximin strategy may be sufficient to earn the reward (Bilancini and Boncinelli 2022, 51).

In this paper I will be concerned with another aspect of interaction between productive social cooperation and concern for relative position, namely mapping how concern for relative position matters for preferences for cooperation and the kinds of bargains such cooperation can result in. Moreover, I will map possible feedback processes of these outcomes on concern for relative position itself, as well as on counteracting forces such as dispositions to equal sharing and sentiments of egalitarian fairness. Competition for relative position often plays out using means that have to be produced first, or desired status or position may simply be determined by possession of goods thus produced. Hence it makes sense to discuss productive social cooperation and competition for relative position as interacting or intertwined.

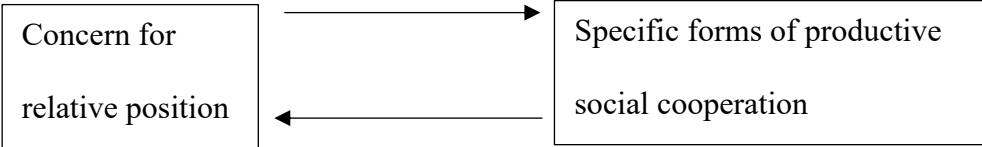
To do so, I use the Stag Hunt model of social cooperation, and model situations derived from it, but add a preference for relative position that has priority over the preference for absolute gains. In other words, players' preference rankings follow two rules:

1. Higher relative position is preferred
2. Within the same relative position, higher absolute gains are preferred

The assumption that relative position always has priority is obviously a strong assumption, and is made for the sake of simplicity. It is however not unreasonably to assume that such concerns are very strong when sufficiently high rewards are at stake, e.g. if access to reproduction is very scarce and monopolized by one or a few winners over time. It is less plausible if the rewards are reallocated more often, such that one may have new chances at winning in later rounds, and incentives to hold out for this, or if less is at stake in the competitive sector, relative to the noncompetitive benefits available. However, this very simple model gives us a good point of departure for exploring the importance of concern with relative position for human cooperation.

Moreover, I will study the possibility of an interaction between concern for relative position and specific forms of social cooperation. That is, I hypothesize, and will argue below, that concern for relative position has implications for the forms of social cooperation and divisions of benefits that are likely to arise, and that there may be feedback effects where the benefits of participating in the social cooperations that come about can have an effect on concern for relative position itself, as well as on other dispositions that favour doing well in the resulting environment. This causal model can be drawn as follows:

Figure 1: Feedback from concern for relative position and forms of productive social cooperation



This model does not have to make assumptions about what comes first, concern for relative position or specific forms of productive social cooperation that may favour such concern. However, it is plausible to assume the following order of events: Concern for relative position and associated preferences for high relative position emerge and gain ground as a result of the advantages they confer with regards to accessing scarce goods, as described initially. They

also shape the forms productive social cooperation can take, in ways that make such preferences more adaptive, and hence reinforce them, up to a certain point, and along with other dispositions such as dispositions to equal sharing and egalitarian fairness.

With these theoretical background assumptions in place, we are ready to start the analysis.

2 Stag Hunt with Concern for Relative Position

Let us start by examining what happens to the basic Stag hunt model when we incorporate concern for relative position. This changes preference rankings and the structure of the game as shown in Table 2, where absolute rewards are given with Arabic numerals and preference rankings with Roman numerals.

Table 2. Stag Hunt with concern for relative position

		Player 2	
		Hunt Stag	Hunt Hare
Player 1	Hunt Stag	10, 10 (II, II)	0, 4 (IV, I)
	Hunt Hare	4, 0 (I, IV)	4, 4 (III, III)

Concern with relative position thus turns Stag Hunts into Prisoner’s Dilemmas. Each player now prefers the situation where they hunt hare whereas the other player hunts stag, despite the losses they end up taking in absolute terms, because this puts them ahead in relative position.

Thus, concern for relative position upsets the apparently harmonious alignment of interests in Stag Hunt and introduces a preference for the situation where one manages to cheat on the other player. This makes it harder to trust collaborators and whatever signals of cooperative intent that they may use. It also means that players must be concerned not only

with the loss in absolute terms that they risk by hunting stag, but also by the risk of falling behind in relative terms. For all these reasons, concern for relative position complicates the possibility of productive social cooperation.

However, concern for relative position may also be conducive to cooperation, for the following reason. The shadow of the future and the strategy of conditional cooperation are enough to turn repeated Prisoner's Dilemma into a Stag Hunt: players who cooperate over time will do better than players who do not (Skyrms 2004, 4–6). This may be the case also when players are concerned with relative position. In any one interaction, cooperation may be incompatible with satisfying each player's preference for advance in relative position over the other player. But players who manage to cooperate over time will advance in relative position over players who are not cooperating. Thus, while concern for relative position may introduce a new incentive to defect, it may also strengthen the incentive for conditional cooperation.

What will help this dynamic is if stag hunters have reliable ways to find each other and maintain cooperation, i.e. to choose who to interact with (Skyrms 2004, chap. 6). Moreover, a population where conditional cooperation has taken over in this way need not be easily invaded by defectors: the gains from cheating in the short run may be small relative to the loss in absolute and relative terms of being excluded from cooperation in the longer term.

Therefore, I suggest that the additional incentive to defect that concern for relative position introduces need not amount to a major obstacle to cooperation over time. However, concern for relative position has further implications for the kinds of social cooperation and divisions of benefits that can emerge. In the following, I will focus on these. To do so, I will in the following ignore the bottom left and top right boxes of the Stag Hunt depicted above, the situations where players defect to obtain relative advantage. This leaves a choice between the top left and bottom right boxes, i.e. the choice between the two original Nash equilibria in the Stag Hunt, which we can think of as a choice between mutual cooperation and non-

cooperation. Once the game is thus narrowed down, the choice seems easy. But this simplification will allow us to see how concern for relative position may interact with the division of the benefits of social cooperation when these benefits need not be shared equally.

3 Dividing the Benefits of Cooperation and the Origins of Inequality

Concern for relative position is likely to matter not only for the possibility of social cooperation, as discussed in the previous section, but also for the forms such cooperation can take, and how the benefits of cooperation can be shared. This is what I start exploring in this section. This picks up Wagner’s (2012) point that cooperation and the dividing of its fruits should be studied together.

We start with the situation where social cooperation yields a larger surplus, a ‘Growing Pie’, which need not be shared equally, unlike in the standard Stag Hunt, and where each player can veto cooperation, in which case the larger outcome is not obtained. This is described in Table 3, where $r+q \gg a+b$:

Table 3. Growing Pie

Cooperate	Not cooperate
r, q	a, b

In the absence of concern for relative position, this would be an easy choice, as long as either of r and q is higher than either of a and b. Concern with relative position complicates this choice.

Assume payoffs are equal in the noncooperative state, i.e. $a=b$. In this case, as long as concern with relative position is strong enough, players will be unwilling to cooperate unless $r=q$. Thus, even if we assume that Player 1 is the better hunter, and that the success of the stag hunt is largely due to his skill, as long as he still needs Player 2 in a supporting role, and Player 2 is unwilling to give up relative advantage, Player 1 will be unable to convert his hunting skills into a larger share of the game, as Player 2 prefers noncooperative hunting here and equality to the state with cooperation, more food, but relative disadvantage.

In this situation concern with relative position and dispositions that uphold it, such as envy, yield a significant adaptive benefit for Player 2. By refusing to cooperate for less than an equal share, Player 2 maintains relative position and gets a much better outcome in absolute terms than if the best hunter was allowed to claim the larger share of the game. When each player effectively has a veto over whether cooperation comes about, concern for relative position increases the benefit the weaker player is likely to extract with their veto.

Concern for relative position may also sheds light on the origins of dispositions to equal sharing and egalitarian fairness. Bargaining is often modelled with the Nash Demand game (Nash 1950), which is also the model Wagner (2012) uses in his compound cooperation and bargaining game. Players demand a certain share of a total, and receive the share they demand as long as their demands can both be satisfied, i.e. add up to 1.0 or less of the total. Wagner (2012) uses a version of this game where players can ask for an equal share, a larger share, namely two thirds, or a smaller share, namely one third. This game turns out to have one symmetric Nash equilibrium in pure strategies where both players demand $1/2$, and two symmetric mixed equilibria, one where players switch between demanding $2/3$ and $1/3$, and one where players switch between all three demands (Wagner 2012, 84). This outcome goes at least some way towards explaining the emergence of dispositions of egalitarian fairness and a

convention of coordinating around an equal split, and Wagner shows a somewhat stronger tendency towards stag hunting with equal split in his compound game.

However, concern for relative position provides a simpler explanation. Once concern for relative position is a fact, equal split may be the only acceptable terms of cooperation. Cooperation around equality can be expected to win out, even without means to explicitly agree on this, simply because concern for relative position means that no one will demand less than equality, at least if the baseline is fairly equal. Moreover, players who demand more always lose, as they will face players who demand at least equality. And given the advantages of cooperating, relative to not cooperating, players who manage to cooperate will benefit relative to players who tend not to manage to cooperate. Concern for relative position favours demanding at least $1/2$. Dispositions to equal sharing favours not demanding more than $1/2$, and will thus facilitate such cooperation.

The situation described here also bears a striking resemblance to the Ultimatum game, where the better hunter is in the situation of the proposer, and the weaker hunter the responder. The proposer is given a sum and proposes a division of the sum, which the responder can accept or decline, in which case neither player one gets anything. As is well known, the responder in this game tends not accept offers that deviate far from equality. This reluctance may have been adaptive because as long as it is known, it forces the proposer towards an equal distribution. Similarly, as long as the weaker hunter has a veto power over whether cooperation takes place, and concern for relative position, the stronger hunter has to offer them a larger share that tends towards equality.

The baseline need not be egalitarian, however, if Player 1 does not need social cooperation for a relative difference in skills to become salient. He may be better at hunting both stag and hare, such that $a > b$. In this case, both players may have an interest in cooperating, even if

benefits are distributed unequally, but relative concerns may still play a role in determining the final outcome. If relative position matters but the size of inequality does not, cooperation may be easy, as both players will prefer the cooperative state as long as ordinal ranking is maintained and both players benefit in absolute terms, i.e. $r > q > b$ (and $r > a$). However, sometimes relative shares may also matter, if competitive rewards are not allocated directly to the person in the leading position, but through some further process where relative position confers benefits proportionate to relative advantage. In that case, the only cooperative state preferred by both players is the one where $r/q = a/b$.

This assumes that players are able to keep track of relative position and bargaining power, but also shows how this ability will have been adaptive. This is adaptive for Player 1 because he may benefit from refusing cooperation unless benefits are distributed unequally, as he already enjoys the benefits of high relative position in the noncooperative equilibrium. Player 1 needs concern for relative position to reap this benefit in the first place. For Player 2 it is therefore beneficial to understand his weaker bargaining position and make demands accordingly, as this is necessary for cooperating at all with a player sensitive to relative position and his stronger bargaining position, and thus to advance at least in absolute terms from a poor noncooperative situation.

Hence, concern for relative position in a situation where cooperation gives a growing pie to share matters for the resulting division of the fruits of cooperation. Moreover, it is likely to be self-reinforcing, and moreover, can contribute to explaining both dispositions to sentiments of egalitarian fairness and equal division, and sensitivity to bargaining power. Concern for relative position allows the weaker player to acquire a greater reward when cooperation departs from an equal baseline, where it also favours a tendency to equal division. On the other hand, it allows the stronger player to take advantage of their initial advantage if

they have one. In the latter situation, sensitivity to bargaining power is nevertheless adaptive for both the stronger and the weaker player.

Concern for relative position and the situation modelled in Growing Pie can also be used to shed light on the origins of inequality in a further, and perhaps more important way. We have just seen that in the second case, where there are what Rousseau (1987, 37) would call a ‘natural or physical’ inequality such as a difference in skill that benefits the possessor also in the noncooperative state, this inequality is preserved through cooperation. The first case, where the non-cooperative state is equal, may however be the more important case. In the state of nature, any gains are insecure. Moreover, many skills need cooperation to flourish, and the benefits of cooperating are significant – arguably so significant that they may outweigh the benefits of being ahead in the noncooperative state.

Natural inequalities play an important role in Rousseau’s account of the origins of inequalities (Rousseau 1987, esp. pp. 62-70). On this account, once notions such as private property are in place, natural inequalities mean that some will accumulate more than others. However, the account developed here rather suggests that as long as cooperation is needed to be productive and the weaker player has veto power on whether cooperation takes place, natural inequalities on their own are not sufficient to give rise to inequalities, at least not to a great extent.

However, we will find more opportunities for inequality to arise once we add another player. In this case, Players 1 and 2 can benefit in absolute terms by cooperating, and in relative terms if they do so while excluding Player 3, who is Left Behind. This is illustrated in Table 5, with outcomes of each of Players 1-3 from left to right.

Table 4. Left Behind

Players 1 & 2 cooperate	Noncooperation
10, 10, 4	4, 4, 4

Here, the possibility of leaving Player 3 behind facilitates cooperation between the two other players, as it provides an opportunity to advance in relative position. Thus, unlike natural inequalities, the possibility of exclusive cooperation is sufficient to give rise to significant inequalities, even if no one has an advantage in the non-cooperative state, and may also be necessary for this to happen, once concern for relative position is taken into account.

At least if the benefits of being ahead of number three are greater than the disadvantage of coming second, relative to the equal state, the presence of multiple possible cooperation partners also returns bargaining power to the player with particularly valuable skills. If Player 1 is the one with hunting skills, and Players 2 and 3 are substitutable as his helpers, Player 1 can drive a hard bargain. Assuming the gains of cooperation still add up to 20, Player 1 can take advantage of his bargaining power to cooperate with Player 2 at minimal expense, as described in Table 5.

Table 5. Left behind, with Hard Bargain

Players 1 & 2 cooperate	Noncooperation
15, 5, 4	5, 4, 4

Player 1 rushes ahead, but Player 2 is still ahead of Player 3. Thus, natural inequalities together with possibilities for exclusive cooperation are sufficient to give rise to significant inequalities that favour the player with more bargaining power.

The possibility of exclusionary cooperation thus also provides another reason why concern for relative position is beneficial and is likely to have been adaptive. The player with

less concern for relative position is more likely to be the one left behind, whereas players with stronger concern for relative position are more likely to engage in exclusive cooperation.

Player 2 may be getting a bad deal, but he is getting ahead of Player 3.

The model so far predicts competition for relative advantage by exploiting one's bargaining power to the extent that one can, and by joining as many exclusionary cooperations as possible, as each such cooperation is a possibility to get ahead of others. While life in modern society may be competitive, to the extent that it is sometimes described as a 'rat race', arguably, social life is not quite as intensely competitive as the model so far seems to predict. Moreover, the hunter-gatherer societies that are often taken to resemble social organization in the ancestral environment more closely are often described as strikingly egalitarian, at least in the distribution of resources and power, even if some differentiation in status is always present. There are several plausible reasons for this. A part of the explanation is presumably that the simple model used here overstates concern for relative position. Moreover, time limits how many exclusive cooperations any one person can participate in. Another important reason is one that emerges when we include more people in the situation modelled, so that Player 3 is not left behind alone.

4 General Social Cooperation: Compromise or Conflict

So far, we have modelled interactions where two individuals cooperate for mutual benefit, potentially leaving a third individual behind. However, for any particular cooperative interaction between two or more individuals in a social group, there will typically be a number of individuals who are not part of that particular interaction. The excluded parties may have effective power over whether the cooperating parties are in a position to keep the benefits of their cooperation or not, especially if they are more numerous, but even a smaller number may have such veto power because sabotaging cooperation may be relatively easy.

They may want to use that power to set the general terms for sharing the benefits of cooperation in that society. Therefore, we need to consider how concern for relative position interacts not only with preference structures and outcomes of particular interactions, but also its implications for the general social contract and the terms it lays down for sharing the benefits of particular cooperative ventures.

Assume a social group where some individuals are more productive than others, call the former the Most Productive and the latter the Less Productive. The former are very productive when cooperating, whereas the latter are not much more productive when cooperating. However, they outnumber the Most Productive and are therefore in a position to take their gains from them if they decide to, or otherwise sabotage their cooperation. Thus, the veto of the weaker players is in effect. The Most Productive prefer to cooperate exclusively, to gain more in absolute terms by keeping the full fruits of their cooperation and to win in relative terms. The alternative is accepting a redistributive compromise where they share the fruits of cooperation with the Less Productive. The Less Productive have little influence over whether the Most Productive decide to compromise or cooperate exclusively, but can sabotage their cooperation if they do not, taking everyone to the noncooperative state of conflict. The situation is described in Table 6, where the Most Productive decide over movement between rows, and the Less Productive decide over movement between columns, and the fruits of cooperation add up to 14, where 10 of those are produced by the Most Productive:

Table 6. Redistributive compromise

	Cooperation	Conflict
Exclusive cooperation	10, 4 (I, III)	3, 3 (III, II)
Redistributive compromise	7, 7 (II, I)	

The situation described in Table 6 has no Nash equilibrium. Whenever a redistributive compromise has been achieved, the Most Productive will be tempted to break the compromise for personal absolute and relative gain. The Less Productive will then prefer to conflict to cooperation, in which case the Most Productive will prefer compromise, and the cycle starts again.

However, the situation modelled may shed light both on the adaptiveness of concern with relative position, and of sentiments of egalitarian fairness. Concern for relative position is a part of what incites the Most Productive to break the redistributive compromise, but also what allows the Less Productive to attain that compromise in the first place, because they prefer their in absolute terms more impoverished, but in relative terms better situation in the conflict state. Again, concern for relative position is what gives force to the veto of the weaker players, just as in the Growing Pie situation in Table 3. Conversely, someone who lacks concern for relative position may fail to be discontent when losing out under exclusive cooperation, and thus fail to reap the benefits of threatening with conflict.

On the other hand, sentiments of egalitarian distributive fairness may also be adaptive in the situation modelled here. Such sentiments may counteract the temptation to break the redistributive compromise, and thereby facilitate avoiding the conflictual situation. Hence, while a the preferences for higher relative position and for egalitarian fairness may conflict, the combination may be beneficial, the latter tempering the effects of the former, as it facilitates cooperation and constrains what inequalities do arise within a range such that conflictual reactions are avoided. The redistributive social contract may always be unstable, as the Most Productive have an incentive to break it, but sentiments of egalitarian fairness may help stabilize it. Groups that manage to spend more time in the cooperative state benefit relative to groups that spend more time in conflict. The explanation of egalitarian distributive fairness as a result of concern for relative position and veto of the weaker players corresponds

well with Boehm's explanation of egalitarianism in hunter-gatherer and ancestral societies as domination of the strong by the weak (Boehm et al. 1993).

A redistributive compromise is of course not the only way the Most Productive can benefit from cooperating with each other while avoiding conflict. They could expand cooperation to the minimal number necessary to preserve the gains from cooperation, i.e. engage in a more restricted distributive compromise. However, it is often possible for a small number to cause significant damage for everyone, if they decide to. Other familiar ways of holding on to one's advantage include monopolizing the means of violence, or ideology, but either of these may have played a greater role in later, more developed stages hierarchical social organization than in the ancestral environment. Hence the particular importance of the redistributive compromise, and the sentiments of egalitarian fairness that support it.

Conclusion

The aim of this paper has been to examine how concern for relative position interacts with productive social cooperation. This has been modelled in a very simple way, using Stag Hunt and derived situations as models of productive cooperation and priority for preference for relative position over absolute gains to model concern for relative position.

The main finding is that the model predicts a two-way interaction between concern for relative position and productive social cooperation. Concern for relative position generates new obstacles to social cooperation by turning Stag Hunts into Prisoner's Dilemmas (Section 2, Table 2), but these are challenges that can be overcome. When social cooperation does take place, concern for relative position shapes the forms such cooperation and distribution of benefits can take because of its implications for what distributions are acceptable to the participants. Conversely, the benefits of participating in such cooperation benefits the individuals who manage to cooperate within the terms set by concern for relative position.

Interestingly, this is likely to reinforce both concern for relative position and sentiments of egalitarian fairness.

More specifically, concern for relative position makes cooperation between two individuals on unequal terms impossible, at least unless one individual can do significantly better than the other also without cooperating. Because of how significant the benefits of cooperation are relative to what can be obtained without cooperation, the former situation is likely to be more important than the latter. This will have favoured a willingness to share, but also reinforce concern for relative position, as this disposition pushes towards demanding a larger share of the fruits of cooperation. In particular, weaker players who refuse to cooperate for a lesser share of the fruits of cooperation will benefit relative to players who do not, whereas all who manage to cooperate benefit from doing so (Section 3, Table 3). Concern for relative position thus contributes to explaining the emergence of dispositions to share equally, and arguably provides an explanation that is more credible than the suggestion that this distribution is ‘salient’, and both simpler and more plausible than studying possible equilibria and evolutionarily stable strategies in versions of the Nash Demand game.

On the other hand, the presence of multiple possible collaborators facilitates exclusive cooperation among players concerned with relative position because it allows them to leave other players behind, and it returns bargaining power to the stronger player who may choose between cooperators. Exclusive cooperation may thus well be an important element in the origins of inequality. Thus, natural inequalities between individuals is typically neither necessary, nor sufficient, for significant inequalities to arise, whereas the possibility of exclusive cooperation is sufficient on its own, and may also be necessary (Section 3, Tables 4-5). Again, the dynamics favour concern with relative position, as individuals without this concern may have been less likely to engage in exclusive cooperation.

The context of a larger social group whose members are concerned with relative position complicates the possibility of exclusive cooperation, because parties external to any particular cooperative venture have an interest in not letting others get ahead, and even a small number of excluded parties may be able to threaten the gains from a cooperative venture by stealing or acts of sabotage. Hence, the veto of the weaker players returns, and we get a result similar to that of cooperation between two players against an egalitarian baseline: the Most Productive individuals have to accept a redistributive compromise. This state may be unstable, as the Most Productive have an incentive to break it, in which case the Less Productive may have an incentive to engage in conflict. This situation seems to render both concern for relative position and sentiments of egalitarian fairness advantageous. Concern for relative position is what allows the Less Productive to benefit from a redistributive compromise, whereas sentiments of egalitarian fairness can make that compromise more stable.

Cooperation among players with concern for relative position thus ends up yielding a social contract that is fairly egalitarian, and perhaps surprisingly so, given that this preference itself may seem inherently inegalitarian. This corresponds well with observed egalitarianism in hunter-gatherer societies. Based on the simple model used here, it is natural to conjecture that the move from such an egalitarian social contract to social structures characterized by more hierarchy in the distribution of power and resources will have been driven by exclusive cooperations together with developments in e.g. technology that have facilitated these.

I cannot explore the finer details of how this may have come about here. Many further questions concerning the interaction between concern for relative position and social cooperation remain, including the effects of varying the strengths of preference for relative position relative to the strengths of preference for absolute gains. The main aim of this paper has been to establish, using a very simple model, that concern for relative position is likely to

have significantly shaped the forms productive social cooperation can take, and conversely, that this has again reinforced concern for relative position, together with dispositions to equal sharing and sentiments of egalitarian fairness.

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