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Free-riders, Faultlines, and Fissions: Understanding Transformations within Small Task Groups

by

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ABSTRACT

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Group fissions occur when two or more members leave a parent group to either form a new group or join an existing group. Despite their widespread occurrence in diverse settings, much of the social psychological research on membership change has concentrated on why individual members leave groups alone, rather than in conjunction with others. This thesis introduces the concepts of group fissions and group faultlines to the study of membership dynamics and transformations in small social dilemma groups.

In a series of studies, two potentially important endogenous factors in the fission process are examined; free-rider conflict and the role of diversity faultlines (subgroup divisions). Evidence of how the free-rider perspective and the subgroup perspective may be linked with fission is proffered in the first part of this thesis. By integrating these perspectives it is possible to make hypotheses about the pathways leading from conflict to fission, and the role that faultlines may play in the process. According to the strong faultline hypothesis, the presence of subgroup divisions magnifies the impact of the free-rider conflict, so that groups with faultlines are more likely to split than those without faultlines. The weak faultline hypothesis presupposes that free-rider conflict alone is sufficient to initiate a fission, and the faultlines facilitate the fission by determining the location of the split -- the faultline is not a cause of the fission per se. The research provided in this thesis has a varied methodological base incorporating both role-playing studies and controlled laboratory experimentation.

The second part of this thesis describes four studies that employ step-level public good dilemmas to examine the validity of the strong and weak faultline hypotheses. In three out of four studies, group fission was shown to be a two-stage process; the free-rider conflict initiated the fission and the faultlines determined the composition of the break-away group, thus supporting the weak faultline hypothesis.

The aims of the third part of the thesis are three-fold. We continue to search for support for the faultline hypotheses, as above, extend the faultline hypothesis by adding a physical faultline manipulation (ease of resource division), and investigate the popularity of the fission option as a way of dealing with free-riders when other structural solutions are available (electing a leader, equal privatisation, harvest cap, sanctions). This was tested in two studies which employed resource dilemmas. The results show that that the popularity of the fission option compared with other structural solutions is largely determined by the ease with which the resource can be divided easily and fairly into two. Participants are more likely to adopt the fission option when the resource is easy-to-divide into two smaller but equal groups than when it is difficult-to-divide. Moreover, an interaction between ease of resource division and subgroup division was found in both studies. In particular, Experiment 5 showed that groups are more likely to fission if the resource is easy to divide and there are faultlines present within the group, thus providing support for the strong faultline hypothesis.

The implications of these findings for theory and research on membership change in small groups are discussed in the final part of this thesis.

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Part I: FREE-RIDERS, FAULTLINES, AND FISSIONS: AN INTRODUCTION

Chapter 1: Introduction and Overview

An Introduction to Group Fission

A key feature of human social organization is its flexibility (Cartwright & Zander, 1953; Hogg & Tindale, 2001). Human groups form, transform, break-up and reform at a speed that has no parallels in the animal world. This organizational flexibility is functional in that it allows individuals to cope with the pressures of group life, which presumably was a key ingredient of the survival of our ancestors in the hostile environment of the Pleistocene (Barkow, Cosmides & Tooby, 1992; Barrett, Dunbar, & Lycett, 2002).

Group transformations (i.e., when an existing configuration is replaced with an alternative configuration) occur in many different forms, but arguably one of the more dramatic changes is a *group fission*. Fissions occur when two or more group members, in conjunction, exit their parent group to either establish a new group (the "exit" group) or join a different group. Examples of group fissions have been documented in numerous settings, including profit and non-profit businesses (Dyck, 1997; Dyck & Starke, 1999), religious groups (Sani & Reicher, 1998, 1999, 2000), political parties (Sani & Reicher, 1998), nation states (Bookman, 1994), traditional hunter-gatherer societies (Kelly, 1995; Barrett, Dunbar, & Lycett, 2002) as well as in non-human societies of primates and social insects (Wilson, 1975).

Group development theories (Tuckman, 1965; Worchel, 1996) have generally ignored such transformation processes. For example, Tuckman's (1965) famous model of stages of group development includes five phases (forming, storming, norming, performing, and adjourning), but it does not recognise the possibility that groups can transform into new systems at the end of their life-cycle. Instead of ending at a natural endpoint, however, some groups may undergo a radical transformation, such that group members may perceive it as a new group even though membership with the old group may be overlapping. Fissions, organisational restructures, and mergers, where two or more groups fuse are perhaps the best known examples of group transformations (Jetten, O'Brien, & Trindall, 2002; Van Knippenberg, Van Knippenberg, Monden, & De Lima, 2003).

Depending upon the literature, group fissions have been referred to as schisms, factions, partitions, splits, group exits or break-aways. We prefer to use the term fission here, because of its similarities to the fission process in nuclear physics (although this metaphor, like any, has its limitations). Like a nuclear fission, a group fission can occur through forces outside the group or it can happen through an internal event. Furthermore, after a force is exerted, the group is split into several smaller fragments, the fission products. Finally, paralleling a nuclear fission, the combined mass of these fission products falls below that of the original group, because the 'social glue' that held the group together is gone (Van Vugt & Hart, 2004). Thus, the fission transforms the old group in such a way that it is impossible to recreate it simply by combining the new groups.

Group fissions are not uncommon. For example, based on a survey in North-America it is estimated that as many as one in five businesses started as a break-away from the parent organisation (Dyck, 1997). Yet, despite the ubiquity of group fissions and their impact on group dynamics, there is surprisingly little theory and research on this phenomenon (for similar observations see Dyck & Starke, 1999; Sani & Todman, 2002).

Social psychological research on membership change in groups has concentrated almost exclusively on why individuals leave groups alone (Moreland & Levine, 1982; Rusbult & Farrell, 1983; Van Vugt, Jepson, Hart, & De Cremer, 2004; Worchel, 1996; Ellemers, Spears, & Doosje, 1997). Yet, these models are less suitable for explaining group exits for at least two reasons.

First, group fissions are more complex because they require the conjunctive efforts of various individuals acting simultaneously, i.e., an active collaboration between a subgroup of individuals. Second, a fission is more likely to transform the culture of the group, because when a subgroup of people leave the parent group, they take away what they have brought to the group in terms of their attitudes, norms, and values. A fission is thus more likely to affect group identity, the very essence of what the group is about (cf. Arrow, McGrath, & Berdahl, 2000; Tajfel & Turner, 1986).[1] To illustrate, after the break-up of Yugoslavia in 1991, each of the former republics changed numerous symbols associated with the culture of the original state, including the flag, the national anthem, and official holidays (Prislin, 2003).

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[1] Granted, individual exits can also affect group culture in important ways, particularly when a high status member, such as a leader, leaves the group.

Previous research focusing on the phenomenon of a group fission is limited. However, Sani and Reicher (1998, 1999, 2000) have reported on schisms within both political parties and religious groups. This research has concentrated solely on conflict caused by differences of opinion. Sani and Todman (2002), in response to these findings, proposed a psychological model to try and explain the schismatic process. They proffered that entitativity and schisms are opposite ends of the same scale. When members have incongruent opinions, the members may negotiate and successfully manage to resolve the issue, in which case the group will regain entitativity. However, on the basis of social identity principles they argue that if some members perceive this incongruity to be subverting the essence of their group identity, negotiations between the subgroups are likely to be unsuccessful. If the group identity is perceived to have been invalidated, Sani and Todman claim that these group members may consequently fear that they will become marginalised, because their views are incompatible with current group beliefs. Furthermore, the group is likely to feel less cohesive, which can be psychologically uncomfortable, and perhaps these members anticipate losing their 'voice' in important decisions regarding the group's future. As a result, a schism is likely to ensue. Thus, according to Sani and Todman, a lack of entitativity is an important predictor of group fission as groups fundamentally strive for uniformity and the right to have a voice (for similar suggestions about entitativity and intragroup relations, see Yzerbyt et al., 2000).

From the real world examples of group fission referred to at the start of this introductory chapter, it is possible to see that fissions may occur over contention caused by opinion conflict, as demonstrated above. However, group fissions may also be precipitated by a conflict over scarce group resources. Frequently, group members experience a conflict between maximizing their personal outcomes and maximizing the outcomes for the group as a whole. The welfare of the entire group suffers if too many group members pursue their short-term selfish interests at the expense of the collective, effectively turning them into free-riders. This free-rider conflict will be the source of contention investigated as a potential cause of fission throughout this thesis.

Thus, our main research questions are why group fissions happen, and if they happen, when are they likely to emerge in groups? This thesis attempts to provide a preliminary answer to these questions by examining two potentially important endogenous factors; the presence of free-rider conflict and subgroup formation within the original group. We hypothesize that subgroups may act as faultlines along which groups break when they experience severe intragroup conflict. We test this group faultline hypothesis in a series of studies, whereby we concentrate exclusively on fissions in small task groups – units aimed at solving a particular project.

The Social Dilemma Perspective on Group Fission

One possible reason why groups may undergo a transformation as dramatic as a fission is because of the experience of a severe intragroup conflict (cf. Levine & Thompson, 1996). In task groups, these conflicts may revolve around the provision or distribution of valuable resources, such as time, effort, or money. Frequently, these problems pit the personal interests of group members against the overarching interests of the whole group. It is in the group's interest to ensure that every member does their fair share of work, for example, in winning a team game, creating a profitable business, or cleaning a house, but at the same time, however, each member may be tempted to free-ride on the efforts of others.

The *free-rider* problem is regarded by many as the key problem that humans needed to solve throughout evolutionary history in order to reap the benefits of group life (Axelrod, 1984; Barkow et al., 1992; Buss, 1999; Hardin, 1968; Kenrick, Li & Butner, 2003; Komorita & Parks, 1994; Schroeder, 1995; Van Vugt, Snyder, Tyler, & Biel, 2000). The fact that humans seems to display excellent cheating detection abilities seems to support this claim (Fehr & Fischbacher, 2003; Cosmides & Tooby, 1992; Brown & Moore, 2000). Living (and working) in groups gained significant survival and reproductive advantages for individuals, but also posed many problems that pitted individual against group interests (e.g., group-defence, hunting). To the extent that groups were more effective in overcoming such problems, individuals profited more from their group membership. Hence, it would have been adaptive for our ancestors to engage in actions that would promote effective group action. Dealing with the problem of free-riders would be essential for enhancing group efficiency. As a result, psychological and behavioural mechanisms may have evolved to enable individuals to deal with free-riders in effective ways (cf. Cosmides & Tooby, 1991).

Consistent with this evolutionary argument, the social dilemma literature suggests several effective strategies (which may be rooted in our evolutionary past) for dealing with the free-rider conflict. Successful strategies either tackle free-riding directly, for example, by punishing free-riders or threatening to exclude them from the group, or indirectly, by strengthening the social norms against free-riding, for example, through developing trust, accountability, and group loyalty (e.g., Fehr &

Gachter, 2000; Kerr, 1999; Messick & Brewer, 1983; Schroeder, 1995; Van Vugt et al., 2000; Yamagishi, 1986; De Cremer, Snyder, & Dewitte, 2001). A third strategy, which in a sense combines elements of the two previous strategies, is to move into smaller groups where free-riding can be more easily contained.

Experimental research on social dilemmas has established that cooperation levels are higher in small groups than in large groups (Dawes, 1980; Hamburger, Guyer, & Fox, 1975; Komorita, Parks, & Hulbert, 1992; Marwell & Schmitt, 1972; for an exception, see Liebrand, 1984). One explanation of this group size effect is that people tend to *trust* each other more in smaller groups because the social pressures to cooperate are stronger as people are more identifiable and feel more accountable to their group (Van Vugt, 1998). Alternatively, Moreland, Levine and Wingert (1996) suggest that the group size effect can be explained in terms of there being greater anonymity and diffusion of responsibility in larger groups. Furthermore, in smaller groups people tend to feel more responsible for the group product, both as a group – they believe that they are better capable of taking effective action, and individually – they think that their contribution to the group is more critical (Kerr, 1989; Kerr & Bruun, 1983). Finally, it is easier to coordinate the actions of members in smaller groups, making them more efficient in providing public goods.[2]

Evidence for the emergence of group fission in response to the free-rider problem stems from research on two very different types of human organisations. Firstly, the literature on business management shows that organisational splits and break-ups are nearly always precipitated by a period of intense conflict within the organisation, often involving competition over scarce resources (Balser, 1997; Dyck, 1997; Pondy, 1967). Secondly, cultural anthropologists have observed fission processes in modern and ancient hunter-gatherer societies (Kelly, 1995). The causes of fissions among tribes such as Eskimos, Aborigines, Sub-Arctic Indians, and Pygmies, are believed to take place as a means of controlling the problem of free-riding (e.g., providing food).

Together, these diverse research lines provide some support for a social dilemma model of group fission by suggesting that fissions occur due to a perceived

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[2] Of course, smaller groups are not always more effective than larger groups. Indeed, larger groups will outperform smaller groups on most additive and compensatory tasks. Yet, when the costs of free-riding become larger than the benefits of group-size, then a fission is a likely solution.

need to manage free-riding. However, due to various methodological constraints of these studies, it is not clear whether such free-rider conflicts are indeed a necessary and/or sufficient cause of group fission. Furthermore, the available research does not specify *how* fissions take place, that is, where groups may actually break.

The Subgroup Perspective on Group Fission

A complementary perspective, rooted in theories and research on group diversity and identity, assumes that the driving force behind fissions is the presence of subgroup boundaries within the group (Moreland, Levine, & Wingert, 1996).

Most groups are internally divided into subgroups (Hornsey & Hogg, 2000; Kramer & Brewer, 1984). For example, many work teams consist of a mixture of men and women, people of old and young age, and people of different ethnic and professional backgrounds, with different personalities, attitudes, and values. According to the subgroup perspective, this diversity may increase the risk of member discontent, group conflict, and group disintegration.

This is supported by several lines of evidence. Research on identity processes in social dilemmas suggests that the salience of subgroups undermines group cohesion and within-group cooperation (Kramer & Brewer, 1984; Wit & Kerr, 2002). For example, Kramer & Brewer (1984; Exp. 2) studied the influence of subgroup divisions on resource allocation decisions within six-person work groups in the laboratory. Three psychology students were told that they would be interacting with three (bogus) economic students. In the subgroup condition, they were told that the researchers were interested in the differences between the psychology and economic students (in the group condition, researchers were supposedly interested in the differences between university students and other groups). They then participated in a social dilemma task, whereby each individual harvested points from a depleting common resource pool over a number of trials. As predicted, these researchers found that in the subgroup condition, participants took more for themselves than in the group condition.

The negative influence of subgroup formation is also echoed in research on management teams, showing that diversity in team composition increases the prevalence of conflict and turnover within teams (Jackson, Brett, Sessa, Cooper, Julin, & Peyronnin, 1991). This is true in the case of demographically (mix of gender, race) and psychologically diverse (mix of attitudes, values) groups. In terms of group efficiency, however, the impact of diversity is less clear. Groups that bring together people who are (psychologically) similar usually outperform groups whose members are (psychologically) diverse (Bond & Shui, 1997; Moreland, Levine, & Wingert, 1996), with the exception of creativity tasks (Jackson et al., 1991).

Research on schisms in social movements, political parties and religious associations denotes more directly the impact of diversity on fission (Dyck & Starke, 1999; Sani & Reicher, 1998; 1999; 2000). Based on interviews with members of the Italian Communist party, Sani and Reicher (1998) concluded that the schism that occurred in the party in 1991 could be attributed to fundamental differences in opinion between different factions regarding the ideological basis of the party – i.e., what the party's position should be after the fall of the Soviet Regime.

The subgroup perspective is theoretically embedded in self-categorisation and social identity theories (Tajfel & Turner, 1986; Turner, Hogg, Oakes, Reicher, & Wetherall, 1987; Stryker, 1980). Following these theories, people derive their self-knowledge and self-worth, at least in part, from the groups that they identify with. Group identifications serve as a guide for the thoughts, emotions, and actions of individuals (Brewer, 1981; Brewer & Brown, 1998). Group members can define themselves either on the level of the entire group, in which case a superordinate identity is salient, but they can also define themselves on the level of the subgroup, in which case a subgroup identity is salient. According to the subgroup perspective, group fissions are more likely whenever a subgroup identity becomes salient, which is perceived to be in conflict with the superordinate identity of group members (cf. Hornsey & Hogg, 2000; Wit & Kerr, 2002; Sani & Todman, 2002).

Taken together, these findings suggest that subgroup formation and conflicting subgroup identities may form the primary basis for fission. But, how can this perspective be reconciled with the idea that the basis for a fission lies in the experience of a free-rider conflict?

Towards an Integration: The Faultline Hypothesis

The faultline hypothesis, originally proposed by Lau and Murnighan, 1998, assumes that most groups can be divided into two or more homogenous subgroups that differ from each other on the basis of a particular set of attributes. These attributes can be demographic (gender, age, profession), or psychological (similarity in personalities, attitudes), and they can create imaginary dividing lines within a group that can be regarded as potential faultlines (Lau & Murnighan, 1998; Thatcher, Jehn, & Zanutto, 2003). Group faultlines are much like geological faults in the earth's surface which are responsible for earthquakes. Like geological faults, group faultlines determine the location where pressures are building up in the group, and where it is likely to break after a force is imposed upon it. Furthermore, group faultlines are often only visible if activated through force. Hence, they may remain unnoticed for long periods, unless there are pressures exerted on them. Finally, like geological faults, group faultlines may differ in strength. Some may be so minor that once they are activated they have little lasting impact on the group, whereas others may be so deep and strong that they may cause the collapse of the group.

Whether or not a faultline will be activated is largely dependent upon the nature of the group task and the association between task and (sub)group characteristics (cf. Oakes, 1987; Lau & Murnighan, in press). For example, in a shared house containing male and female students, the gender of the housemates may become a potential faultline if there is a severe conflict over the cleaning arrangements within the house. As males are generally regarded as being somewhat less clean than females, gender may become a salient dividing line along which the group may have to reorganize itself to cope with the conflict.

The faultline analogy can be a useful tool in developing hypotheses about the paths leading from conflict to fission. Using this comparison, there seems to be at least two different routes that groups can take to fission. These pathways offer different predictions about the role that subgroup divisions play in the splitting process. Both of these pathways seem like plausible explanations, and both may be activated under differing conditions.

A first possibility is that subgroup divisions merely determine along which lines the group will break after it experiences conflict, i.e., subgroup divisions primarily determine the location of the split. We refer to this as the *weak faultline* hypothesis because it assumes that conflict drives the fission, yet the presence of faultlines dictates the composition of the break-away groups. Thus, we would expect to find a main effect of free-rider conflict only on the fission choice and a main effect of subgroup division only on the exit group composition choice.

It is also entirely plausible that subgroup divisions magnify the impact of an intragroup conflict, such that groups with faultlines are, in general, more likely to break-up than those without faultlines. We refer to this as the *strong faultline* hypothesis because it assumes that the presence of faultlines makes a group inherently less stable. In the case of the *strong* faultline hypothesis, we would expect there to be an interaction between free-rider conflict and subgroup divisions on the fission preference.

Both versions of the faultline hypothesis are depicted in Figure 1.

To illustrate the difference between these predictions, let's take the example of the student house. The *strong faultline* hypothesis would predict that the likelihood of a fission in the house is greater if there is a faultline, such as gender, which is associated with the nature of the conflict in the house, e.g., cleaning arrangements. The *weak faultline* hypothesis would predict that the presence of gender differences does not by itself increase the chances that the group will break, but if it breaks, it will do so along gender boundaries.[3]

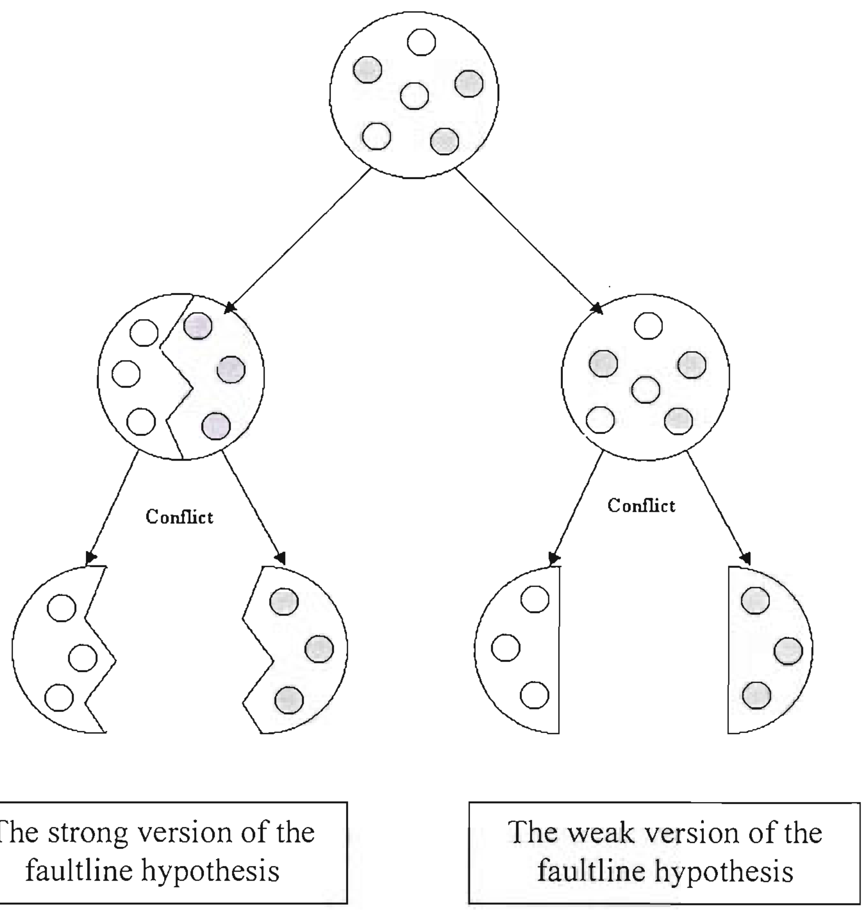

Figure 1. The two versions of the faultline hypothesis of group fission

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[3] The strong and weak faultline hypotheses are not entirely incompatible. Both hypotheses predict that groups will split along the dividing lines created by subgroups. Unlike the weak faultline hypothesis, however, the strong faultline hypothesis also predicts that the presence of subgroups is a potential *cause* of group fission.

Thus, using this faultline hypothesis as a basis we need to identify and investigate the possible risk factors that may promote a fission. Once these antecedents have been identified it will possible to suggest remedial action or protective factors to prevent such a phenomenon. Such information would be particularly useful in cases where a group fission would lead to the downfall of the parent group. In the following sections, we shall outline what we consider to be possible risk factors that may cause or aggravate a free-rider conflict, and potential faultlines within the parent group that may contribute to subgroup formation.

Possible Risk Factors Promoting a Free-Rider Conflict in Groups

We have previously advocated that conflict caused by free-riders in a group may be sufficient to cause a group fission, either alone (according to the *weak* faultline hypothesis) or in combination with a faultline (according to the *strong* faultline hypothesis). This section will discuss possible factors and situations that exacerbate the likelihood of free-riding and thus conflict within the group. Such factors discussed here include social dilemma paradigms (resource dilemmas and public goods dilemmas) and group size.

Social Dilemmas. When individuals participate in groups, a conflict exists between an individual's desire to maximise personal interests and his or her motive to maximise collective interests. This is known as a social dilemma. This situation is defined by two properties: (1) each individual receives a higher pay-off for defecting (i.e., maximizing one's own gain) rather than cooperating (i.e., maximizing the collective gain), and, (2) all individuals will be worse off if everyone defects rather than cooperates (Dawes, 1980). Thus, it is in a group's interest to ensure that every member does their fair share, for example to win a team game, or create a profitable business. At the same time, however, each member may be tempted to *free-ride* on the efforts of others, and make an individually rational choice rather than a collectively rational choice (Kollock, 1998; Van Dijk & Wilke, 1995; Samuelson & Messick, 1995; Komorita & Parks, 1994; Van Vugt, 1998; Kopelman, Weber, & Messick, 2002; Levine & Moreland, 1990).

The term social dilemma can be used to explain mixed-motive choices in both situations that require provisions to the public good (i.e., Public Good Dilemmas) and the distribution of scarce resources (Resource Dilemmas) (De Cremer & Van Vugt, 1999).

Resource Dilemmas. A resource dilemma is a situation in which a group shares a common resource from which individual members can harvest freely. Examples of common resources include natural resources, such as air, water, fisheries, parks, and forests, and manufactured resources, such as electricity and gasoline. Since individuals are free to harvest the common resource, there is the risk that they may take too much, and the resource will consequently become exhausted (Kramer & Brewer, 1984; Van Vugt, 2002).

Resource conservation dilemmas are characterised by several properties. First, access to many common resources is unrestricted or 'free', thus it may be impossible to exclude individuals from accessing the resource. Second, the aggregate number of users and the amounts they harvest from the common pool may exceed available supplies of the resource at a rate at which it can or can not be replenished (Kramer & Brewer, 1984; Van Dijk & Wilke, 1995; Kramer, 1991; Messick, Wilke, Brewer, Kramer, Zemke & Lui, 1983; Van Vugt, 2002). Finally, one person's use of the good extenuates its availability to others, as the common resource pool if often finite, and thus each individuals harvest is subtractable from the common pool (Shankar & Parvitt, 2002).

Thus, conservancy of the collective resource is largely dependent upon the cooperative restraint of all those members who share access to it. It is in the groups interest to ensure that only moderate harvests are extracted per individual in order to sustain the public good (collective rationality), but personal interests may induce the individual to harvest excessively (individual rationality). Thus, if free-riders are present in the group and harvest excessively, the common resource will eventually become depleted and all group members will suffer as a result, even those members who extracted moderate harvests. Hence it is possible to see how the actions of some greedy members can cause conflict and frustration within the group, especially for those members who deliberately chose not to maximise their own interests for the good of the group.

Public Goods Dilemmas. A public good is a product or service that can be consumed by members of a group. Its provision is dependent upon the contributions made by group members in order to either initialise or sustain the public good. An example of such a public good is a television network. The television network is able to broadcast because of individual contributions, that is, people buy a TV license to fund the network. It can not be 'used up' no matter how many group members use it. Furthermore, public goods are non-excludable, meaning that it is not possible to ban any individual from watching the television if they have not purchased a license. Public goods are also non-rival in that one person's use of the good does not extenuate its availability to others. Since consumption of the good will not affect the amounts that other members can consume, people can benefit from the public good without contributing to its provision, and no-one can be proscribed from consumption, the individually rational choice is to free-ride on the contributions of others, i.e., not purchase a license but continue to watch the television. However, if many people think like this, they run the risk that the television network may cease broadcasting due to a lack of funding. This would be to the detriment of everyone who watches television. Thus, the collectively rational choice is to contribute to the public good in order to maintain it (Komorita & Parks, 1994; Van Dijk & Wilke, 1995; Kollock, 1998).

There are two types of public good dilemmas: A *continuous public good* depends on the contributions of the collective as a whole, thus, the public good can be provided as long as there is at least one contributor. For example, a charity can provide at least some help as long as one person invests time, money, or effort. The more people who contribute, the more resources are available, and the more help can be provided to those people dependent on that charity (Komorita & Parks, 1994). A *step-level public good* requires a certain number of people to contribute in order for the good to be provided, i.e., contributions must often surpass a certain threshold, or step-level (De Cremer & Van Dijk, 2002). This was demonstrated in the television network example.

Once again it is possible to see how a free-rider conflict may be inaugurated in a situation involving a public goods dilemma. If some members choose to maximise their own interests over collective interests, the group may fail to reach the provision point needed (in a step-level public goods dilemma) to provide members with a share of that common good. The selfish motives of these members may thus lead to non-success, dissatisfaction and conflict within the group, especially for those members who contributed their endowment which has consequently been wasted.

Group size

Having already noted the significance of free-riding in situations featuring social dilemmas, this section examines the effects of the size of the groups which are experiencing the dilemmatic situations and the effects that this has on the prevalence of free-riding.

The effects of group size and free-riding have been well documented in the social dilemma literature. One of the most robust findings is that as group size increases, cooperation decreases (Komorita & Lapworth, 1982; Fox & Guyer, 1975; Hamburger, Guyer, & Fox, 1975), that is, the temptation to free-ride seems stronger in larger groups than in smaller groups. But what are the reasons for this inverse relationship between group size and free-riding?

Firstly, the rules of probability prescribe that as the size of a group increases, the likelihood that at least one person in the group will free-ride also increases (Komorita and Lapworth, 1982). This is hardly surprising as motivation within the group is reported to decrease as group size increases (Moreland and Levine, 1992). This decrease in motivation may stem from a number of factors including greater difficulty in coordinating members' activities in larger groups and the greater anonymity that larger groups provide, which decreases the visibility of individual contributions (Comer, 1995; Moreland, Levine & Wingert, 1996; Komorita & Parks, 1994). Furthermore, as group size increases, the likelihood that any one individual's contribution will be critical to the group's success declines. If members do not feel that their individual contribution will make a difference to the group's success, they may be less likely to cooperate than members who are in smaller groups where their contribution is perceived to be more critical (Komorita & Parks, 1994; Komorita & Lapworth, 1982; Rapoport, 1988; Bornstein, 1992).

It has also been documented that larger groups tend to be less cohesive than smaller groups (Moreland & Levine, 1992). This can have implications for the levels of trust group members have in one another and consequently the degree of free-riding in the group. If trust is low and the individual is unsure whether the other group members will defect, they may defect themselves to avoid wasting their contribution and to avoid exploitation from others – the "sucker" effect (Komorita & Parks, 1994; De Cremer & Van Vugt, 1999; De Cremer, Snyder, & Dewitte, 2001; Kramer, 1993; Chen & Komorita, 1994). According to Komorita and Parks (1994, p. 66), "People would rather see a good go un-provided than be taken advantage of". However, when people trust each other they are less likely to believe that other members will try to exploit them and thus will be less likely to free-ride themselves out of fear (Komorita & Parks, 1994).

Finally, the larger the size of the group the more likely it is that cliques will form (Moreland and Levine, 1992). The negative influence of subgroup divisions on within-group cooperation (Kramer & Brewer, 1984; Wit & Kerr, 2002) means that individuals will be more likely to pursue choices that will maximise their own selfish interests rather than the collective interest. If larger groups are more likely to create subgroup divisions, and larger groups are also more likely to experience free-rider conflict we would expect an increased likelihood that members of such groups would initiate a fission (according to the *strong* faultline hypothesis).

To reiterate, the effects of group size are investigated in this thesis as we believe it to be a precipitating factor of free-rider conflict.

The free-rider conflict alone may be sufficient to initiate a group fission if the *weak* faultline hypothesis is true. However, if the *strong* faultline hypothesis is true a fission will be more likely if a faultline is also present that divides the group into homogenous subsets.

Potential Faultlines within Groups

In his paper on the formation of small groups, Moreland (1987) discusses relationships among co-workers and the formation of "cliques" within organisations. These cliques, he claims, may form as a result of propinquity - people who interact on a regular basis because they are in the same department or share an office are more likely to become friends. But cliques can also form among co-workers who are similar to one another in important ways, for example, age, sex, race, or job classification. In other words, cliques can form along faultlines. These faultlines divide the superordinate group up into homogenous subgroups.

Following from theories of social identity theory (Tajfel & Turner, 1986; Turner et al., 1987) subgroup identification accentuates members' awareness of a subgroup's boundary and the members' feelings of belongingness. Once a subgroup identity becomes salient, people become more attracted to their subgroup rather than to the group as a whole, and view in-subgroup members in more favourable terms than out-subgroup members (Hornsey & Hogg, 2000; Kramer & Brewer, 1984; Wit &

Kerr, 2002; Brewer, 1979). As a consequence the superordinate group will be viewed as less cohesive, and polarisation of the subgroups may occur (Lau & Murnighan, in press).

Demographic faultlines are likely to divide a group into sub-groupings based on the observable physical characteristics of that group such as gender, age, or race. So, for example, if a gender faultline was activated, the parent group would divide into two homogenous subgroups of males and females. We would expect this sub-grouping based on demographic faultlines to be especially likely in newly formed groups or when group members have very little knowledge of one another (Lau & Murnighan, 1998). However faultlines do not have to be based on readily observable physical attributes of the group. In this section we review two non-demographic faultlines that we believe can create subgroup formation within the parent group. These potential faultlines are attitude similarity and the presence of newcomers in the group.

Please note however that any faultlines, demographic or non-demographic, are predicted to have their greatest effect at dividing a group into subgroups when conflict arises that is directly related to the faultline (Lau & Murnighan, 1998).

Attitude Similarity. People bond more easily with individuals who have similar values to the self and tend to apply negative assumptions to those with whom they are dissimilar. This can be explained by the fact that self-defining attributes are generally viewed as positively valued attributes, thus, others who possess those same attributes are also positively evaluated (Byrne & Griffith, 1973; Byrne, 1971; Newcomb, 1961).

Research by Batson et al. (1981) supports the notion that perceived attitudinal similarity precipitates greater levels of interpersonal liking and that this promotes higher levels of interpersonal helping, even toward strangers. In their study participants observed a confederate receiving electric shocks. Participants were given the opportunity to help the confederate by trading places with them which would entail receiving electric shocks themselves. Batson et al. found that people were more willing to trade places with the confederate if they believed the confederate was attitudinally similar to themselves, even when they had the opportunity to simply escape the situation and avoid further exposure to the confederate receiving additional shocks.

Thus, when attitudinal similarity is made salient, we believe that people will use this as a heuristic for partitioning the group.

Newcomers and Membership Change. Another potential faultline that can divide a group up into subgroups may be caused by the admittance of newcomers. Insofar as these newcomers affect the group culture and group identity, they may create subgroup divisions which distinguish newcomers from old-timers who share a common history.

Existing members who have shared a common history also tend to share an understanding of the group norms, group history and group tasks. In comparison, newcomers entering an already established group rarely have this kind of knowledge (Lau and Murnighan, 1998; Arrow et al., 2000). If newcomers share similarities with established group members, the new versus old member distinction becomes less important. Thus, if subgroups form, new members may join old members with whom they share important similarities. However, if new members do not agree, for example, with the existing group norms, this may become a source of conflict which divides the group up into newcomers and old-timers (Moreland & Levine, 2001; Lau & Murnighan, 1998).

So, if group members already share a common history, the addition of newcomers to the group can potentially act as a heuristic for dividing the group into subgroups.

Physical Faultlines

The faultlines discussed above, including demographic (gender, age, race, and newcomers entering a group) and psychological faultlines (attitudinal similarity) are all examples of social or diversity faultlines that can potentially split a group into homogenous subgroups. However, we propose that there are also potential natural or physical faultlines within groups that can moderate the relationship between free-rider conflict and these diversity faultlines. We propose that one such physical faultline is the ease with which a resource can be divided easily and fairly into two.

The Fairness of Resource Allocations. All things being equal, individuals favour an egalitarian ethos. Often norms are followed and rules are evoked in groups that are in favour of obtaining at least an equal share of resources for the self, while making sure that no-one else takes more than their fair share. This sense of getting a fair share prevails in a wide variety of circumstances, even in non-human species of primates (Charlton, 1997; Brosnan & de Waal, 2003).

This section discusses how an inability to get a fair share of a resource can decrease the likelihood that fission will prevail.

In groups in which the allocation of outcomes is salient, such as a resource or public goods dilemma, fairness considerations or distributive justice concerns are evoked. In such cases a set of rules are often prescribed by which outcomes are apportioned to individuals based on equity, equality, or need (Levine & Thomson, 1996; Wilke, 1996). Equity prescribes that benefits should be proportional to contributions, equality specifies that everyone should benefit equally, and need specifies that benefits should be proportional to need. These rules all purport to achieve fairness in groups by introducing a norm to the effect that one takes/gives resources in proportion to their endowments in order to avoid the expression of conflict. If people are striving to get a fair share of the resource they will be less concerned with trying to maximise their own interests and therefore less inclined to free-ride (Wilke, 1996).

Research involving public good dilemmas, resource dilemmas, and coalition games have consistently shown that when outcomes are evenly divisible by the number of persons in the group, or everyone is equal on a certain dimension, for example, endowment, access, or interest (and other dimensions on which they differ are considered to be of less or no relevance) people strive for equal outcomes. In other words, symmetry evokes a preference for an equal division rule (Allison and Messick, 1990; Van Dijk & Wilke, 1995; Van Beest, Van Dijk, & Wilke, 2004; Van Beest, Wilke & Van Dijk, 2003; Van de Kragt et al., 1986).

Alternatively, if outcomes are not evenly divisible by all members of the group, or status levels or interest in the resource are asymmetric, equality is no longer the primary choice and a proportionality or equity rule is evoked (Allison and Messick, 1990; Van Beest, Van Dijk, & Wilke, 2004; Van Beest, Wilke & Van Dijk, 2003). For example, in groups containing members of different power or status levels, those with the lower power want equality, whereas those with high power desire equity (Komorita & Chertkoff, 1973). These findings are more pronounced when these power or status differentials are seen as legitimate as opposed to unjustified (Samuelson & Allison, 1994). The more the individual perceives the privilege position as being legitimate and justified, the more likely that individual is to deviate from the "share equally" rule.

However, research by Van Dijk and Wilke (1995) has shown that this link between symmetry and equality and asymmetry and equity is not always quite so straightforward. In their study on coordination rules in asymmetric social dilemmas, Van Dijk and Wilke showed that in situations involving asymmetry (both with regards to participants' interest in the resource and their endowments), participants in a public good dilemma prescribed an equity rule when allocating resources, whilst participants in a resource dilemma enforced an equal division rule. The reason for this, they believe, may lie in the salience of the problem of distributing outcomes. In resource dilemmas, the aim of the task is to distribute the resource, and thus participants are forced to focus on the preferred distribution of final outcomes, whereas in a public good dilemma the aim of the task is to reach a certain threshold with less emphasis on the preferred end state. These findings suggest that a norm of equality is not solely evoked in groups where all members occupy identical positions (i.e., symmetry). The equal final outcomes rule also extends to asymmetrical conditions where members extract harvests from a common resource.

This distributive justice perspective is further advocated by game theory (Van Vugt, 2002). In particular, ultimatum games have been used to show that concerns for fairness matter to experimental subjects (Handgraaf, Van Dijk, Wilke, & Vermunt, 2004; Van Dijk, De Cremer, & Handgraaf, 2004; Andreoni, Brown, & Vesterlund, 2002; Camerer, 2003; Van Dijk & Vermunt, 2000).

Ultimatum Games. In an ultimatum game a Proposer makes a one-time offer on how to divide a sum of money between themselves and a Responder, who can accept it or reject the proposed division. If the offer is rejected the game ends and they both get nothing. If the offer is accepted, the proposal is implemented. A robust finding in these games is that offers made by the Proposer are on average 30-50% of the total sum to be divided and offers of less than 20% are rejected by the Responder with a very high probability. The fact that the Responder rejects the offer and thus forfeits the share of money offered by the Proposer nicely illustrates that people are willing to punish others at a cost to themselves to prevent unfair outcomes (Fehr & Fischbacher, 2003).

To summarise, when the allocation of resources is salient, individuals often strive to get an equal share of the resource. Distributive norms are evoked which consequently decrease free-riding as individuals' attention is directed away from maximising own outcomes and is focused on getting a fair share. We believe that if some individuals disregard these fairness norms and continue to maximise their own outcomes, for example, by harvesting excessively from a common pool in a resource dilemma, or withholding their endowments in a public goods dilemma, this will cause free-rider conflict that could potentially lead to a fission. However, the distribution of outcomes is clearly important to individuals. Thus, we believe that a group will be more likely to fission if the break-away groups will get an equal share of the original common pool, whereas an unequal distribution of resources (and if the break-away groups are unsure which of the unequal resources they will be allocated if they split) will deter group members from initiating a fission.

The Present Research

Based on the assumption that free-rider conflict and subgroup boundaries are important endogenous factors in the group fission process, this thesis explores how these factors can be integrated in order to explain how a group fission is initiated, i.e., the pathways that lead a group to fission. We explore two pathways here. The *strong* faultline hypothesis predicts that the presence of subgroup boundaries magnifies the impact of the free-rider conflict, such that a group with faultlines is more susceptible to a group fission than a group without faultlines. The *weak* faultline hypothesis predicts that the free-rider conflict alone initiates the fission, and the role of subgroup boundaries is to demarcate the break-away groups. Thus, free-rider conflict is important in both the *weak* and the *strong* faultline hypothesis but the role that subgroups play in the fission process differs.

Throughout this thesis, the faultline hypotheses are tested by investigating a number of different faultlines -- both diversity faultlines (gender, graduate status, attitude similarity, and presence of newcomers) and physical faultlines (ease of resource division) -- and varying the free-rider conflict depending on whether the free-rider is withholding their contribution (in a public goods dilemma) or harvesting excessively from a public resource (in a resource dilemma). The effect of group size as a possible precipitating factor in promoting free-rider conflict is also examined.

In doing so, this thesis aims to explain when a fission is likely to occur and how it will occur, in order to place the group fission phenomenon within the broader context of membership dynamics as part of the ongoing patterns of change and continuity in a group system.

Research Overview

The present studies employ either a step-level public good dilemma or a resource dilemma which enables us to manipulate the presence or absence of free-riders in the group, in addition to manipulating subgroup boundaries. These manipulations make it possible to test the faultline hypotheses of group fission. During each of the six studies featured in this thesis, participants were exposed to a dilemmatic situation and were asked two key questions which served as our main dependent variables: "Do you want this group to split?" (fission preference) and "Which group members do you choose to establish a new group?" (composition of exit group).

Part II of this thesis focuses on four studies which aim to test whether the *weak* faultline hypothesis (subgroups determine the exit group composition but do not augment the likelihood of a fission) or the *strong* faultline hypothesis (subgroups exacerbate the likelihood of a split) is accurate in predicting the route to fission in these dilemmatic situations. In each of these four studies, we employed a task with a potential opportunity to free-ride, thereby causing a conflict within the group, and we manipulated the presence or absence of various diversity faultlines (gender, graduate status, attitude similarity) within the group.

More specifically, in Chapter Two we focus on role-playing studies. In Experiment 1, the presence (or absence) of free-rider conflict within the context of living in shared student accommodation was manipulated. The conflict manipulation involved a cooking rota in the house and whether all household members were cooking when it was their turn (no-conflict condition) or neglecting to cook when it was their turn (conflict condition). The subgroup division manipulation used was gender; participants either shared a house with all females (no-subgroup condition), or a combination of males and females (subgroup condition). Experiment 2 was also set in student accommodation, however, in this study the conflict manipulation was concerned with cleaning arrangements and noise levels in the house. Participants were either all doing their fair share of the housework and were being considerate with noise levels (no-conflict condition), or some members were disregarding their household duties as well as being inconsiderate with noise-levels (conflict condition). Furthermore, in this study graduate status served as the subgroup boundary.

Participants either shared a house with all postgraduates (no-subgroup condition), or a mixture of undergraduates and postgraduates (subgroup condition).

Chapter Three features two computer based studies, conducted in a controlled laboratory environment. In Experiments 3 and 4 a step-level public-good dilemma task was employed to create a group conflict. Participants received an endowment at the start of every session and were asked to choose whether to keep the endowment for themselves or invest it in the public good. Participants either received feedback indicating that the group had reached the provision point, enabling participants to gain a group bonus in four of the six trials (no-conflict condition), or in two of the six trials (conflict condition). The subgroup division manipulation was introduced using an attitude similarity questionnaire. Participants rated their preferences for music, films, food, the environment, friendship groups, and future careers, on a multiple choice measure and then received false feedback concerning how their responses compared with the other members in the group. Participants either had much in common with all members of their group (no-subgroup condition) or with some members of their group (subgroup condition). Experiment 4 was an extension of Experiment 3, which continued to provide participants with information regarding the success or failure of reaching the provision point. However, in addition to this information participants were provided with individualised feedback about the contributions of each task member, allowing participants to explicitly see who the free-riders and co-operators were in the group. This manipulation was such that in the subgroup condition all members of the out-subgroup were the free-riders.

Part III of this thesis continues to search for support for the *strong* and *weak* faultline hypothesis, but in addition, we investigate the popularity of the fission option, as a way of dealing with free-riders when other structural solutions are available (electing a leader, equal privatisation, harvest cap, sanctions). Thus, in Chapters Four and Five we conducted two studies to further investigate the fission process, which employed resource dilemmas.

Unlike the earlier studies, the conflict domain was fixed in Experiments 5 and 6 (a role-playing study and a laboratory study, respectively) so that all participants were exposed to a free-rider conflict. In order to induce free-rider conflict in these studies participants were told that certain members were taking more than their fair share of resources from the common pool. In accordance with the earlier studies we continued to manipulate the presence or absence of subgroup divisions. In these studies the diversity faultline was dependent on whether participants shared a common history with the members of their group, i.e., they had all successfully worked together before (no-subgroup condition), or whether there was a mixture of newcomers in the group as well as some members that the participants had worked with previously (subgroup condition).

In addition to the presence of free-rider conflict and the manipulation of subgroup boundaries, in Experiments 5 and 6 we extended the original faultline hypothesis featured in Part II of this thesis to include our physical faultline manipulation - the ease of resource division. The ease with which the resource (common pool) could be divided easily and fairly into two (easy-to-divide condition versus difficult-to-divide condition) was manipulated as a within-subjects factor to test our hypothesis that groups are more likely to fission if a resource is easy to divide equally and to see whether the presence of physical faultlines affects the role of diversity faultlines in the fission process. Finally, we manipulated the size of the group (four, eight, and sixteen) as an additional between-subjects factor to test our hypothesis that larger groups are more likely to fission than smaller groups.

During Experiments 5 and 6 participants were asked, "Do you want this group to split?" (fission preference) and "Which group members do you choose to establish a new group?" (composition of exit group). In addition, participants were asked to rate the effectiveness of a number of structural solutions for dealing with the free-rider problem, in both the easy and difficult-to-divide condition, and to select which structural solution they would like to implement for the following task.

Table 1

Overview of Studies

Study	*Main Aims*	*Main Hypotheses*	*Methodology*	*Sample*
1	To pit the weak faultline hypothesis against the strong faultline hypothesis.	1a) The strong faultline hypothesis; fission is more likely if there is a free-rider conflict *and* subgroup divisions within the group. 1b) The weak faultline hypothesis; fission is more likely if there is a free-rider conflict within the group. The faultline determines how the group will split once a fission is imminent but is not responsible for the split.	Role-playing methodology in shared student house. *Free-rider conflict*: cooking arrangements *Faultline*: gender	74 female students. Mean age = 20.2 years (*SD* = 2.3)
2	To pit the weak faultline hypothesis against the strong faultline hypothesis.	1a) and 1b) as above	Role-playing methodology in shared student house. *Free-rider conflict*: cleaning arrangements *Faultline*: graduate status	92 postgraduate students; 35 males, 57 females. Mean age = 26.39 years (*SD* = 5.91)
3	i) To pit the weak faultline hypothesis against the strong faultline hypothesis. ii) To replicate the findings of Experiment 2 using a different methodology.	1a) and 1b) as above	Laboratory based experiment featuring a step-level public goods dilemma. *Free-rider conflict*: performance on dilemma task *Faultline*: attitudinal similarity	104 students; 17 males, 87 females. Mean age = 20.02 years (*SD* = 2.43)
4	i) To pit the weak faultline hypothesis against the strong faultline hypothesis. ii) To replicate the findings of	1a) and 1b) as above	Laboratory based experiment featuring a step-level public goods dilemma.	46 students; 15 males, 31 females.

Study	*Main Aims*	*Main Hypotheses*	*Methodology*	Mean *Sample*
	Experiments 2 and 3 when an explicit link between faultline and source of conflict was highlighted.		*Free-rider conflict*: performance on dilemma task *Faultline*: attitudinal similarity	age = 21.46 years (*SD* = 3.11)
5	i) To pit the weak faultline hypothesis against the strong faultline hypothesis. ii) To examine how fairness allocations (resource division) affects fission likelihood. iii) To examine how group size affects fission likelihood. iv) To examine the prevalence of the fission choice when other structural solutions are available.	1a) and 1b) as above 2) A fission will be more likely if the common resource is easy to divide equally than if it is difficult to divide equally. 3) Participants will be more likely to fission in larger groups than in smaller groups. 4) The fission option will be selected more often over alternative solutions and will be rated as more effective for dealing with the free-rider problem when the resource is easy rather than difficult to divide.	Role-playing methodology featuring working on a shared vegetable patch. *Free-rider conflict*: excessive harvesting from vegetable patch *Faultline*: newcomers entering the group	84 students; 24 males, 60 females. Mean age = 23.1 years (*SD* = 4.53)
6	i) To pit the weak faultline hypothesis against the strong faultline hypothesis. ii) To replicate the findings of Experiment 5 using a different methodology.	1a) and 1b) as above 2) as above 3) as above 4) as above	Laboratory based experiment featuring a resource dilemma. *Free-rider conflict*: excessive harvesting from a common pool *Faultline*: newcomers entering the group	113 students; 47 males, 66 females. Mean age = 21.7 years (*SD* = 3.7)

Part II: GROUP FISSION: A TWO-STAGE PROCESS

Chapter 2: Free-riders, Faultlines, and the Group Fission Phenomenon: Scenario Studies in a Shared Student House

The aim of this chapter is to investigate the antecedents of a group fission using the group faultline hypotheses. Reading of the literature and examination of real world examples of fission as discussed in Chapter One has led us to believe that both free-rider conflict and subgroup boundaries may be important endogenous factors in the fission process. However, due to a lack of actual empirical research within the area of fission in general, and more specifically the effects of free-rider conflict on fission, this chapter describes two studies that use role-playing methodologies to see whether free-rider conflict can initiate a fission, and the role that subgroup boundaries play in this fission process. That is, these experiments investigate whether subgroup boundaries magnify the impact of the free-rider conflict to make a fission more likely (*strong* faultline hypothesis) or whether their presence is redundant in determining whether a fission will ensue but defines where the group will split once a force is imposed upon it (the *weak* faultline hypothesis). Despite the limitations of using such a methodology, its use was considered most practical in these circumstances where it could be used in an exploratory vein to research an area that is relatively unfamiliar and unknown. Thus Chapter Two focuses on the first steps of discovering why group fissions occur and when they are likely to happen.

Experiment 1

In the first role-playing study, group fission was examined through a scenario on living arrangements in shared student accommodation. More specifically, *cooking arrangements* served as the free-rider conflict domain and *gender* as the subgroup boundary (for an example of the scenario and questionnaire presented to participants, see Appendix 1). This was informed by the results of a pilot study among 20 undergraduate students, currently living in shared student accommodation. This revealed that cooking (90%) was one of the most frequently mentioned sources of contention in shared households, alongside cleaning arrangements (87.5%), noise (66.7%), and paying bills (62.5%). In particular, it became apparent from participants' responses that people not cooking when a rota was in place, and it was that persons' designated time to cook, led to frustration and arguments amongst students in the shared household. More importantly, the participants (all females) attributed the causes of these conflicts more frequently to males in the house (55% to males) than to other females (5% to females), whereas 40%

were indifferent. Based on these findings, gender was considered to be a salient subgroup category for this type of conflict, which enabled us to test the two hypotheses for the antecedents of group fission.

Hypotheses. According to the *strong* faultline hypothesis, a fission will be more likely if there is both a free-rider conflict (over cooking arrangements) and clearly identifiable subgroups, that is, a mixture of female and males (subgroup condition) in the student house as opposed to an all female house (no-subgroup condition). Thus, an interaction between the free-rider conflict and subgroup division manipulation would be expected. The *weak* pathway predicts that free-rider conflict alone is sufficient to initiate a fission and that subgroup divisions aid this process by determining the composition of the exit groups. Thus, the weak faultline hypothesis predicts two main effects – a main effect of free-rider conflict on the fission choice and a main effect of subgroup division on the exit group composition.

Method

Participants and Design

Seventy-four female undergraduate students at the University of Southampton participated in this study for course credits, all of them living in shared student accommodation. The mean age of participants was 20.2 years ($SD = 2.3$). They were randomly assigned to one of four conditions, according to a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) between-participants factorial design. There were between 17 and 21 females per cell.

Scenario and Questionnaire

Participants received information concerning cooking arrangements in an imaginary student household.

First, they received background information about the house which included the subgroup division manipulation. In the no-subgroup condition, participants read:

"You live in a student house with five other girls: Emma, Sarah, Rebecca, Catherine, and Rachel."

In the subgroup condition, participants read:

"You live in a student house with two girls and three boys: Emma, Sarah, Daniel, Ben, and David."

Everyone then received information about the cooking arrangements:

"It was decided when you first moved into the student house that there should be a rota for cooking because the kitchen in the shared house is quite small and it would be too difficult for six people to try and cook individually."

This was followed by the manipulation of the free-rider conflict. In the no-conflict condition it was stated that:

"So far, the rota seems to be working quite smoothly and if one of the housemates knows that they will not be available to cook on the day specified on the rota they have made alternative arrangements to swap with those housemates who can. All of your housemates, including yourself, seem satisfied with the current arrangements."

In contrast, in the conflict condition it was stated that:

"The cooking arrangements are starting to cause some dissatisfaction in the house. Different housemates keep trying to get out of preparing the dinner when the rota says that it is their turn to cook. This arrangement is clearly causing frustration and arguments amongst the group."

This was followed by a set of questions pertaining to the dependent variables. First, each participant answered the primary group fission question, "What do you want to do, leave the cooking arrangements as they are (0) or split into two smaller groups of three?"(1). Subsequently, participants were informed that a split was imminent, and they were asked to indicate their choices for two housemates that they would like to form a break-away group with (exit group composition).

Procedure

Upon arrival at the laboratory in groups of varying sizes (between three and ten persons), participants were seated at desks that had been partitioned off from each other. Each cubicle was equipped with a pen and a booklet, containing the scenario and accompanying questionnaire. After completing an informed consent form, participants received the task instructions. They were told to carefully read through the scenario and then to answer the questions in the accompanying booklet. On average, the completion of the task took ten minutes. Once the participants had finished they were debriefed about the purpose of the study and thanked for their participation.

Results

Manipulation Check

A two-way ANOVA on the manipulation question, "How satisfied were you with the current rota situation in the house" (1 = *not at all,* 7 = *very much so*), showed that, as expected, participants in the conflict condition ($M = 2.50$, $SD = .86$) reported being less satisfied with the cooking arrangements than those in the no-conflict condition ($M = 5.47$, $SD = 1.16$), $F(1, 70) = 157.89$, $p < .001$. There was no main effect of Subgroup division, $F(1, 70) = .33$, $p = .57$, and no Free-rider conflict x Subgroup division interaction, $F(1, 70) = .01$, $p = .93$. Thus the results show that the free-rider conflict manipulation was successful.

Group Fission

To analyze the data, a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) logistic regression was conducted on the fission choice. This revealed a main effect of Free-rider conflict, $\chi^2(1, N = 74) = 51.67$, $p < .001$, with 97.4% of participants wanting to split in the conflict condition compared with 22.2% in the no-conflict condition. There was no main effect of Subgroup division, $\chi^2(1, N = 74) = .06$, $p = .81$, nor a significant Free-rider conflict x Subgroup division interaction, $\chi^2(1, N = 74) = 1.54$, $p = .21$. Thus, there was no evidence for the *strong* faultline hypothesis, which predicted that the likelihood of a fission would be affected by the presence of subgroups, i.e., females vs. males.[4]

Composition of the Exit Group

To test whether the presence of subgroup boundaries in the original group determines the composition of the break-away groups, the exit group composition preferences were analysed using a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) ANOVA. Recall that Emma and Sarah were mentioned in both the subgroup and no-subgroup conditions. Hence, we recoded each participant's combination of choices for two housemates to form a continuous dependent variable. That is, participants received a score of 1 if they chose Emma and Sarah to form an exit

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[4] The fission percentages in the four conditions were: No-conflict, no-subgroup (17.6%), no-conflict, subgroup (26.3%), conflict, no-subgroup (100%), conflict, subgroup (95.2%).

group with, a score of 0 if they chose just one of these girls, and a -1 score if they did not choose any of these girls.

According to the *weak* faultline hypothesis, we would expect a main effect of Subgroup division, however, this effect was not statistically reliable, $F(1, 70) = .71, p = .40$. There was no main effect of Free-rider conflict, $F(1, 70) = .18, p = .67$, nor a Free-rider conflict x Subgroup division interaction, $F(1, 70) = 2.13, p = .15$.[5]

Summary

The results of Experiment 1 failed to find support for the *strong* faultline hypothesis. Subgroup division did not exacerbate the likelihood of a fission when groups experienced a free-rider conflict, even though, as we established in the pilot study, that a gender division was believed to be associated with the nature of the conflict (i.e., cooking arrangements). There was support for the proposition that free-rider conflict alone was sufficient to initiate a fission, however, the presence of subgroups did not affect the composition of the exit groups, thus there was also no support for the *weak* faultline hypothesis.

Experiment 2

Experiment 1 was our first attempt to understand the dynamics underlying group fission. Although we found no consistent support for either pathway of the faultline hypothesis, there may have been several idiosyncratic properties of Experiment 1 that may have stacked the deck against finding support for the hypotheses. First, the focus on gender as the subgroup category may not have given a fair chance to the faultline hypothesis. Although gender may be correlated with the emergence of certain conflicts in student houses, it is also true that members of mixed gender groups generally report higher satisfaction and in-group attraction than members of single gender groups (cf. Levi, 2001). Second, the group fission measure was perhaps not optimal in Experiment 1, because it merely constituted a membership change in the acting group (i.e., the cooking group) rather than the standing group (i.e., the student

[5] To serve as a comparison with the participants actual preferences for break-away members, the chance probability of selecting all possible exit group choices was calculated. Since the subgroup conditions were composed of two members who were similar to the participant and three members who were dissimilar to the participant, simple probability analysis shows us that the probability of picking two similar members from the original group by chance is 10%; the probability of picking one similar and one dissimilar member is 60%; and the probability of picking two dissimilar members is 30%. If these probabilities are compared with our actual results, we can infer that these break-away groups have not just been selected randomly.

house; cf. Arrow & McGrath, 1995). This is arguably a less severe threat to the integrity of the group.

To address these issues, we created another role-playing situation in Experiment 2 whereby a fission would actually result in the termination of the original group. Students were given the choice to continue renting a shared house with a group of six students or rent a smaller place with a subgroup of three other students. Moreover, the salient subcategory in Experiment 2 was the *status* of the student, graduate versus undergraduate student. A pilot study among twelve graduate students revealed that 91.7% of students would not like to live with undergraduate students, mentioning conflict over cleaning arrangements (76%) and noise (67%) as primary sources of contention. Hence, the sample consisted of graduate students only, and we used the graduate-undergraduate distinction to create the subgroup categories in the shared house.

Hypotheses. The *strong* faultline hypothesis predicts an interaction between free-rider conflict and subgroup division. Thus, when there is a conflict in the house over cleaning arrangements, postgraduates will be more likely to opt for a split if the house is shared with undergraduate students (subgroup condition) than with postgraduate students only (no-subgroup condition). The *weak* faultline hypothesis predicts two main effects: Free-rider conflict alone produces the fission, but the subgroup division determines along which lines the group will split.

Method

Participants and Design

In total, 92 postgraduate students at the University of Southampton, 35 males and 57 females, participated voluntarily in this study. All participants lived in a shared student house at the time of the study. The mean age of participants was 26.39 years (SD = 5.91). These participants were randomly assigned to one of four scenario conditions according to a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) between-participants factorial design. There were between 22 and 24 participants per cell.

Scenario and Questionnaire

First, participants received some background information about the student house which included the subgroup division manipulation. In the no-subgroup condition, participants read:

"You are a postgraduate living in a student house with five other people: Andrea, Chris, Sam, Jamie, and Nicky – all of whom are *postgraduates*, like yourself."

In the subgroup condition, participants read:

"You are a postgraduate living in a student house with five other people: Andrea, Chris, Sam, Jamie, and Nicky. Whilst Andrea and Chris are *postgraduates*, like yourself, Sam, Jamie, and Nicky are *undergraduates*."

Everyone then received information about the living arrangements:

"You have been living in your student house for nearly a year."

This was followed by the manipulation of the free-rider conflict. In the no-conflict condition it was stated that:

"Everyone in the house gets along well with each other. You all do your fair share of the housework and are considerate of each other's needs by being quiet when you go out in the evening and come back late. Generally, you are all quite satisfied with the current living arrangements as they are."

In contrast, in the conflict condition participants read:

"Recently, there have been arguments in the house. Certain housemates are not doing their fair share of the housework, and these same housemates are going out some evenings and coming back in the early hours and making a lot of noise. Generally, you are not very satisfied with the current living arrangements as they are."

Participants in all conditions were then informed:

"It is approaching the end of the academic year and the tenancy agreement on your student house is due to end next month. The landlord has contacted the house to let you know that he is perfectly happy for you to extend the warranty if you all want to. You have been looking on the University notice-board and have seen that there is a house advertised, which can accommodate three people."

As in Experiment 1, this was followed by a set of questions pertaining to the dependent variables. First, each participant answered the primary group fission question, "What would you like to do, stay in the house or move out with some others?" (0 = *stay*, 1 = *move out*). Subsequently, participants were told that a fission was imminent and were asked to indicate which two housemates they would like to form an exit-group with.

Procedure

The participants received the scenario and questionnaire per email after responding to an advert, asking for volunteers to take part in a study on "living arrangements in shared student accommodation."[6] The task instructions were exactly the same as in Experiment 1. After the participants had returned the completed questionnaire, they received a debriefing about the purpose of the study per email, and were thanked for their help.

Results

Manipulation Check

A two-way ANOVA on the manipulation question, "How satisfied were you with the current living arrangements?" (1 = *not at all*, 7 = *very much so*) revealed a main effect of Free-rider conflict, $F(1, 88) = 146.71, p < .001$. Those participants in the conflict condition ($M = 2.64, SD = 1.26$) reported being significantly less satisfied with the living arrangements than those participants in the no-conflict condition ($M = 5.71, SD = 1.17$). There was no main effect of Subgroup division, $F(1, 88) = .01, p = .91$, and no Free-rider conflict x Subgroup division interaction, $F(1, 88) = 1.43, p = .24$. These results show that our free-rider conflict manipulation was successful.

Group Fission

To analyze the data, a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) logistic regression was conducted on the fission choice. In a preliminary analysis we also included the gender of the participant as a factor in the design, but, because there was no gender effect in this study, $\chi^2(1, N = 92) = .09, p = .77$, nor indeed in any of the other studies, we collapsed the design across gender.

As in Experiment 1, the analysis showed that more people wanted to split in the conflict (88.6%) than in the no-conflict condition (22.9%), $\chi^2(1, N = 92) = 44.24$, $p < .001$. There was no main effect of Subgroup division, $\chi^2(1, N = 92) = .02, p = .88$, nor a significant Free-rider conflict x Subgroup division interaction, $\chi^2(1, N = 92) =$

[6] Note that this questionnaire was designed by the author using Macromedia Authorware 5.1 (Macromedia, 2000).

1.92, $p = .17$. Thus, there was no support for the *strong* faultline hypothesis. The presence of subgroups in the household did not affect the likelihood of a fission per se.[7]

Composition of the Exit Group

Participants' preferences for the exit group composition were analysed using a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) ANOVA. Recall that Andrea and Chris were mentioned in both the subgroup and no-subgroup conditions as sharing the same postgraduate status as the participant. As in Experiment 1, we recoded each participant's combination of choices for the two housemates, such that they received a score of 1 if they chose both Andrea and Chris to form an exit group with, a score of 0 if they chose just one of these names and one other member, and a score of -1 if they chose neither of these names.

The *weak* faultline hypothesis predicts a main effect of Subgroup division, which was significant, $F(1, 84) = 60.85, p < .001$.[8] Consistent with this prediction, 80.0% of participants in the subgroup condition chose to form a group with the two postgraduate students, Andrea and Chris, compared to just 14.0% in the no-subgroup condition. Thus, demonstrating in the subgroup condition, a clear preference for dividing the group along subgroup boundaries.[9] There was no main effect of Free-rider conflict, $F(1, 84) = .04, p = .84$, nor a Free-rider conflict x Subgroup division interaction, $F(1, 84) = .08, p = .78$.

Summary

The results of Experiment 2 provided support for the *weak* faultline hypothesis. Subgroup division did not exacerbate the tendency for groups to fission when they experienced a free-rider conflict, even though it was established in the pilot that the subgroup categories (postgraduates vs. undergraduates) were believed to be related to the nature of the conflict (cleaning). Once again, free-rider conflict alone was sufficient to

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[7] The fission percentages in the four conditions were: No-conflict, no-subgroup (20.8%), no-conflict, subgroup (25%), conflict, no-subgroup (90.9%), conflict, subgroup (86.4%).

[8] Note that four participants were excluded from this analysis for failing to select the required number of members to form a break-away group with.

[9] To examine whether the exit group composition was affected by the participants' original decision to fission, the above analysis was repeated, with fission preference as a covariate. There was no main effect of the covariate, $F(1, 83) = 1.42$, $p = .24$, and no change of the main effect of Subgroup division in the participants' exit group choice. Thus, fission preference did not affect participants' choice of break-away members.

induce a fission. Furthermore, Experiment 2 showed that prior subgroup divisions strongly affected the composition of the exit groups.

Chapter Discussion and Conclusions

The major purpose of this chapter was to investigate the antecedents of a group fission by testing two alternative hypotheses; the *weak* and the *strong* faultline hypotheses. In Experiment 1 we failed to find support for either of these hypotheses. Some possible explanations for this have been previously proffered, such as, gender being an unsuitable subgroup category as members of mixed groups often report being more satisfied than single gender groups (Levi, 2001). Furthermore, our measure of fission may have been less than optimal as participants knew that regardless of their decision to stay or split the cooking group they would still have to interact with the other household members in other aspects of everyday life. The results of Experiment 2 offered support for the *weak* faultline hypothesis, that is, free-rider conflict over participants not pulling their weight with cleaning the house was responsible for participants choosing to move into separate houses. Whilst the role of the subgroup division (graduate status) did not in itself increase the likelihood of a fission in the student house, it did determine which members would be selected by the participant to move into another house with. Thus, participants in the subgroup condition, where there was an undergraduate-postgraduate divide, were more likely to select fellow postgraduates to live with in the next academic year.

Interestingly, neither of these experiments found any evidence that subgroup boundaries exacerbated the likelihood of a fission (i.e., the *strong* faultline hypothesis). One possibility for this could be that the manipulation of free-rider conflict in these studies was so strong that it obscured any possible interaction effects. The group fission choice in Experiment 1 displayed a ceiling effect; 100% of participants chose to fission in the conflict, no-subgroup condition, and 95.2% chose to fission in the conflict, subgroup condition. Although slightly less in Experiment 2, the fission preference was still exceptionally high; 86.4% of participants chose to fission in the conflict, subgroup condition, and 90.9% chose to fission in the conflict, no-subgroup condition. Thus, in the following experiments it will be necessary to tone down this free-rider manipulation in order to give the *strong* faultline hypothesis a chance.

Although it was clear in both studies that our free-rider manipulation was successful and that participants exposed to free-riders were significantly more likely to fission than participants not exposed to free-riders in the group, there was still a high percentage of participants wanting to fission in the no-conflict condition. In Experiment 1, 26.3% of participants wanted to fission in the no-conflict, subgroup condition, and 17.6% chose to fission in the no-conflict, no-subgroup condition. In Experiment 2, 25% of participants in the no-conflict, subgroup condition chose to fission, as did 20.8% of participants in the no-conflict, no-subgroup condition. The reasons why these participants chose to split, despite being in a situation in which there was no free-rider conflict may have been a bi-product of the methodology that was employed. Participants may have believed that we wanted people to fission, and thus were giving us socially desirable answers.

The evidence so far is based on the results of role-playing studies. However, this methodology is open to social desirability and self-presentational tendencies (Greenwood, 1983). Such biases may have played a role in the experiments presented in this chapter, for example, the females may not have wanted to appear prejudiced towards the males in the house, and the postgraduates may not have wanted to appear prejudiced against undergraduates. Furthermore, there were no tangible outcomes associated with the scenarios because the participants did not experience the house conflicts themselves, although they would have been all too familiar with these problems. Hence, the fission may not have had a direct effect on the participants' outcomes. To counteract these criticisms, in the subsequent chapter the free-rider conflict and subgroup categories will be manipulated in order to test the faultline hypotheses, however the role-playing methodology will be replaced with controlled laboratory experimentation. Thus, we shall be looking to see if the current findings are replicable when using a different methodology.

In conclusion, it seems that free-rider conflict alone is sufficient for participants to initiate a group fission and the role of subgroup categories is to determine the exit group composition once a fission is imminent.

Chapter 3: Free-riders, Faultlines, and the Group Fission Phenomenon: Laboratory Evidence

The aim of this chapter is to replicate the findings of the previous chapter using a different methodological basis for which to test the faultline hypotheses. The experiments featured in Chapter Two could be criticised for their role-playing methodology, which is subject to social desirability and self-presentational tendencies (Greenwood, 1983), thus controlled computer-based laboratory experimentation was employed in the two studies discussed in this chapter.

Experiment 3

To deal with the potential criticisms of Experiments 1 and 2, a third experiment was designed, which allowed us to study group fission and its possible determinants in 6-person task groups, working under controlled conditions in the laboratory. The task involved a step-level public goods dilemma, which resembles a variety of larger and smaller free-rider problems in the real-world, including tax paying, contributing to community schemes, as well as shared living arrangements (Van Vugt et al., 2000). In this task, group members can decide whether to invest money in a collective good for the group or not. This good is only provided, however, if a minimum number of group members make an investment. Moreover, if the group fails to provide the good, each contributor will lose their endowment. Thus, unlike the previous role-playing studies in Chapter Two where there were no tangible outcomes associated with the free-rider conflict, in this study, the presence of free-riders in the group could potentially jeopardise members receiving a monetary bonus.

In this task environment, free-rider conflict was manipulated by providing bogus feedback about how successful or unsuccessful the group had been in providing the good. Furthermore, an attitude similarity questionnaire was included at the start of the task to manipulate the subgroup divisions. With the use of false feedback participants were led to believe that they either shared similarities with all other members of their group, or with just a subgroup of two other members. At the end of six trials, participants were presented with the main dependent variables. They were given the option to stay in the six-person group or split into three-person groups for the remainder of the task (fission preference) and decide which other members they would like to form a break-away group with (exit group composition choice).

Hypotheses. The *strong* faultline hypothesis predicts an interaction between free-rider conflict and subgroup division on the preference to fission and work in a smaller group. Thus, this hypothesis predicts that a fission is more likely to the extent that there is a conflict over the group's performance in a step-level public goods dilemma task and that there are a mixture of similar and dissimilar members in the group (subgroup condition) as opposed to all similar members (no-subgroup condition). The *weak* faultline hypothesis predicts two main effects: that the free-rider conflict alone will initiate a fission, and that subgroup divisions determine how the group will split, i.e., the groups will split along the similarity faultline in the subgroup condition, once a fission is imminent.

Finally, this experiment enabled us to search for mechanisms underlying the emergence of group fission. On the basis of previous social dilemma research (for example, Kerr, 1989, Komorita, Parks, & Hulbert, 1992), we hypothesised that fissions may occur due to a fear of free-riders. Hence, we expected to find fission preferences to be associated with lower levels of trust in other group members. The perceived benefits of a fission for dealing with the free-rider problem were also measured.

Method

Participants and Design

In total, 104 undergraduate students at the University of Southampton, 17 males and 87 females, participated voluntarily in this study. The mean age of participants was 20.02 years (*SD* = 2.43). These participants were randomly assigned to one of four experimental conditions, according to a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) between-participants factorial design. There were between 25 and 27 participants per cell.

Procedure

Participants volunteered to take part in a study on "group interactions and group performance". Upon arrival at the laboratory in groups of six, participants were seated in individual cubicles, each containing a computer. After completing an informed consent form, participants were told that all further instructions would be presented on the computer screen.[10]

Manipulation of Subgroups. Participants were given a number to identify themselves (the participant was always number 18) and the other group members (always 16, 17, 19, 20, and 21).

They then completed an attitude similarity questionnaire, which they were told would allow them to find out which members of the group they shared similarities with. Participants were asked about their favourite tastes in music, films, TV programs, food, and leisure activities. They were also asked about their views on environmental issues and friendship groups.

Before proceeding with the social dilemma task, participants received feedback from the attitude similarity questionnaire. This was, in fact, bogus feedback to incorporate the subgroup manipulation; in the no-subgroup condition participants were told that they gave similar answers to everyone else in their group, whilst in the subgroup condition their answers were said to be similar to those of two other group members (participants 16 and 21), and dissimilar to the rest.

This manipulation was followed by six group identification questions which were used to determine the salience of their group (versus subgroup) identity (for a similar scale, see Brown, Condor, Mathews, Wade, & Williams, 1986). These questions were measured on a 7-point rating scale (1 = *not at all*, 7 = *very much so*), asking, "To what extent do you … fit in well with this group?, … identify with other group members?, … have a lot in common with other group members in general?, … have a lot in common with other group members in terms of specific opinions and attitudes?", "Would you say you had a lot in common with the other members of the group?" and "To what extent do you feel that your group is cohesive?" (*alpha* = 0.89).

Experimental Task. Participants then received standard instructions for a step-level public good task:

"Each individual will get some start-up money before each session of the task. The start-up money is called an endowment. In each session group members will have the

[10] Note that the computer program running this experiment was written by the author using Authorware 5.1. All further laboratory based experiments discussed in this thesis were also designed using the same software (Macromedia, 2000).

opportunity to earn an extra sum of money for the group. Each of you will receive this extra sum, provided that enough people from your group invest their endowment. If the group is successful everyone in the group receives a larger sum than they had at the start, regardless of whether they invested or not. However, if the group fails to provide the good, the people who invested will lose their endowment!"

Furthermore, participants were told that:

"Before each session, you will get an endowment of £3. Per session, you will have the opportunity to invest these £3 in your group or keep the £3 to yourself (you must either invest all or nothing!) If enough people in your group invest, each of you will earn a £5 bonus for that particular session. At least 4 out of 6 members need to invest their endowment in order to earn a £5 bonus for the group. If fewer than 4 individuals invest, the bonus is not provided and each of the investors will lose their endowment, while non-investors keep it, in that session." In order to help participants understand the consequences of contributing their endowment or not, and to show how the outcome could be affected by the behaviour of other members of the group, they were given an information sheet which summarised all possible pay-offs (see Figure 2).

	Other Group Members:	
	Less than 4 members contribute	4 or more members contribute
You Invest	£0	£5
You do not Invest	£3	£8

Figure 2. An example of an outcome matrix for a step-level public goods dilemma task. The matrix shows pay-offs that the participant can receive depending on their choice, and the choice of other group members, whether to invest their endowment in the group.

This was followed by several practice sessions to check their understanding of the pay-offs.

Subsequently, the investment task began. In each session, participants were asked, "Do you wish to invest your endowment in the group?" (0 = *no*, 1 = *yes*). After each session participants were provided with feedback detailing whether the group had achieved the bonus or not in that particular round.

Manipulation of Resource Conflict. The outcome feedback was manipulated such that the group managed to achieve the bonus in either two of the six sessions (conflict condition) or in four of the six sessions (no-conflict condition).

After the sixth session, participants received a message from the experimenter:

"Dear group members, we are now halfway through the task. Previous research has indicated that not all people were equally happy with their group performance at this point in the task, and they wished to undertake some kind of action. As a result, we have decided to give you the opportunity, if you so wish, to split into a smaller group of three before the commencement of the next task."

Each participant then answered the primary group fission question, "What would you like to do?" (0 = *stay in group of six*, 1 = *split into smaller groups of three*).

Subsequently, participants indicated the extent to which they agreed with four statements (1 = *very strongly disagree*, 7 = *very strongly agree*), referring to the impact of a fission on the free-rider problem within their group, "It is more efficient to work in a smaller group," "It is more practical for us to work in smaller groups," "In a smaller group, we have a better chance of obtaining the bonus," "I do not trust all group members to contribute." These items were combined into one efficacy-scale (*alpha* = 0.81).

In addition, in Chapter One, we advocated that co-operation levels may be higher in smaller groups compared to larger groups because people tend to trust each other more in smaller groups. To test this prediction, participants were asked to reveal the amount of trust they had in their fellow group members. For each group member, participants were asked to guess the number of times they thought that each participant had contributed their endowment to the group (0-6 times).

Finally, participants were told that the split was imminent, and they were asked to choose the two members they would like to form an exit group with.

On completion of the experiment, participants were debriefed, whereby they were told about the nature of the deception and the reasons for it. They were then thanked for their participation and received a lump sum of £5 (regardless of their performance on the group task). During the debriefing session, no suspicions were raised regarding the experimental manipulations.

Results

Manipulation checks

A two-way ANOVA on the manipulation question, "How satisfied were you with the performance of your group?" (1 = *not at all*, 7 = *very much so*), showed that, as expected, participants in the conflict condition ($M = 2.62$, $SD = 1.03$) reported being significantly less satisfied with the groups performance than those in the no-conflict condition, ($M = 4.94$, $SD = 1.11$), $F(1, 100) = 122.59$, $p < .001$. There was no main effect of Subgroup division, $F(1, 100) = .20$, $p = .66$, and no significant Free-rider conflict x Subgroup division interaction, $F(1, 100) = 1.60$, $p = .24$.

Furthermore, an average score across the group identification questions was calculated to create one single identification scale. This was then subjected to a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) ANOVA, to check the effectiveness of the subgroup manipulation. This revealed a significant main effect of Subgroup division, $F(1, 100) = 9.94$, $p = .002$, suggesting that participants in the subgroup condition identified less with the entire group ($M = 3.78$, $SD = 0.85$) compared to those in the no-subgroup condition ($M = 4.33$, $SD = 0.92$). A one sample t-test showed that both the means in the subgroup and no-subgroup conditions differed significantly from the mid-point of the scale, $t(50) = 26.20$, $p < .001$, and $t(52) = 29.11$, $p < .001$, respectively.

There was no main effect of Free-rider conflict, $F(1, 100) = .33$, $p = .57$, nor a Free-rider conflict x Subgroup division interaction, $F(1, 100) = .001$, $p = .97$.

These checks show that both the free-rider conflict and subgroup division manipulations were successful.

Group Fission

To analyze the data, a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) logistic regression was conducted on the fission choice. This revealed a main effect of Free-rider conflict, $\chi^2(1, N = 104) = 23.50$, $p < .001$, suggesting that participants were more inclined to split in the conflict condition (51.9%) than in the no-conflict condition (9.6%). There was no Subgroup division main effect, $\chi^2 < 1$, nor a significant Free-rider conflict x Subgroup division interaction, $\chi^2(1, N = 104) = 1.43$, $p = .23$.[11,12]

Investment

To examine if the fission choice was influenced by the amount of cooperation during the task, the total number of times participants made a contribution over the six trials was calculated. This sum (0 = *never invest*, 6 = *always invest*) was entered into a one-way ANOVA, along with the fission choice as an independent variable. The results showed that 'stayers' versus 'splitters' did not differ in the number of times they had invested across the trials, $F(1, 102) = .51$, $p = .48$.

Furthermore, an ANOVA including the sum of contributions and the 2 (Free-rider conflict: conflict, no-conflict) by 2 (Subgroup division: subgroup, no-subgroup) factorial design revealed only a main effect of Subgroup division, $F(1, 100) = 4.48$, $p = .04$. Consistent with other research (Kramer & Brewer, 1984; Wit & Kerr, 2002), the rate of group contributions was higher in the no-subgroup condition ($M = 4.22$; $SD = 1.66$) than in the subgroup condition ($M = 3.52$, $SD = 1.67$). There was no main effect of Free-rider conflict, $F(1, 100) = .03$, $p = .86$, nor a Free-rider conflict x Subgroup division interaction, $F(1, 100) = .50$, $p = .48$.

Composition of the Exit Group

The preferences for the exit group composition were analysed using a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) ANOVA. Recall that participants 16 and 21 were the only members that were mentioned as being similar to the participant, based on the results of the similarity test, in both the subgroup and no-subgroup conditions. Therefore, the participants' choices of break-away members were recoded such that they received a score of 1 if they chose both participants 16 and 21 to form a break-away group with, a score of 0 if they picked a similar and a dissimilar

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[11] The fission percentages in the four conditions were: No-conflict, no-subgroup (3.7%), no-conflict, subgroup (16%), conflict, no-subgroup (50%), conflict, subgroup (53.8%).

[12] The analysis on fission preference and exit group composition was also repeated using group identification as an independent variable (rather than subgroup division). A median split on the composite group identification score allowed us to dichotomise the group into high and low identifiers. However, there was no significant main effect of group identification on either fission preference, $\chi^2(1, N = 92) < 1$, $p = ns$, nor exit group composition, $F(1, 88) = .23$, $p = ns$.

member, and a score of -1 if they selected two dissimilar members (participants 17, 19, or 20).

This analysis revealed a significant main effect of Subgroup division, $F(1, 100) = 88.26, p < .001$. As predicted by the *weak* faultline hypothesis, both participants 16 and 21 were elected to form part of a break-away group by 84.3% of participants in the subgroup condition and only 7.5% in the no-subgroup condition, thus suggesting a clear preference for dividing up the group along subgroup lines. There was no main effect of Free-rider conflict, $F(1, 100) = .78, p = .38$, nor a Free-rider conflict x Subgroup division interaction, $F(1, 100) = .63, p = .43$.

Trust in Other Group Members

Participants were asked, "During the contribution sessions, how many times do you think participant [16, 17, 19, 20 and 21] contributed their endowment?" (0-6). A composite trust index was calculated, and entered into a correlation with the fission preference, to enable us to test the hypothesis that fissions may occur due to a fear of free-riders. This revealed a negative correlation between trust and fission preference, $r = -.26, p = .01$, thus, supporting a possible link between fission and fear of free-riding.

In addition, a 2 (Free-rider conflict: conflict, no-conflict) x 2 (Subgroup division: subgroup, no-subgroup) MANOVA was used to analyse the participants' responses to the above trust questions. The results of which revealed a significant main effect of Free-rider conflict, $F(5, 96) = 5.05, p < .001$, and Subgroup division, $F(5, 96) = 5.23, p < .001$, but no significant Free-rider conflict x Subgroup division interaction, $F(5, 96) = 1.15, p = .34$.

Further univariate analyses revealed that, not surprisingly, participants in the no-conflict condition expected their fellow group members to contribute more than those in the conflict condition. Significant differences in trust were obtained for each group member; Participant 16, $F(1, 100) = 14.80, p < .001$, Participant 17, $F(1, 100) = 14.79, p < .001$, Participant 19, $F(1, 100) = 17.88, p < .001$, Participant 20, $F(1, 100) = 5.77, p = .02$, Participant 21, $F(1, 100) = 15.33, p < .001$. The means for each of these main effects are presented in Table 2.

Table 2

Mean Trust Scores in Other Group Members in the Conflict and No-Conflict Conditions

Participant Number	No-Conflict Condition	Conflict Condition
16	3.56 (1.04)	2.83 (1.09)
17	3.35 (1.08)	2.56 (1.18)
19	3.54 (1.18)	2.63 (1.09)
20	3.33 (1.28)	2.71 (1.35)
21	3.87 (1.16)	3.00 (1.17)

Note. The above scores represent the mean response to the question, "How many times do you think participant X contributed their endowment?" (0 – 6). Standard deviations are presented in parentheses.

More importantly, the univariate analyses associated with the main effect of Subgroup division revealed that in the subgroup condition, there was greater trust in participants 16 and 21 -- those with whom they shared similarities. Participant 16 was expected to contribute more in the subgroup condition ($M = 3.50$, $SD = 1.13$) than in the no-subgroup condition ($M = 2.92$, $SD = 1.05$), $F(1, 100) = 8.33$, $p = .01$, and the same was true for participant 21, ($M = 3.60$ *vs.* 3.29, *SD*s = 1.35 and 1.09, respectively), although this failed to reach statistical significance, $F(1, 100) = 1.86$, $p = .18$.

Reasons for Splitting

Participants were asked to indicate the extent to which they agreed or disagreed with four statements concerning the benefits of a fission (1 = *not at all*, 7 = *very much so*). The scores on these measures were summed to create a composite efficacy score which was then analysed in an ANOVA with the complete factorial design. This analysis revealed a main effect of Free-rider conflict, $F(1, 100) = 23.36$, $p < .001$, and the associated means showed a greater perceived efficacy in the conflict condition ($M = 4.16$, $SD = 1.35$) than in the no-conflict condition ($M = 3.02$, $SD = 1.01$). Note that only the mean in the no-subgroup condition differed significantly from the mid-point of the scale, $t(52) = -2.74$, $p = .01$. There was no main effect of Subgroup division, $F(1, 100) = .36$, $p = .55$, nor a Free-rider conflict x Subgroup division interaction, $F(1, 100) = 1.11$, $p = .30$.

Summary

The results of this laboratory study provided support for the *weak* faultline hypothesis. Subgroup division did not exacerbate the likelihood of a fission, although there was generally less cooperation and less trust in each other when subgroups were present. The subgroup divisions affected the formation of the exit groups by establishing a clear preference for in-subgroup members over out-subgroup members. Finally, participants more strongly perceived the benefits of a fission when free-riding was prevalent within their group.

Experiment 4

The results of the experiments as yet have provided no support for the *strong* faultline hypothesis. A critic might argue, however, that this hypothesis has not yet received a fair trial. According to Lau and Murnighan (1998), the activation of particular faultlines depends on the contents and outcomes of the group task. Although in the previous studies, participants knew the group outcomes, they were not able to tell with one hundred percent confidence which group members were causing the group's poor performance (in the conflict condition). Instead, participants made inferences based upon the information that they had available to them, that is, with whom they shared (dis)similarities and therefore trusted more (less).

Thus, in this experiment participants received explicit feedback about who the co-operators and free-riders were in the group. According to the *strong* faultline hypothesis, if those co-operators would be members of their in-subgroup (and the free-riders would be members of the out-subgroup), this would be more likely to lead to a fission than if there were no subgroup divisions.

Hence, Experiment 3 was redesigned to incorporate bogus feedback about the investment decisions of the group members after each session. As before, participants were first informed about the presence or absence of subgroups within their group, following an attitude similarity questionnaire. Second, during the investment task (comprising of a step-level public goods dilemma) participants received feedback regarding whether the group had been (un)successful in reaching the provision point necessary to obtain the bonus. Because the previous studies had revealed such reliable effects for the conflict manipulation, it was decided to only create a condition in this study where the groups failed in the majority of sessions (i.e., the original conflict condition). Thus, there were only two cells in this fourth experiment (Subgroup division: subgroup, no-subgroup). Finally, after each session, participants received feedback about the investment decisions of *each* group member.

Hypotheses. Within such a design, the *strong* faultline hypothesis predicts a main effect of subgroup division on the fission choice, i.e., groups containing a mixture of similar and dissimilar members (subgroup condition) will be more likely to split than groups that contain members who are all similar to one another (no-subgroup condition). The *weak* faultline hypothesis predicts that subgroup divisions only influence the formation of the exit groups. Thus, the free-rider conflict caused by the group's poor performance in the task will induce the fission, but *how* the group splits will be determined by the similarity–dissimilarity faultline.

Method

Participants and Design

In total, 46 psychology undergraduate students at the University of Southampton, 15 males and 31 females, volunteered to take part in a study on "group interactions" for which they received credits as part of their course requirement. The mean age of participants was 21.46 years (SD = 3.11). These participants were randomly assigned to one of the two experimental conditions – the subgroup vs. no-subgroup condition, with 23 participants per cell.

Procedure

The procedure and instructions were largely similar to those used in Experiment 3, with a few notable exceptions.

First, rather than a number, the six group members each received an identification letter (A to E), with the participant always being identified as C (after a pilot study revealed that people memorised letters better than numbers).

As in Experiment 3, participants were asked to complete an attitude similarity questionnaire. This was the same as the one used in the previous experiment, however to broaden the range of questions further, two additional questions were added which asked participants about the qualities they looked for in a partner and what they considered to be important factors in making job choices. These additional questions were included so that participants believed they were similar to each other on a wider range of topic areas, to further strengthen in-group identity.

The bogus feedback used to manipulate subgroup division was similar to that in Experiment 3. In the subgroup condition, members A and F were reported to be similar to the participant, and B, D, and E dissimilar to the participant.

This manipulation was followed by the same group identification questions as in Experiment 3 (*alpha* = 0.87).

Participants then began the investment task. This was still comprised of six contribution sessions but the feedback they received after each session was altered to include feedback about the investment choices of individual members. This information was such that members A and F *cooperated* in four out of the six sessions, and members B, D, and E *defected* in four out of the six sessions.

After completing the six sessions, participants indicated their fission choice and selected two members that they would like to form a break-away group with.

As a further manipulation check, participants were also asked a series of "guess" questions to see how aware they were of the actions of the other members of their group. This was to check whether they were aware of whom the co-operators and free-riders were now that they had received individualised feedback regarding each members' contributions following each session.

Unlike in the previous experiment, in this fourth study, participants completed three extra contribution sessions after the fission had taken place. This would give us an indication of whether cooperation levels would actually increase after the split into smaller groups (as we predicted). The participants were informed:

"For the purpose of the second round, you are working with the two members you have selected to be in a smaller group with. At least two out of three members need to contribute in order to get the bonus."

On completion of the final contribution session, participants were debriefed and thanked for their participation. During the debriefing session, no suspicions were raised by participants regarding the experimental manipulations.

Results

Manipulation checks

Analysis of the group feedback question, "How satisfied were you with the performance of your group during the task?" (1 = *not at all*, 7 = *very much so*) confirmed that participants felt dissatisfied with their current group performance (*M* = 2.83, *SD* = 1.04). A one sample t-test showed that this mean differed significantly from the scale mid-point, $t(45) = -7.66, p < .001$.

Furthermore, analysis of the group identification scale was performed to check the effectiveness of the subgroup division manipulation. This revealed a significant main effect of Subgroup division, $F(1, 44) = 4.27, p < .05$, suggesting that participants in the subgroup condition identified less with the entire group (*M* = 3.77, *SD* = 0.91) compared to those in the no-subgroup condition (*M* = 4.41, *SD* = 1.17). These means did not differ significantly from the scale mid-point in either the subgroup condition, $t(22) = -1.22, p =$ .24, nor the no-subgroup condition, $t(22) = 1.67, p = .11$.

These results show that our manipulations were successful.

Group Fission

The group fission analysis was conducted using a logistic regression on the fission choice. The results failed to find a significant main effect of Subgroup division, $\chi^2(1, N = 46) = .11, p = .74$. Thus, it appears that subgroup division does not determine whether group fission will ensue, even when the actions of out-subgroup members clearly cause the free-rider conflict.[13,14]

Composition of the Exit Group

The faultline hypotheses predict that when a fission is imminent, subgroup boundaries in the original group circumscribes the composition of the exit group. To test this, we analysed the participants' preferences for break-away members using an ANOVA, whereby the dependent variable was the combined choice for two individuals. Recall that participants A and F were mentioned as being similar to the participant in both the subgroup and no-subgroup conditions. Thus, each participants' combination of choices for break-away group members was recoded. Participants were assigned a score of 1 if they chose both members A and F to form a break-away group with, a score of 0 if they

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[13] The fission percentages in the two conditions were: No-subgroup (69.9%), subgroup (73.9%).

[14] The analysis on fission preference and exit group composition was also repeated using group identification as an independent variable (rather than subgroup division). A median split on the composite group identification score allowed us to dichotomise the group into high and low identifiers. However, there was no significant main effect of group identification on either fission preference, $\chi^2(1, N = 43) = 1.63, p = ns$, nor exit group composition, $F(1, 41) = .36, p = ns$.

selected just one of these members and one other member (B, D, or E), and a score of -1 if they chose neither A nor F.

As predicted, the analysis revealed a main effect of Subgroup division, $F(1, 44) = 10.75$, $p = .002$. In the subgroup condition, considerably more people chose participants A and F, with whom they shared similarities (69.6%), than in the no-subgroup condition (21.7%). Thus, in the subgroup condition the exit group was nearly always formed along subgroup lines.

Awareness of Other Members' Actions

A further manipulation check concerning the participant's awareness of other members' actions during the contribution sessions was also analysed. These "guess" questions asked participants to estimate, "How many times do you think Participant (A, B, D, E, and F) contributed their endowment?" Participants were asked to select a number between one and six for each of the other members in their group (corresponding to the number of contribution sessions). A MANOVA was conducted with the contribution "guesses" for participants A and F as the dependent variables (i.e., the participants that were similar to the target participant in both the subgroup and no-subgroup conditions), and subgroup division as the independent variable. This analysis revealed a marginally significant main effect of Subgroup division, $F(2, 43) = 3.01, p = .06$.

Further univariate analysis revealed that participants in the subgroup condition ($M = 3.26$, $SD = .75$) believed that participant A had contributed their endowment to the group on more occasions than participants in the no-subgroup condition[15] ($M = 2.91$, $SD = 1.08$). Unfortunately, this difference failed to reach statistical significance, $F(1, 44) = 1.60, p = .21$. However, significant differences in participants' estimations of how many times participant F invested their endowment were obtained, $F(1, 44) = 5.89, p = .02$. Those in the subgroup condition ($M = 3.35$, $SD = .88$) believed that participant F had contributed on more occasions than those in the no-subgroup condition ($M = 2.48$, $SD = 1.47$), even though the amount of contributions that participant F had made across sessions was constant in both the subgroup and no-subgroup conditions.

[15] In the subgroup and no-subgroup conditions, Participants A and F both cooperated in four of the six sessions, and Participants B, D, and E cooperated in two of the six sessions.

Effects of Fission on Group Performance

Participants undertook three extra contribution sessions within the smaller groups to investigate the effects of a fission on co-operation. The average number of times participants invested in the six sessions before and three sessions after the fission was calculated. The results of a repeated measures ANOVA revealed a significant increase in investments after the fission, $F(1, 44) = 23.71, p < .001$. Participants contributed more often in the smaller groups ($M = .85$, $SD = .29$) than they did in the original group ($M = .63$, $SD = .28$). There was no main effect of Subgroup division, $F(1, 44) = 1.18, p = .28$, and no Investment x Subgroup division interaction, $F(1, 44) = 1.53, p = .22$.

Summary

The results of Experiment 4 provide support for the *weak* faultline hypothesis. In this study it was shown that pre-existing subgroup divisions determine the composition of groups after a fission, but not the likelihood of a fission per se, even though in this experiment the subgroup division was clearly associated with the nature of the conflict. Furthermore, participants were more aware of who the co-operators and free-riders were in the group when subgroups were present. Finally, as predicted, fission improved the group performance by increasing the rate of co-operation amongst group members.

Chapter Discussion and Conclusions

The primary aim of this chapter was to pit the *weak* and *strong* faultline hypotheses against each other in the laboratory. The secondary aim was to see if the previous findings in Chapter Two could be replicated when a different methodology was used, to test the reliability of these findings. The results of Experiments 3 and 4 demonstrated the robustness of our findings by providing further support for the *weak* faultline hypothesis. Thus free-rider conflict, caused by members withholding their contributions in a step-level public goods task, was sufficient in both experiments to inaugurate a group fission. Furthermore, the presence of subgroup categories, based on attitudinal similarity, was sufficient to determine the location of the split once a fission was imminent. In both experiments participants in the subgroup condition chose to form an exit group with members with whom they shared similar attitudes.

Once again, there was no evidence that subgroup formation exacerbated the likelihood of a fission (i.e., the *strong* faultline hypothesis). We can rule out the previous concern in Chapter Two that free-rider conflict was so strong that it was obscuring any chance of producing an interaction effect. In Experiment 3 only 50% of participants in the conflict, no-subgroup condition chose to fission, and only 53.8% of participants in the conflict, subgroup condition, and yet there was still no significant interaction between free-rider conflict and subgroup division on the fission choice.

Another explanation is that the subgroup category used in these studies (i.e., attitudinal similarity) was not very meaningful to participants. However, we can effectively rule this out based on the manipulation checks which showed that in the subgroup conditions people identified less with the overall group and were more suspicious of individuals that belonged to the out-subgroup. It may be, however, that these faultlines were simply not deep enough. Lau and Murnighan (1998) discuss the possibility of group faultlines being caused by two or more overlapping subgroup divisions, for example, a student house containing three female psychology undergraduates and three male economics graduates. Perhaps in these types of settings, the *strong* faultline hypothesis is more likely to gain support. Future research should address this possibility.

A final explanation, which can also be eliminated, is that participants believed that there was no connection between the cause of conflict and the subgroup division. However, the feedback in Experiment 4 was quite unambiguous: In the subgroup condition the free-riders within the group all belonged to the out-subgroup.

Fission in the Absence of Free-riders

In Experiments 1 and 2 featured in Chapter Two, it was noted that even in the absence of free-riding (i.e., the no-conflict condition) the percentage of participants wanting to fission was still notably high. This was put down to the role-playing methodology. In Experiment 3, the percentage of people in the no-conflict condition wishing to fission was substantially lower in the no-subgroup condition (3.7%) yet still quite high in the subgroup condition (16%). Thus it seems that even in the absence of free-rider conflict, group members felt that their group was less cohesive if subgroups were present, as shown by the group identity manipulation. This showed that members in the subgroup condition identified less with their group than members in the no-subgroup condition. Thus, it seems that a striving for uniformity, as suggested by Sani and Todman (2002) and Yzerbyt et al. (2000), may explain the actions of those members in the no-conflict conditions that preferred to fission rather than stay in their existing groups. However, note that subgroup division did not significantly induce a fission in any of our studies.

Free-rider Conflict and Fission

Our findings suggest that one of the causes for a fission is the need to control free-riding. Group members were more likely to opt for a fission when free-riders were present in the group. Moreover, in these laboratory experiments, participants confronted with a group conflict more strongly believed in the benefits of a fission for dealing with the free-rider problem. Finally, once the fission took place, the overall level of cooperation increased. These findings suggest that group fission may be quite an effective strategy for managing social dilemmas. If groups become too large to effectively control free-riding, it may be adaptive for individuals within these groups to initiate a fission.

Faultlines and Fission

The evidence so far supports the *weak* faultline hypothesis which claims that the role of faultlines in the fission process is not to magnify the impact of the free-rider conflict, but to determine the location of the split. But why do faultlines play a role in the fission process? A possible explanation is that the salience of subgroup membership may be used as a cue for assigning trust to others. In Experiment 3, we found that in the subgroup condition, participants anticipated greater cooperation from members of the in-subgroup than the out-subgroup. In social dilemmas, participants should only co-operate if they expect their efforts to be reciprocated by others (i.e., reciprocal altruism; Trivers, 1971). Yet, without a history of interactions with other individuals, it is impossible to determine who can be trusted. Hence, individuals often rely on (fallible) heuristics to search for co-operative partners. The experience of a common group membership may be one of the reciprocity heuristics that individuals apply (Gaertner & Insko, 2000; for an evolutionary account of this see Van Vugt, Schaller, & Park, 2005). As Brewer stated, shared group membership may function as a "rule for defining the boundaries of low-risk interpersonal trust that bypasses the need for personal knowledge and the costs of negotiating reciprocity with others" (Brewer, 1981, p. 356).

Awareness of Other Group Members

In Experiment 4 it was interesting to see that members in the no-subgroup condition failed to pick participants A and F to form a breakaway group with, even though these were the co-operative members in the contribution sessions. At first glance this may seem problematic to our proposal that forming subgroups is adaptive because it helps to control the free-rider problem. Why would participants in the no-subgroup condition find free-riders equally as attractive as non-freeriders? To answer this question it is necessary to look at the participants' estimates of how many times they believed each of the other participants in their group contributed their endowment. These results indicated that participants in the subgroup condition were more aware of the actions of their fellow group members compared to those participants in the homogenous condition and were better able to identify the contributors from the defectors. The reasons for this increased attentiveness may be explained using principles from Social Identity Theory (Tajfel & Turner, 1986; Turner et al., 1987). In the homogenous condition all members are similar and the participant may feel less inclined to monitor the actions of the other group members. However, when subgroups are present Tajfel and Turner argue that the mere presence of an out-group causes us to *categorise* ourselves into in-groups and out-groups, *identify* with these groups, and *compare* the performance of our in-group against the out-group as a means of boosting our self esteem. Thus, the mere presence of another subgroup increases the need to monitor the actions of other individuals compared with a situation in which all participants are similar. So, rather than contradict our claim that subgroup formation is adaptive for dealing with the free rider problem, it further illustrates the importance of subgroup salience in the fission process.

Limitations and Future Research

The extra contribution sessions that participants undertook in Experiment 4 allowed us to monitor the investments that participants made both before the split and after the split. This revealed that participants were more likely to contribute their endowments following a fission. However, these results should be interpreted with caution. The fission may not be responsible for this increase in contributions, but may be the result of a time effect (whereby a fission happened to occur before time 2).

A major limitation of the studies so far is that group members were forced to choose between two options - staying together or splitting the group. This begs the question whether participants would have preferred a different kind of solution if it would have been available. In many real life situations, other options are made available for dealing with free-riding that are not necessarily as dramatic as a fission. Thus, in Chapters Four and Five we consider these alternative ways of dealing with free-riders (including fission, appointing a leader, equal privatisation, applying a harvest cap, or enforcing sanctions) and allow participants to choose their preferred structural solution. This allows us to test the popularity of the fission choice against other options in a social dilemma situation (for similar studies, see Samuelson, 1993).

Conclusion

The supporting evidence for the *weak* faultline hypothesis in Experiments 3 and 4 adds credence to the findings from Chapter Two, which also found support for the *weak* faultline hypothesis using a role-playing methodology. Thus this combined use of methodology makes our findings more tenable and suggests that the presence of free-riders in a group makes that group more susceptible to fission. Furthermore, once a fission is impending, the faultlines that are created by the subgroup boundaries determine which members will come together to form an exit group. These faultlines are not responsible for the fission.

Part III: FISSION VERSUS ALTERNATIVE STRUCTURAL SOLUTIONS TO THE FREE-RIDER PROBLEM

Chapter 4: How Popular is Fission when Other Structural Solutions are Available? Scenario Based Evidence

Introduction to Part III

The aims of Part III of this thesis (featuring Chapters 4 and 5) are threefold. Firstly, we continue to pit the *strong* faultline hypothesis (subgroup boundaries exacerbate the likelihood of a split when a free-rider conflict is present) against the *weak* faultline hypothesis (free-rider conflict alone is sufficient to cause a fission and subgroup boundaries determine the location of the split) by continuing to manipulate a free-rider conflict and the presence of subgroup divisions within a group. Secondly, we have extended the faultline hypothesis to include a physical faultline, ease of resource division, and group size, to test their effects on fission preference. Thirdly, we investigate the popularity of the fission choice when other structural solutions are made available to the group as a means of controlling the free-rider problem.

Part III embodies two studies, one that utilises a role-playing methodology (in this chapter) and the other, a controlled laboratory study (in Chapter 5). In both of these studies a resource dilemma paradigm is employed rather than a public goods dilemma paradigm (as featured in Part II). This shift in research paradigm was necessary to accommodate our resource division manipulation. In order for participants to experience conflict over some members taking more than their fair share of the resources from the common pool, it was necessary for participants to prescribe a norm of equality, i.e., all members should feel entitled to an equal share of the common resource. Members deviating from this norm would cause group members to receive unequal shares of the resource, thus causing conflict. The nature of the resource division manipulation employed in this study meant that participants were asked whether they would initiate a fission when the common resource was easy to divide equally into two (symmetrical condition), *and* when the common resource could not be divided equally into two (asymmetrical condition). Previous research has shown that if asymmetry exists within the group, either with regards to participant's endowments, interests, or outcome allocations, people will no longer prescribe a "share equally rule", and instead other norms may be evoked, such as a "first come, first served" rule (Allison & Messick, 1990). Further investigation of this research, however, revealed that such a claim was limited and that whilst asymmetry will deter individuals away from a norm of equality when participants are preoccupied with contributing to a resource (a public goods) this is not the case if participants are focusing their attention on how to divide the resource (a resource dilemma) (Van Dijk & Wilke, 1995). Individuals still strive for final equal outcomes in conditions of asymmetry *if* they are exposed to a resource dilemma. Thus, the resource dilemma paradigm was employed here to enable participants to experience a free-rider conflict caused when some members deviated from the norm of equality when harvesting from the common pool, and to enable this norm to be prescribed when the common pool was easy to divide equally and fairly into two, and when it was difficult to divide equally and fairly into two.

The Weak versus Strong Faultline Hypothesis

As in the experiments featured in Part II of this thesis, we continue here to investigate the roles of free-rider conflict and faultlines in the *weak* and *strong* versions of the faultline hypothesis. In both Experiments 5 and 6 free-rider conflict was fixed so that all participants were exposed to free-riding. This was determined by some members in the group harvesting excessively from the common pool, resulting in members receiving an unfair share of the resource. Previous research has shown that if all else is equal (i.e., individual's endowments, levels of interest in the group, status, power, etc.) individuals strive for equality of final outcomes (Allison & Messick, 1990; Van Dijk & Wilke, 1995; Van Beest et al., 2003; Van Beest et al., 2004; Van de Kragt et al., 1986). In our studies, participants were expected to strive for equal final outcomes as they received very little information about each other, other than an identification number/letter (and the knowledge that all participants were students at Southampton University in Experiment 6), and they were given no indication that any one individual had any more right to the common resource than any other individual. Thus, it was expected that deviation from this equality norm when individuals were shown to pursue their own interests would create conflict within the group.

Due to the previous success of the free-rider conflict manipulation in Experiments 1 – 3, which showed that participants exposed to a free-rider conflict were significantly more likely to fission than those were not exposed to such a conflict, it was decided that all participants in Experiments 5 and 6 would be exposed to a situation in which free-rider conflict was present. Although our decision to fix the free-rider conflict may be considered a weakness, as it makes comparison of the results across all studies impossible, we considered the free-rider conflict manipulation trivial - participants in the no-conflict condition were not likely to fission! Excluding this free-rider conflict manipulation thus allowed us to focus more on other potential risk factors that may promote a fission, namely ease of resource division and group size.

The subgroup division manipulation in Experiments 5 and 6 involves new members entering the group, creating a newcomer/old-timer division. Previous research investigating the admittance of newcomers into a group has suggested that members entering a group may cause disruption if they question the existing group norms or attempt to interfere with the general running of the group, whilst the old-timers are satisfied with the status quo (Lau & Murnighan, 1998; Moreland & Levine, 2001). Disagreements may follow which divide the group up along this faultline into subgroups of old-timers and newcomers. In the absence of any other information about fellow group members, other than who are newcomers and who are old-timers, we would expect that the blame for the free-rider conflict, i.e., the greedy behaviour of some members, would be apportioned to these newcomers, especially if previous interactions between members in the group prior to the newcomers' arrival were successful and without conflict. Thus, to test the role of diversity faultlines in the fission process in Experiments 5 and 6, participants are either in a group with all old-timers with whom they have worked with previously (no-subgroup condition), or a group containing a mixture of newcomers and old-timers (subgroup condition).

Thus, presence of free-rider conflict and the manipulation of newcomers entering the group allows us to pit the *weak* faultline hypothesis against the *strong* faultline hypothesis.

(Hypothesis 1a) According to the *strong* faultline hypothesis, a fission will be more likely if there is a free-rider conflict and clearly identifiable subgroups, that is, a mixture of newcomers and old-timers (subgroup condition) in the group as opposed to all old-timers (no-subgroup condition).

(Hypothesis 1b) According to the *weak* faultline hypothesis, free-rider conflict alone is sufficient to initiate a fission but the newcomer/old-timer faultline will determine the exit group composition.

Physical Faultlines: The Ease of Resource Division

When all else is equal it has been shown that individuals apply a norm of equality when allocating resources to ensure that they get at least as much of the resource as everybody else (Charlton, 1997). So, how does this affect fission preference? To examine this, an additional within-subjects factor was added to the experimental design – the ease of resource division. As discussed in Chapter One, in groups in which the allocation of resources is salient, distributive justice concerns are evoked (Levine & Thompson, 1996; Wilke, 1996). Furthermore, when outcomes are evenly divisible by the number of people in the group, or everyone is equal on a certain dimension, for example, endowment, access, or interest, individuals strive for equal outcomes (Allison & Messick, 1990; Van Dijk & Wilke, 1995; Van Beest et al., 2003; Van Beest, et al., 2004; Van de Kragt et al., 1986). We believe that the ease of resource division will create a new faultline within the group – a physical faultline as opposed to a diversity faultline, so that when the resource is easy to divide equally and fairly into two, this will create a line through the resource that becomes salient once a free-rider conflict is salient.

(Hypothesis 2) A fission will be more likely to the extent that free-rider conflict is salient and the common resource can be divided easily into two equal halves (the easy-to-divide condition), ensuring that the two smaller groups following the fission will receive an identical and equal share of the resource. However, if the resource is difficult to divide into two equal halves (the difficult-to-divide condition), and the smaller groups will receive an unequal share of the original resource, participants will be less likely to fission.

We shall also test whether the resource division manipulation affects the role of diversity faultlines in the fission process, for which we have no hypothesis at present due to a lack of research in this area.

Group Size

A further aim of these studies was to investigate the effects of group size on the likelihood of a fission. Thus, in addition to manipulating the presence of free-rider conflict and faultlines (both diversity faultlines and physical faultlines) in the group, participants were either in a group of four, eight, or sixteen persons.

In Chapter One we discussed how increasing group size is correlated with a decrease in within group cooperation (Komorita & Lapworth, 1982; Fox & Guyer, 1975; Hamburger, Guyer, & Fox, 1975), suggesting that free-riding is more prevalent in larger groups than in smaller groups. Possible reasons for this negative correlation were offered, such as larger groups experiencing decreased levels of motivation, (Moreland & Levine, 1992), having greater difficulty in co-ordinating members' actions (Moreland, Levine & Wingert, 1996), receiving greater anonymity (Comer, 1995; Komorita & Parks, 1994), and perceiving a decrease in the criticality of one's contributions (Komorita & Parks, 1994; Komorita & Lapworth, 1982; Rapoport, 1988; Bornstein, 1992). Furthermore, larger groups were identified as being less cohesive than smaller groups, having implications for the degrees of intrapersonal trust between group members. Less trust is associated with fear of being exploited by other members of the group and thus increases the likelihood that members will themselves free-ride to avoid being perceived as a "sucker" (Komorita & Parks, 1994; De Cremer & Van Vugt, 1999; De Cremer, Snyder, & Dewitte, 2001; Kramer, 1993; Chen & Komorita, 1994). In addition, previous research has suggested that increasing group size also increases the likelihood of subgroup divisions being present in the group (Moreland & Levine, 1992).

(Hypothesis 3) Larger groups are more likely to contain free-riders, thus, if free-rider conflict is a primary antecedent of group fission, larger groups will be more likely to fission than smaller groups. Furthermore, larger groups are more likely to contain subgroup divisions, thus, if the *strong* faultline hypothesis (Hypothesis 1a) is true and the presence of subgroup divisions exacerbates the impact of the free-rider conflict, we should again expect an increase in the likelihood of a fission with increasing group size.

Alternative Structural Solutions to the Free-Rider Problem

A major criticism of the experiments featured in Part II of this thesis was that participants were only offered two options to deal with the problem of free-riders in the group: to fission or to do nothing. Due to the confinement of choices available for dealing with the free-rider problem it is possible that the participant's preferred action was not available. This may have inadvertently forced the participant to endorse a less preferred but available option (fission), or alternatively, to choose inaction (Wright, Taylor, & Moghaddam, 1990). To counteract this shortfall of the previous studies, the experiments featured in Part III of this thesis offer participants alternative structural solutions for dealing with the free-rider problem, including electing a leader, enforcing equal privatisation, establishing a harvest cap, and imposing a fine (see Samuelson, 1993, for similar procedure). This additional information allowed us to monitor the popularity of the fission choice when other alternatives are made available. Thus, in Experiments 5 and 6 participants are asked to vote on which option they would prefer to implement for the subsequent task and to rate the effectiveness of each of the options for dealing with the free-rider problem.

In relation to the resource division manipulation, we believe that the preferred structural solutions that participants will choose to implement in subsequent tasks, and the effectiveness ratings of these structural solutions for dealing with the free-rider problem, will depend on whether participants are in the easy or difficult-to-divide condition.

(Hypothesis 4) The fission option will be implemented more often and will be rated as more effective for dealing with the free-rider problem in the easy-to-divide condition. If participants can not obtain an equal share of the resource (in the difficult-to-divide condition), alternative structural solutions will be preferred over the fission option for the subsequent tasks and will be rated as more effective for dealing with the free-rider problem.

If obtaining equal outcomes is of importance to our participants, as we predict, we would also expect the equal privatisation option to be rated as more effective for dealing with the free-rider problem in the easy-to-divide than the difficult-to-divide condition. However, we have no specific hypotheses about the popularity of the other structural solutions (harvest cap, sanctions, leader) depending on whether the resource is easy or difficult to divide.

Experiment 5

In this role-playing study, group fission was examined using a scenario of a shared allotment (for a full version of the scenario and accompanying questionnaire, see Appendix 2). By controlling the amount of vegetables that participants harvested from the plot we were able to induce the free-rider conflict by informing participants that some members were taking more than their fair share. Consequently, the participant was left with a less than equal share of the harvest for themselves, fuelling feelings of frustration and injustice. The presence of newcomers joining the group served as the subgroup boundary in this study. Participants either shared the allotment space with a mixture of newcomers and old-timers (subgroup condition) or shared the allotment space with all old-timers (no-subgroup condition), that is, all members had a shared history.

In addition, the ease with which the vegetable patch could be divided into two equal halves was manipulated. In the easy-to-divide condition, the allotment could be split into two identical plots of land by applying a vertical position down the middle of the allotment (thus highlighting the physical faultline). However, in the difficult-to-divide condition, the allotment was arranged in such a way that using a vertical, horizontal, or diagonal partition to divide the plot of land into two equal sized plots would result in the two groups receiving an unequal distribution of the available vegetables growing on the patch.

Finally, the number of other people who shared the allotment space with the participant was manipulated so that they were either in a group of four, eight, or sixteen persons.

Alternative structural solutions for dealing with the free-rider problem were also made available to participants to allow us to see how popular the fission choice was when other options were available.

Method

Participants and Design

In total, 84 students from the University of Southampton, 60 females and 24 males participated in this study for course credits. The mean age of participants was 23.1 years (*SD* = 4.53). The participants were randomly assigned to one of twelve conditions, according to a 2 (Subgroup division: subgroup, no-subgroup) x 3 (Group size: four, eight, sixteen) between-participants factorial design, and a within-subjects factor, 2 (Resource division: easy-to-divide, difficult-to-divide), which was counterbalanced to avoid any possible order effects. In total, there were seven participants per cell.

Scenario and Questionnaire

Participants received information pertaining to an imaginary allotment that they cultivated in their spare time. This was a shared allotment with other people who also enjoyed growing and harvesting vegetables in their free time.

In each scenario, participants received background information about the other members with which they shared the allotment. This contained both our group size manipulation and subgroup division manipulation. Participants were told that they shared this plot of land with three, seven, or fifteen other people. Participants in the no-subgroup condition read: [16]

"In your spare time you (Person B) work on an allotment with three other people (Persons A, C, and D). You have *all* worked together on this plot of land for many years, and as a result, you all know each other quite well."

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[16] Please note that *all* examples pertaining to the procedures used in Experiments 5 and 6 are represented by those displayed to participants in the group size four condition only. This is purely for reasons of consistency and space restrictions.

In the subgroup condition, participants read:

"In your spare time you (Person B) work on an allotment with three other people (Persons A, C, and D). Every six months people can apply to work on the allotment and 50% of existing members are substituted for new members joining, therefore people do not always get to know each other all that well. Recently, the lottery was drawn to decide which members get to stay or leave. You and one other (Person A) were chosen at random to stay and two new members joined (Persons C and D)."

All participants were then told "You are currently growing potatoes, carrots, lettuces, and leeks, in the allotment space (vegetables that were in season at the time of the study in case any of our participants were budding horticulturists!)". Thus followed our resource division manipulation. The graphical information that was presented to participants differed depending on whether they were exposed to the easy-to-divide plot of land or difficult-to-divide plot of land, i.e., our within-subjects factor (see Figure 3). In the easy-to-divide condition participants were shown a picture of a rectangular plot of land that was divided up into four equal size rows. Each row contained pictures of different vegetables; potatoes, carrots, leaks and cabbages. In addition to the diagram, participants were informed:

"The allotment is divided into rows, with each row containing a different vegetable."

This 'easy-to-divide' plot is straightforward to divide into two, simply by using vertical partitions, whilst still allowing participants in the two fission groups to obtain an equal amount of land and a fair distribution of vegetables.

In the difficult-to-divide condition, participants were shown a rectangular plot of land that had been divided into equal quadrants. Each quadrant contained a picture of a different vegetable. In addition, participants read;

"The allotment is divided into four with a different vegetable growing in each quadrant."

This was referred to as the 'difficult-to-divide' plot because dividing the land up into two would mean that participants in the two fission groups would be unable to obtain an equal amount of the full range of vegetables available from the original plot.

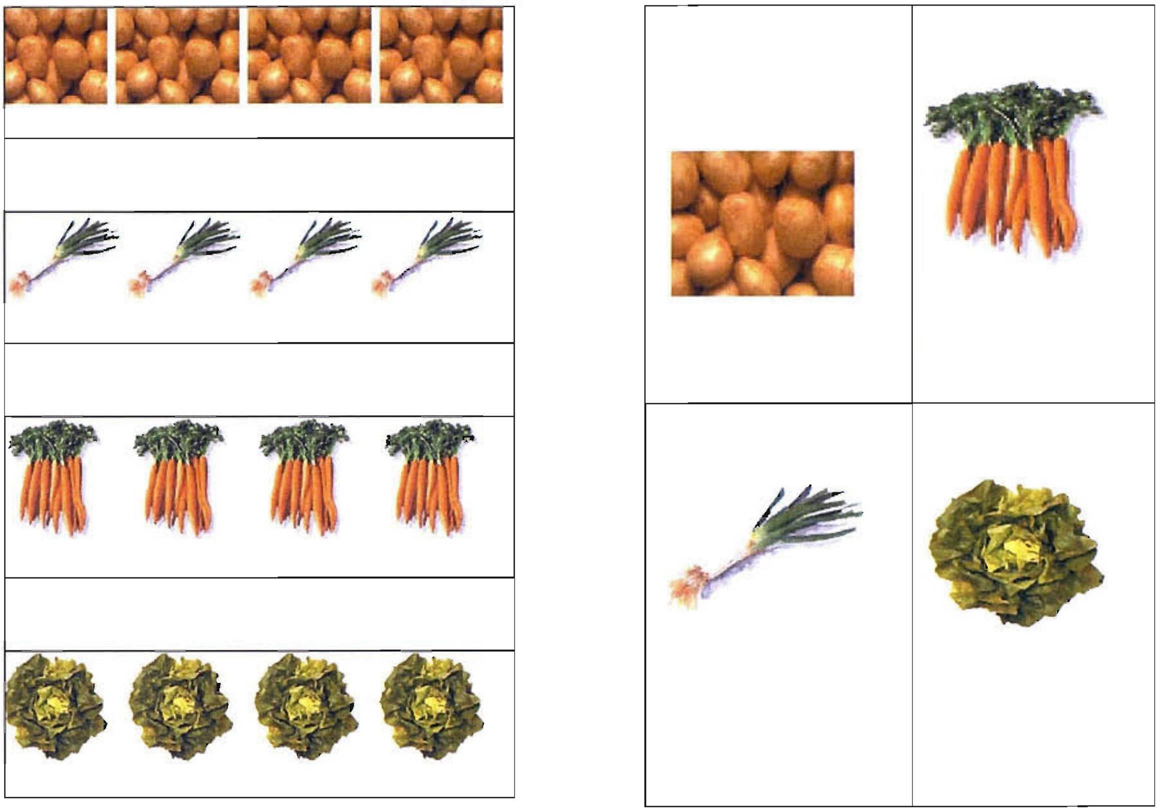

Figure 3. Diagrammatic representations of the resource division manipulation. The plot on the left depicts the easy-to-divide condition, and the plot on the right depicts the difficult-to-divide condition.

Please note that due to the within-subjects design, only the information regarding the plot of land and how easy or difficult it was to divide equally differed between the first scenario and second scenario. All other information, including the subgroup division and group size manipulations, remained identical in the first and second scenarios. It should also be noted that to avoid any possible order effects this within-subjects factor was counterbalanced so half the participants received the easy-to-divide plot first, followed by the difficult-to-divide plot, and the other half received the difficult-to-divide plot first, followed by the easy-to-divide plot.

The scenario concluded with a paragraph to highlight the current problem that some greedy members on the allotment were taking more than their fair share of the produce. Participants were informed:

"When the vegetables are ready to harvest, you all usually take as much as you want from the land for personal use, regardless of the amount of effort you have put into working on the allotment. This season there has been as much produce grown as in previous years and yet you have received fewer vegetables than in previous years! Thus it seems that some people are taking more than their fair share and are reaping more of the rewards than others.

You all enjoy working on the vegetable patch and want to continue doing so for as long as possible. However, due to the greediness of certain members, you have decided to meet to discuss the future of the vegetable patch."

After reading the scenario, participants were asked to fill in the accompanying questionnaire. Firstly, participants were asked to think about what steps could be taken to prevent some members taking more than their fair share in an open-ended question. Following this, participants were informed about the possibility of splitting the land into two and for two groups to form, which would work independently of one another. Members of these groups would only be able to harvest produce from their own plot (the *fission* option). To help participants decide whether splitting the group into two would be an appropriate solution for dealing with the free-rider problem (i.e., the greedy members taking more than their fair share of the vegetables), participants were shown a plan of their existing plot of land and were asked to divide the land into two in the easiest and fairest way possible using a single divide line. By physically segregating the land into two themselves participants could clearly see the resources that the 'fission groups' would have if a split was initiated. Thus, it highlighted that in the easy-to-divide condition it is possible for both subgroups to get an equal share of the plot of land and a fair distribution of vegetables, however, in the difficult-to-divide condition, although it is possible to get an equal share of land it is not possible for both groups to get an equal share of the produce.

After dissecting the plot of land, a set of questions pertaining to the dependent variables followed. Firstly, a measure of the fission preference was taken. Participants were asked to, "Indicate whether you would consider dividing the land into two and have two groups working on the separate plots" (1 = *not at all*, 7 = *very much so*).

Participants were then informed about some other possible options that may be implemented to tackle the free-rider problem. Suggestions offered included, 1) appointing one person to be in charge of the land and to decide how much produce each person can take for personal use (*leader* option), 2) dividing the land up into *n* smaller private vegetable patches of equal size, so that members can only yield the produce from their own plot of land (*equal privatisation* option), 3) making a group decision regarding a maximum limit of how much produce each person can take for personal use (*harvest cap* option), 4) imposing a fine on any person who takes more than their fair share (*sanction* option), and 5) doing nothing (*status quo* option) (for a full account of the information that participants received regarding each of the structural solutions, see Appendix 2). From the above list, participants were asked to vote on their *preferred* choice of structural solution to deal with the free-rider problem in subsequent tasks. Following this, participants were asked to rank each of the options (including the fission option) for how *effective* they felt these structural solutions were for dealing with the current dilemma, where 1 = *most preferable option,* and 6 = *least preferable option.*

Subsequently, participants were informed that a fission was imminent, and they were asked to indicate their choices for the *n* (one other, three other, or seven other) members they would like to form a breakaway group with (exit composition choice).

Finally, participants were asked a few questions to clarify their understanding of the scenario. On completion of the first scenario and questionnaire participants were asked to read the second scenario and to fill in the accompanying questionnaire.

Procedure

Upon arrival at the laboratory, participants were seated in cubicles that were partitioned off from one another to prevent interaction between participants. Each cubicle was equipped with a pen and a booklet containing two scenarios and two accompanying questionnaires. After completing an informed consent form participants were asked to "read carefully through the first scenario before answering the accompanying questionnaire. You can return to the scenario page at any point whilst answering the questionnaire to clarify any details. Once you have answered all the questions please move straight on to the second scenario. Again, read through this carefully before answering the accompanying questionnaire. Once you have finished the second questionnaire, please let the experimenter know that you have finished."

On average, completion of the two questionnaires took between 10 and 15 minutes at which point participants were debriefed about the purpose of the study and thanked for their participation.

Results

Manipulation Checks

Analysis of the group feedback question, "How satisfied were you with the current arrangement that everybody was free to take as much produce as they wanted for themselves?" (1 = *not at all*, 7 = *very much so*), confirmed that participants felt dissatisfied with the current situation, both in the easy-to-divide and the difficult-to-divide conditions ($M = 3.44$, $SD = 1.62$, and $M = 3.55$, $SD = 1.56$, respectively). Furthermore, both these means differed significantly from the mid-point of the scale, $t(83) = -3.17$, $p = .002$, and $t(83) = -2.65$, $p = .01$, but did not differ significantly from each other, $t(83) = -1.12$, $p = .27$.

Furthermore, a 2 (Subgroup division: subgroup, no-subgroup) x 3 (Group size: 4, 8, 16) x 2 (Resource division: easy, difficult) repeated measures ANOVA was performed on the group identification question, "Did you feel that all members, including yourself, belonged to one group?" (1 = *not at all*, 7 = *very much so*), to check the effectiveness of the subgroup division manipulation. As expected, this revealed a significant main effect of Subgroup division, $F(1, 78) = 11.57$, $p = .001$, suggesting that participants in the subgroup condition were less likely to feel part of one group ($M = 4.29$, $SD = 1.82$), compared to those in the no-subgroup condition ($M = 5.48$, $SD = 1.45$). Furthermore, these were entered into a one sample t-test which showed that the mean for the no-subgroup condition differed significantly from the mid-point of the scale, $t(41) = 6.48$, $p < .001$, whilst in the subgroup condition the mean did not differ significantly from the mid-point of the scale, $t(41) = 1.05$, $p = .30$. There was no main effect of Resource division, $F(1, 78) = .05$, $p = .82$, no main effect of Group size, $F(2, 78) = .61$, $p = .55$, and no significant interactions.

A final manipulation check, used to assess participants' understanding of the Resource division manipulation asked, "How easy was it to divide the vegetable patch easily and fairly into two?" (1 = *not at all easy*, 7 = *very easy*). A 2 (Subgroup division: subgroup, no-subgroup) x 3 (Group size: 4, 8, 16) x 2 (Resource division: easy, difficult) repeated measures ANOVA revealed a main effect of Resource division, $F(1, 78) = 248.37$, $p < .001$, showing that as expected, participants in the easy-to-divide condition found it much easier to divide the vegetable patch easily and fairly into two ($M = 6.08$, $SD = 1.43$) compared with those in the difficult-to-divide condition ($M = 2.55$, $SD = 1.84$). There was no main effect of Subgroup division, $F(1, 78) = .002$, $p = .97$, no main effect of Group size, $F(2, 78) = .35$, $p = .70$, and no significant interactions.

These results show that our manipulations were successful.

Group Fission

To analyse the participant's fission choice, a 2 (Subgroup division: subgroup, no-subgroup) x 3 (Group size: 4, 8, 16) x 2 (Resource division: easy, difficult) repeated measures ANOVA was conducted on responses to the question, "Would you consider dividing the land into two?" (1 = *not at all*, 7 = *very much so*).[17] This revealed a significant main effect of Resource division, $F(1, 78) = 115.22, p < .001$[18]. In accordance with Hypothesis 2, participants seem to strive for equal final outcomes when allocating resources in a resource dilemma paradigm. Participants were more likely to want to split the land into two if they were in the easy-to-divide condition ($M = 4.46$, $SD = 2.01$), than the difficult-to-divide condition ($M = 2.39$, $SD = 1.47$).

The results revealed no main effect of Subgroup division, $F(1, 78) = .19, p = .67$, however, there was a significant Resource division x Subgroup division interaction, $F(1, 78) = 5.50, p = .022$ (see Figure 4), thus providing some support for Hypothesis 1a – the *strong* faultline hypothesis. Further analysis of this interaction showed that there was a significant difference between fission preference in the different resource division conditions both when newcomers were present (easy-to-divide condition, $M = 4.76$, $SD = 2.01$, difficult-to-divide condition, $M = 2.24$, $SD = 1.41$), $t(41) = 8.97, p < .001$, and when the group consisted of all old-timers (easy-to-divide condition, $M = 4.17$, SD = 1.99, difficult-to-divide condition, $M = 2.55$, $SD = 1.53$), $t(41) = 6.14, p < .001$ (using Paired Samples T Tests).

Although the means suggest that fission preference is greatest if participants are in the easy-to-divide condition and there are subgroup divisions present, further testing indicated that there were no significant differences between fission preference in the easy-to-divide condition when newcomers were present or absent (subgroup condition, $M = 4.76$, $SD = 2.01$, no-subgroup condition, $M = 4.17$, $SD = 1.99$), $t(82) = 1.37$, *ns*, nor in

[17] In the original analysis, gender and order of presentation of the two scenarios were included as independent variables, but because there was no main effect of either, $F(1, 60) = .26$, *ns*, and $F(1, 60) = .47$, *ns*, respectively, gender and order were collapsed across the design and excluded from further analysis.

[18] A median split conducted on the fission preference measure allowed us to obtain the percentages of those who chose to fission in the easy and difficult-to-divide conditions. Participants who rated fission preference with a 4 were excluded (the midpoint of the scale), whereas participants who rated fission preference with 1-3 were considered unlikely to fission and ratings of 5 - 7 were considered likely to fission. In total, 65.3% of participants in the easy-to-divide condition chose to fission ($n = 72$) compared with 11.7% in the difficult-to-divide condition ($n = 77$).

the difficult-to-divide condition when newcomers were present or absent (subgroup condition, $M = 2.24$, $SD = 1.41$, no-subgroup condition, $M = 2.55$, $SD = 1.53$), $t(82) = -.96$, *ns* (using Independent Samples T Tests).

The results revealed no main effect of Group size, $F(2, 78) = .43$, $p = .65$, thus our findings did not support Hypothesis 3 - that larger groups would be more likely to split than smaller groups. Furthermore, there were no other significant interactions.

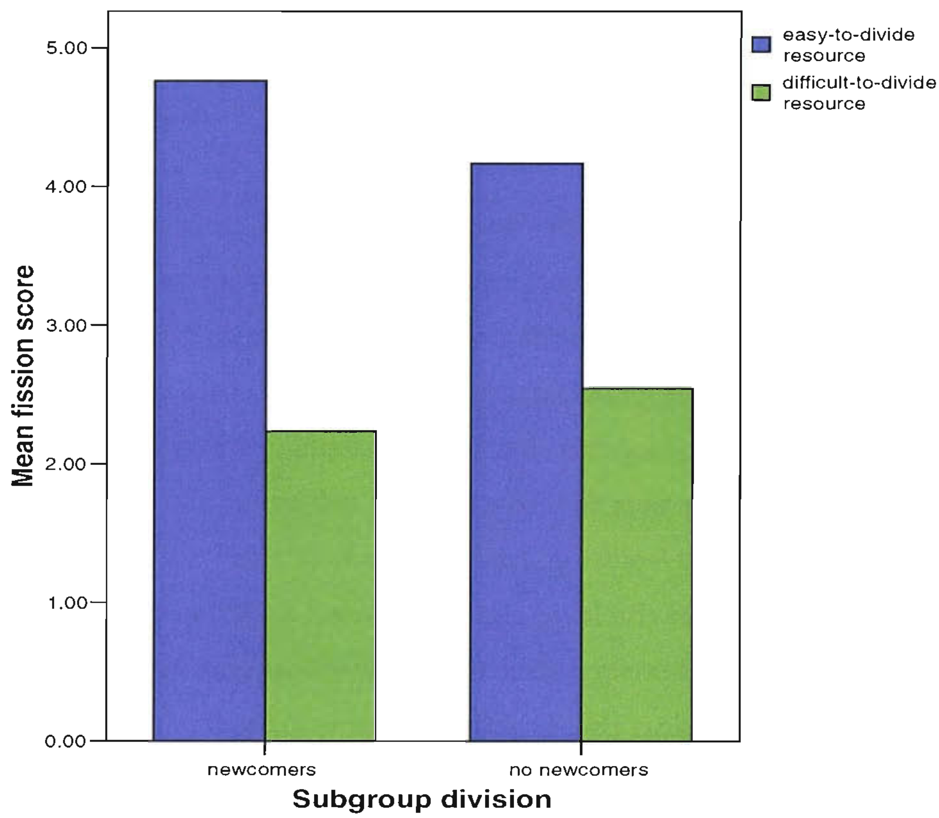

Figure 4. The effects of resource division and subgroup division on fission preference.

Composition of the Exit Group

Whether the presence of subgroup boundaries determines the formation of exit groups was examined using a repeated measures ANOVA on the exit group composition choice. Due to the group size manipulation, this analysis was conducted three times, i.e., to analyse those participants in the group size 4, 8, and 16 conditions. Recall that in the group size 4 condition, participant A was the only member with whom the participant shared a history of successful interactions in both the subgroup and no-subgroup conditions. The same was true for Participants A, C and D in the group size 8 condition, and Participants A, C, D, E, F, G, and H in the group size 16 condition. Thus, we recoded the exit group composition preferences so that participants received a score of +1 if they selected all members with whom they shared a common history to form a break-away group, a score of 0 if they selected a mixture of old-timers and newcomers, and a score of -1 if they selected only newcomers to form an exit-group with. The faultline hypotheses propose that participants would be more inclined to select members with whom they shared a history of successful interactions to form a breakaway group with, over newcomers who had recently joined the group. However, the results revealed no main effects of Subgroup division in either the group size 4 condition, $F(1, 26) = .01, p = .79$, the group size 8 condition, $F(1, 26) = .40, p = .53$, nor the group size 16 condition, $F(1, 26) = .41, p = .53$.

Preferred Structural Solution for Dealing with the Free-rider Problem

In addition to asking participants whether they would consider initiating a fission, participants were offered a range of other structural solutions to deal with the free-rider problem. From a list of possible solutions, including electing a leader, equal privatisation, enforcing a harvest cap, imposing sanctions, and doing nothing, participants were asked to vote for the *one* option that they felt would be most effective for dealing with the free-rider conflict (see Table 3). As can be seen in Table 3 the most preferred structural solution was to enforce a harvest cap, then equal privatisation, followed by electing a leader, then imposing sanctions, and the least preferred choice was the status quo option. The popularity of these choices, according to their rank position did not differ in the easy and difficult-to-divide conditions.

However, a McNemar test, conducted on the equal privatisation option in the easy and difficult-to-divide conditions, revealed that equal privatisation was significantly more likely to be selected in the easy-to-divide condition than in the difficult-to-divide condition ($p = .013$). Similarly, the harvest cap option was significantly more likely to be adopted if the resource was difficult-to-divide than if it was easy-to-divide ($p = .021$).

Table 3

Preferred Structural Solution for Dealing with the Free-rider Problem

Structural Solution	Easy-to-divide	Rank (easy)	Difficult-to-divide	Rank (difficult)
Elect a leader	4.8%	3	4.8%	3
Equal privatisation	23.8% [a]	2	11.9% [b]	2
Harvest cap	69.0% [a]	1	81.0% [b]	1
Sanctions	0%	5	0%	5
Status quo	2.4%	4	2.4%	4

Note. Values with different superscript letters (across rows) are shown to be significantly different from each other, $p < .05$, using a McNemar Test. Rank data: 1 = *most popular* structural solution, 5 = *least popular* structural solution.

Ranking the Effectiveness of Structural Solutions

Finally, participants were asked to rank each of the six available structural solutions (including the fission option) for how effective they felt these options were for dealing with the free-rider problem (where 1 = *most effective option* and 6 = *least effective option*). The absolute values of the ranked data were calculated and the average of these scores was computed (see Table 4).

Note, that a high score represents the least effective option and a low score represents the most effective option. It is apparent from the table that the most effective structural solution for dealing with the problem of free-riders in both the easy and difficult-to-divide condition is the harvest cap option, ranked as the number one choice. To remain with the status quo is considered the least effective option in both conditions. However, we can see that participants rate the effectiveness of the fission option, electing a leader option, equal privatisation option, and imposing sanctions option differently depending on whether they are in the easy or difficult-to-divide resource condition.

Table 4

The Effectiveness of Different Structural Solutions for Dealing with the Free-rider Problem

Structural solution	Easy-to-divide Mean score	Rank (easy)	Difficult-to-divide Mean score	Rank (difficult)
Fission	2.81 [a]	2	3.93 [b]	4.5
Leader	3.42 [a]	3	2.99 [b]	2
Equal privatisation	3.48 [a]	4	3.55 [a]	3
Harvest cap	1.81 [a]	1	1.38 [b]	1
Sanction	4.17 [a]	5	3.93 [b]	4.5
Status quo	5.37 [a]	6	5.23 [b]	6

Note. The scores in the table represent the average score taken from the absolute values of the ranked data (n = 84). Participants were asked to rank the effectiveness of each of the structural solutions, giving a score of 1 for the most effective option, 2 for the second most effective option, etc, with 6 being the least effective option. Thus, a higher score represents the least effective option, and the lowest score represents the most effective option. Values with different superscript letters (across rows) are shown to be significantly different from each other, $p < .05$, using a Wilcoxon Signed Ranks Test on the absolute value scores.

Wilcoxon Signed Ranks Tests.

A series of Wilcoxon Signed Ranks Tests were used to search for significant differences between the absolute value scores indicating the effectiveness of each of the structural solutions in the easy and difficult-to-divide conditions. Of primary importance is the fission choice where analysis showed that the difference in the scores between the easy and difficult-to-divide conditions was significant ($p < .001$). Interestingly, the rank position for effectiveness of the fission choice shows the most pronounced change compared with all other structural solutions; the fission choice moves from the second most effective option in the easy-to-divide condition to the tied fourth most effective option in the difficult-to-divide condition. In support of Hypothesis 4, participants would prefer to utilise the fission option to deal with the free-rider problem in conditions where a resource is easy-to-divide, but this popularity decreases if the resource is difficult-to-divide.

The option to elect a leader also revealed a significant difference in absolute scores between the easy and difficult-to-divide conditions, ($p < .001$). Participants believed that the leader option was more effective when the resource was difficult-to-divide (ranked 2^{nd} most effective option) than if the resource was easy-to-divide (ranked 3^{rd} most effective option).

The equal privatisation option was not affected by the Resource division manipulation, (p = .54), although the effectiveness of the option did change from 4^{th} position in the easy-to-divide condition to 3^{rd} position in the difficult-to-divide condition. This change in direction was unexpected because the ability to get an equal and fair share of the produce from the plot of land would be simpler in the easy-to-divide plot of land.

Finally, the Wilcoxon Signed Ranks Test for the option to impose sanctions revealed a significant difference between the absolute value scores in the easy and difficult-to-divide conditions (p = .03). Although this was not considered particularly effective in either the easy or difficult-to-divide conditions, it appears that the sanction option is considered more effective when the resource is difficult-to-divide (tied rank position 4) than when it is easy-to-divide (rank position 5).

Summary

Consistent with the *strong* faultline hypothesis (Hypothesis 1a), we found some support that subgroups act as faultlines that break the group up when there is a pressure imposed upon them via the easy-to-divide resource manipulation, providing some indication that this physical faultline is a moderating variable in the fission process.

The ease with which a resource could be divided equally into two was shown to affect fission preference. Participants that could abide by a "share equally" rule when dividing the original resource into two were more likely to initiate a fission than those who could not obtain equal outcomes, thus providing support for Hypothesis 2.

Our group size manipulation did not affect the likelihood of a fission in this study, as predicted by Hypothesis 3. Thus, in Experiment 5, larger groups were no more likely to split than smaller groups.

Finally, in support of Hypothesis 4, results showed that participants rated the fission option as being more effective for dealing with the free-rider problem (rated as the second most effective option) over alternative solutions in the easy-to-divide condition. Its popularity and effectiveness for tackling the free-rider problem was significantly decreased (tied fourth most effective option) when the resource was difficult-to-divide.

The robustness of these findings when a different methodology is employed is examined in the following chapter.

Chapter 5: How Popular is Fission when Other Structural Solutions are Available? Laboratory Evidence

The aims and hypotheses of Experiment 6 are identical to those of Experiment 5, however, a different methodology is employed in Experiment 6 to test the robustness of our previous findings, where we found some support for the *strong* faultline hypothesis and evidence that a physical faultline can moderate the role of diversity faultlines in the fission process. To reiterate, this study aims to test the *strong* and *weak* versions of the faultline hypothesis. In addition, an extended version of our original faultline hypothesis is used that also includes manipulations of a physical faultline - ease of resource division, and group size, to see how these factors affect fission preference. Finally, participants are offered multiple solutions for dealing with the free-rider problem to allow us to gage the popularity of the fission option when alternatives are available.

Since the manipulations employed in Experiment 5 are the same manipulations here in Experiment 6, the hypotheses are also the same as those featured in Experiment 5. Thus, according to the *strong* faultline hypothesis, a fission will be more likely when there is a free-rider conflict and clearly identifiable subgroups, that is, a mixture of newcomers and old-timers (subgroup condition) in the group as opposed to all old-timers (no-subgroup condition) (*Hypothesis 1a).*

Alternatively, the *weak* faultline hypothesis claims that free-rider conflict alone is sufficient to initiate a fission but the newcomer/old-timer faultline will determine the exit group composition (*Hypothesis 1b*).

In addition we manipulate the ease with which a resource can be divided equally into two. According to *Hypothesis 2, a* fission will be more likely to the extent that the common resource can be divided easily into two equal halves (the easy-to-divide condition), enabling the two fission groups to receive an equal share of the resource. However, if the resource is difficult to divide into two equal halves (the difficult-to-divide condition), and the fission groups will receive an unequal share of the original resource, participants will be less likely to fission. We also wish to see if this ease of resource division continues to moderate the role of the diversity faultline in the fission process as it did in Experiment 5.

With regards to our group size manipulation, *Hypothesis 3* predicts that larger groups are more likely to contain free-riders than smaller groups. Thus, if free-rider conflict is a primary antecedent of group fission, larger groups will be more likely to fission than smaller groups. Furthermore, larger groups are more likely to contain subgroup divisions, thus, if the strong faultline hypothesis (*Hypothesis 1a*) is true and the presence of subgroup divisions exacerbates the impact of the free-rider conflict, we should expect an increase in the likelihood of a fission with increasing group size.

Finally, with regards to the presence of additional alternative structural solutions for dealing with the free-rider problem, *Hypothesis 4* predicts that the fission option will be implemented more often and will be rated as more effective for dealing with the free-rider problem in the easy-to-divide condition. If participants can not obtain an equal share of the resource (in the difficult-to-divide condition), alternative structural solutions will be preferred over the fission option for the subsequent tasks and will be rated as more effective for dealing with the free-rider problem.

Experiment 6

Experiment 6 consisted of a computer based task in a controlled laboratory environment. The aim of this study was to test the robustness of our findings in Experiment 5 and to see whether they could be replicated using a different methodology -- a methodology that unlike the scenario study had tangible outcomes for the participants. In this study participants believed that points extracted from the common pool could be converted into lottery tickets. These tickets would be entered into a prize draw to win a monetary prize. Thus the presence of free-riders in this study could jeopardise the participants' chances of winning this money.

Like Experiment 5, this study utilised a resource dilemma paradigm in order to induce a free-rider conflict when some members harvested excessively from the common pool. The subgroup division manipulation was identical to Experiment 5, i.e., in the no-subgroup condition participants continued to work with the same participants that they had worked with in a series of practice sessions. In the subgroup condition, half of the existing members were substituted with newcomers after a supposed computer error had occurred. Finally, both the resource division manipulations and group size manipulations were the same as Experiment 5; participants were either in a group of four, eight, or sixteen, and the common pool could either be divided equally into two smaller pools with an identical number of points in each pool (easy-to-divide condition), or the two pools contained unequal numbers of points (difficult-to-divide condition).

Method

Participants and Design

In total, 113 students at the University of Southampton, 66 females and 47 males participated in this study. The mean age of participants was 21.7 years ($SD = 3.7$). These participants were randomly assigned to one of twelve experimental conditions, according to a 2 (Subgroup division: subgroup, no-subgroup) x 3 (Group size: four, eight, sixteen) between-participants factorial design, with an additional within-subjects factor, 2 (Resource division: easy-to-divide, difficult-to-divide), which was counterbalanced to avoid any possible order effects. There were between 7 and 12 participants per cell.

Procedure

Upon arrival at the laboratory in groups of six, participants were seated in individual cubicles, containing a computer, a pen, and a "participant information" sheet. After signing an informed consent form, participants were told that all further instructions would be presented on the computer screen.

The study began with an introduction screen which informed participants that they were about to take part in a "computer based study looking at how people make decisions in groups." They were told:

"You will be working in a group. The group will be issued with a common pool which will contain points. The aim of the task is to collect as many points from the common pool as you can for yourself. The points that you collect during the tasks will be converted into lottery tickets. The more points you collect during these tasks, the more lottery tickets you will receive, and the more chances you will have to win a £50 prize.

In total, you and your fellow group members will complete three similar tasks and we will be looking at how you make decisions in your groups, that is, how many points you and the other group members collect from the common pool."

Manipulation of Group Size. Following this, participants were presented with some additional background information concerning the other participants that they were to be working with in the tasks. This allowed us to introduce our group size manipulation. Participants read:

"This study is being conducted around the University in a variety of different schools/departments all at the same time. In total, we have employed 32 participants per session." All participants were then issued with a number to identify themselves -- the participant was always number 3 and the other group members ranged from 1 to 32 (corresponding to the number of participants in the study). In actual fact, a maximum of six participants took part in the study at any one time and all feedback provided to participants about the other members of their group was false. In order to manipulate group size participants were then allocated into groups. They were told:

"It would be very difficult to co-ordinate the actions of 32 people to take part in the following tasks, so for ease and convenience, you will be working in groups of four/eight/sixteen." Below this, the participant numbers (1 to 32) were divided up into lists of eight groups of four, four groups of eight, or two groups of sixteen members, respectively. The participant was asked to look through the lists to identify which group they had been assigned to and which other members were in their group. The participants recorded this information on the "Participant Information" sheet provided.

Experimental task. In preparation for the commencement of the task, participants were presented with a common pool of points (see Figure 5). The pool was divided up into cells and each cell contained a number which represented the number of points participants could collect by selecting that cell. The size of the common pool differed depending on the group size – each group member had to select a total of four adjacent squares, thus the number of cells in each pool equated to *n* participants x 4.

Manipulation of Resource Division. Furthermore the arrangement of cells in the common pool was manipulated so that participants could either split the common pool into two smaller but identical pools, each containing an equal number of points (easy-to-divide condition; see diagram on the left of Figure 5), or splitting the common pool into two would result in one of the smaller pools containing more points than the other pool (difficult-to-divide condition; see diagram on the right of Figure 5).

Participants then received instructions for the task. They read:

"In each of the three tasks you will be presented with a common pool. The common pool is divided up into 16 squares, and each square contains a number of points. In total, there are 40 points available to your group.

Each of the four members in your group will take it in turns to select four adjacent squares from the common pool. Remember, the number of points collected by each member will be converted into lottery tickets, so the most attractive option would be to click on the squares that contain the highest number of points." Following this, a number of task examples were presented on the screen to indicate how to select the points from the common pool.

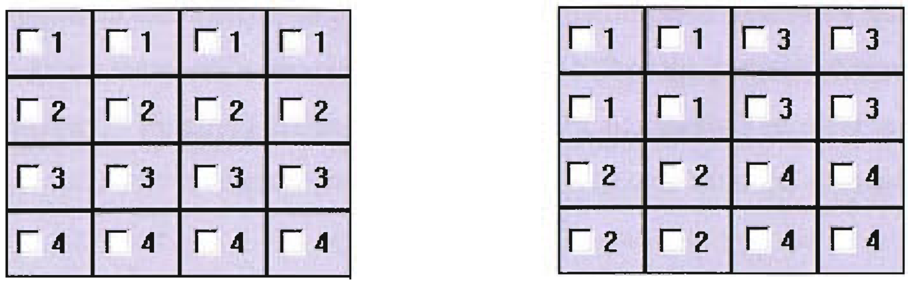

Figure 5. Examples of the common pools used to manipulate resource division. The easy-to-divide condition is pictured on the left and the difficult-to-divide condition is pictured on the right.

Our own previous research (in Chapters Two and Three) has shown that a fission is more likely to occur if there is a free-rider conflict present within the group. Thus, it was necessary to ensure that all participants experienced conflict over not receiving a fair share of the points from the common pool due to some greedy members harvesting excessively. In order to attain this, participants were informed that the computer would determine the sequence in which group members would select points from the common pool, ostensibly by a random procedure. The feedback received was manipulated so that the participant was always assigned the last position, i.e., they were told that they would be the final participant from the group to select points from the common pool. Thus, the points that they could collect was largely determined by the group members that selected the points before them. Furthermore, participants were told that:

"The number designated to you by the computer now will be used for *all* forthcoming tasks." Once the participant was aware of their assigned position, two practice sessions took place. Participants read:

"Before taking part in the actual tasks, you will be given the chance to work with your group in two practice sessions. The tasks in these practice sessions will be carried out in the same format as the actual tasks you will take part in later, but these will give you a chance to see how other people make decisions. These practice sessions will also allow you to see how the arrangement of points within the common pool will differ in each task." The actual premise of these practice sessions was to build up a history of successful interactions between the group members. The outcome of both practice sessions was manipulated to ensure that all members got an equal share of the points in the easy-to-divide condition (all participants received 10 points) and as close to an equal share as possible in the difficult-to-divide condition (participants received 8 points) i.e., none of the group members who selected their points before the participant were outwardly greedy.[19] Finally, after each practice session, participants received a summary of the number of points that each group member had collected from the common pool to highlight the pervasiveness of the equality norm, i.e., it was apparent that participants were striving for final equal outcomes.

Manipulation of Subgroup Division. On completion of the second practice session, participants were told that the actual tasks were about to begin, at which point our subgroup division manipulations were introduced. In the subgroup condition, participants read:

"During Task 1 you will only be working with *some* of the group members that you previously worked with in the practice sessions. As a result of some computer problems we are experiencing, half of the group members have been reassigned to different groups so you will now be working with the following group members: 4, 20, and 21.

For the following tasks you will continue to select points from the common pool in the order that the computer generated in the practice sessions, i.e., you will be the fourth person to collect points from the common pool. New members joining the group will take over the sequence number of the group member they are replacing." To reiterate, regardless of group size, in the subgroup condition 50% of original members remained in the group and 50% were replaced with newcomers.

In the no-subgroup condition, participants were told:

"During Task 1 you will be working with the same group members that you previously worked with in the practice sessions. That is, you will be working with the following group members: 1, 2, and 4.

For the following tasks you will continue to select points from the common pool in the order that the computer generated in the practice sessions, i.e., you will be the fourth person to collect points from the common pool."

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[19] Note that if members selected points from the common pool in a greedy manner, the first member in the easy-to-divide condition, for example, could have selected 16 points (4 + 4 + 4 + 4), the second member could have selected 12 points (3 + 3 + 3 + 3), the third member could have selected 8 points (2 + 2 + 2 +2), leaving only 4 points for the final participant. However, in the practice sessions it was necessary to construe the other group members as following a norm of equality, and therefore all members in the easy-to-divide condition selected 10 points from the common pool (1 + 2 + 3 + 4), leaving 10 available points for the final participant. Group members in the difficult-to-divide condition selected either 12 points (2 + 2 + 4 +4) or 8 points (1 + 1 + 3 + 3), leaving 8 available points for the final participant, which is still a reasonable number of points.

Participants were asked to make a note of those group members that they would be working with in the actual tasks on the "Participant Information" sheet provided.

Subsequently, Task 1 began. To avoid any possible order effects linked with the within-subjects design, the order in which participants received the easy-to-divide common pool and difficult-to-divide common pool were counterbalanced. Thus, half of the participants received the easy-to-divide condition for Task 1 and the difficult-to-divide condition for Task 2, and half of the participants received the difficult-to-divide condition for Task 1 and the easy-to-divide condition for Task 2.

As in the practice sessions, the participant was the final group member to select points from the common pool in the actual tasks. However, in the actual tasks participants always received the lowest share of points possible, that is, a total of four points from the common pool, in both the easy and difficult-to-divide conditions. This was an infringement on the equality norm that the group had established in the two practice sessions, where all members got a fair share of the points (10 points in the easy-to-divide condition and 8 points in the difficult-to-divide condition) and thus implied that at least some of the group members were harvesting excessively to maximise their own interests in order to obtain more lottery tickets.

At the end of Task 1, participants were presented with feedback summarising the number of points each member had collected from the common pool during that task. This feedback was structured to show that "the first person to select their points scored X points, the second person to select their points scored X points, etc." So, participants were unable to tell with 100% certainty which members (according to their participant number) had been greedy and whether or not they were newcomers (in the subgroup condition). However, the information did allow participants to compare their own score against that of the other group members and highlight the fact that they got the lowest score possible. On completion of the first task, participants received a message from the experimenter. This read as follows:

"Previous research has shown us that usually at this point in the study, between Tasks 1 and 2, some people are unhappy with their group's performance (especially if some members are taking more than their fair share of points) and wish to take action before starting Task 2." Thereafter participants were presented with six structural solutions which could potentially be employed to deal with the free-rider problem. These options included initiating a fission and splitting into two smaller groups (*split* option), electing a leader to make resource allocation decisions on behalf of the group (*leader* option), opting for equal privatisation and no longer working as part of a group (*work alone* option), deciding upon and enforcing a harvest cap (*maximum limit* option), imposing a sanction for greedy members (*impose fine* option), or maintaining the status quo (*stay as it is* option) (for a more detailed explanation of each of these structural solutions, please refer to Appendix 3).

Participants were told that after viewing all six options they would have to vote on their preferred choice of structural solution and that the majority vote would decide which option would be implemented for Task 2 (for a similar methodology, see Samuelson, 1993). As each of the structural solutions were presented, participants were asked to decide whether they would favour maintaining the status quo or implement the change. Amongst these questions featured the primary group fission question, "What would you like to do? (*0 = stay as it is, 1 = split into two smaller groups)*" (fission preference). Following this we asked our second dependent measure concerning the exit group composition. Participants were questioned:

"If the split option is selected by the majority of group members, the common pool will be divided into two and you will be working in smaller groups. Please select from the list the one/three/seven member(s) you would like to work with *if* the common pool is divided" (exit composition choice).

Finally, participants were asked to vote for one of the six options that they wanted to implement for the following task. They were instructed;

"The majority vote wins, however, in the event of a tie, Task 2 will commence in the same format as Task 1, i.e., the *stay as it is* option will win by default." It was essential for Task 1 and Task 2 to be identical due to the within-subjects design, however it was also necessary to find out whether participants would choose to fission over other available structural solutions. This default option allowed us to provide feedback to participants notifying them that there had been a tied vote and that Task 2 would commence in the same style as Task 1. Whilst waiting for the computer to sort through the votes, participants were asked to rank each of the six structural solutions for how effective they were for dealing with the free-rider problem. Finally, the computer informed participants that Task 2 was about to begin and that it would be carried out in the same format as the previous task.

Subsequently Task 2 began. The only difference between Tasks 1 and 2 was the resource division manipulation, so if participants had received the easy-to-divide common pool in Task 1, they were now presented with the difficult-to-divide condition, and vice versa. Task 2 employed all the same questions as Task 1, including our main fission preference and exit composition dependent variables and the vote for which structural solution the participants wanted to implement for Task 3. However, after making this choice, participants were told that there was not enough time to continue with the third task, at which point participants were debriefed and thanked for their participation. The nature of the deception used in the study (i.e., that participants had not really interacted with other participants) and the reasons for it was also explained. In addition all participants received a lump sum of five pounds, regardless of their performance in the task.

Results

Manipulation checks

A 2 (Subgroup division: subgroup, no-subgroup) x 3 (Group size: 4, 8, 16) x 2 (Resource division: easy, difficult) repeated measures ANOVA was used to analyse the responses to the manipulation question, "How satisfied were you with the current arrangements that members could take as many points as they wanted from the common pool?" (1 = *not at all*, 7 = *very much so*). This revealed a main effect of Resource division, $F(3, 105) = 21.19, p < .001$. Participants were more satisfied with the status quo if it was possible to get an equal share of the points (regardless of whether they actually did) than if it was not possible to get an equal share. So, participants were more satisfied with the current arrangement in the easy-to-divide practice session ($M = 4.04$, $SD = 1.92$), followed by the easy-to-divide task ($M = 3.01$, $SD = 1.71$), then the difficult-to-divide practice session ($M = 2.98$, $SD = 1.62$), and finally the difficult-to-divide task ($M = 2.54$, $SD = 1.45$). As all participants were exposed to the free-rider problem, we expected all members to be dissatisfied with the current scenario. Although participants' ratings of satisfaction were slightly higher than expected in the easy-to-divide practice session, participants' ratings in general were low and represented dissatisfaction with the status quo. One sample t-tests were performed on each of these conditions which showed that the satisfaction scores differed significantly from the midpoint of the scale in the easy task, $t(112) = -6.17, p < .001$, the difficult practice session, $t(112) = -6.69, p < .001$, and the difficult task, $t(112) = -10.78, p < .001$, but not in the easy practice session, $t(112) = .25, p = .81$.

Interestingly, a main effect of Subgroup division was also shown to be significant, $F(1, 107) = 14.39, p < .001$. This showed that in the subgroup condition (i.e., newcomers present), participants were less satisfied with the current arrangement regarding the status quo ($M = 2.70$, $SD = 1.43$) than if no-subgroups were present in the group and all members shared a history ($M = 3.52$, $SD = 1.76$). There were no other significant main effects or interactions.

Furthermore, a 2 (Subgroup division: subgroup, no-subgroup) x 3 (Group size: 4, 8, 16) x 2 (Resource division: easy, difficult) repeated measures ANOVA was performed on the manipulation question, "Considering the total number of points available to the group, do you feel that you got a fair share of the points?" (1 = *not at all*, 7 = *very much so*). This revealed a main effect of Resource division, $F(3, 105) = 169.31, p < .001$. Participants correctly identified that they received a fair share of the points in the easy-to-divide practice session ($M = 6.11$, $SD = 1.65$) where they received the same number of points as every other member in the group (10 points), followed by the difficult-to-divide practice session ($M = 2.84$, $SD = 1.48$), where other group members received either 12 or 8 points and the participants themselves received 8 points, and then the easy-to-divide task ($M = 2.07$, $SD = 1.53$) and the difficult-to-divide task ($M = 1.70$, $SD = 1.08$), where participants received four points in both conditions and other group members collected between 8 and 16 points. Pair-wise comparisons were performed between the four conditions which showed that participants' ratings of whether they got a fair share of the points in each condition were all significantly different from one another at the level of $p < .05$.

Again, there was also a main effect of Subgroup division, $F(1, 107) = 23.45$, $p = .008$. Participants in the subgroup condition were less likely to feel that they received a fair share of the points ($M = 2.93$, $SD = 1.26$) compared to those in the no-subgroup condition ($M = 3.39$, $SD = 1.54$). There was no main effect of Group size, $F(2, 107) = .86, p = .42$, and no significant interactions.

A further group identification manipulation question asked, "Do you feel that all the members that collected points from the common pool, including yourself, belonged to one group?" (1 = *not at all*, 7 = *very much so*). Unexpectedly, this did not reveal any significant main effects or interactions. We expected to find a main effect of Subgroup division in accordance with our previous studies, but this failed to reach significance, $F(1, 107) = .64, p = .43$. There was no significant difference in group identification when newcomers were present in the group ($M = 2.47$, $SD = 1.34$), than when they were absent ($M = 2.83$, $SD = 1.63$).

Participants were also asked, "How easy do you think it would be to divide the common pool easily and fairly into two?" (1 = *not at all*, 7 = *very much so*). A 2

(Subgroup division: subgroup, no-subgroup) x 3 (Group size: 4, 8, 16) x 2 (Resource division: easy, difficult) repeated measures ANOVA was used to analyse the responses to this question. As expected, the results revealed a significant main effect of Resource division, $F(1, 107) = 45.05, p < .001$. Participants correctly identified that it was easier to divide the common pool into two in the easy-to-divide condition ($M = 4.51$, $SD = 1.82$) than in the difficult-to-divide condition ($M = 3.20$, $SD = 1.69$).

Furthermore, there was a significant Resource division x Subgroup division interaction, $F(1, 107) = 8.22, p = .005$ (see Table 5). Further analysis showed that when newcomers were present in the group and when the group consisted of all old-timers, the ease with which participants reported being able to divide the common pool into two differed depending on whether participants were in the easy or difficult-to-divide condition, $t(51) = 3.69, p < .001$ and $t(60) = 6.07, p < .001$, respectively (using Paired Samples T-Tests). Furthermore, Independent Samples T-Tests on the easy-to-divide task revealed that the ease with which participants could divide the common pool into two differed significantly when newcomers were present and when they were absent from the group, $t(111) = -2.62, p = .01$, however, no such differences were found for the difficult-to-divide task, $t(111) = .71$, *ns*. Thus, participants considered it easier to divide the common pool into two in the easy-to-divide condition than the difficult-to-divide condition, as expected, but they found it easier to divide the common pool in two in the easy-to-divide condition when there were no-subgroups present. Based on the findings of Experiment 5, we had expected for participants to find it easier to split the common pool into two if they were in the easy-to-divide condition and there were subgroups present in the group. In addition, participants found it more difficult to divide the common pool if they were in the difficult-to-divide condition task and there were no-subgroups present.

There were no other significant interactions.

Table 5

Effects of Resource Division and Subgroup Division on How Easy it is to Fission

Condition	Mean	Std. Deviation
Subgroup		
Task (easy)	4.04 [a]	1.76
Task (difficult)	3.33 [b]	1.78
No-subgroup		
Task (easy)	4.91 [c]	1.79
Task (difficult)	3.10 [b]	1.62

Note. Responses to the question, "How easy do you think it would be to divide the common pool easily and fairly into two?" were measured on a bipolar scale ranging from 1 = *not at all*, to 7 = *very much so*. Values with different superscript differ at the level of $p < .05$, using Paired Samples T Tests and Independent Samples T Test.

These results show that some but not all of our manipulations were successful. Although participants correctly identified that it was easier to divide the resource and they could get a fair share of the resource in the easy-to-divide condition rather than the difficult-to-divide condition, our subgroup division manipulation was not successful. The level of group identification did not differ significantly depending on whether participants were in the subgroup or no-subgroup condition, as they had done previously in Experiments 3-5. Obviously this will have implications for our findings as the faultline hypothesis depends upon participants identifying with the subgroup (in the subgroup condition) and superordinate group (in the no-subgroup condition). Nevertheless, we continued to analyse the data.

Furthermore, our manipulation question asking participants how easy it would be to divide the common pool equally and fairly into two provided some interesting results. Here, it was shown that participants believed it would be easier to divide the common pool into two in the easy-to-divide condition when there were no subgroups present, even though we would expect participants to find it easier to split the group if subgroup boundaries are present, as these boundaries determine the location of where the group will split. The results may stem from our questioning which asked participants how easy it would be to split the resource both *equally* and *fairly* into two. Although we expected equality to be equated with fairness, in retrospect these should have been asked as two separate questions because the results of this manipulation question suggest that participants in the subgroup condition did not consider equal division to necessarily be the fairest division. It is important that in future research we make a distinction between equality and fairness and test them as two separate constructs.

Group Fission

To analyse fission preference, a 2 (Subgroup division: subgroup, no-subgroup) x 3 (Group size: 4, 8, 16) x 2 (Resource division: easy, difficult) repeated measures ANOVA was conducted on the group fission statement, "Please indicate whether you would prefer dividing the common pool into two and working in smaller groups" (1 = *not at all*, 7 = *very much so*).[20] In support of Hypothesis 2, this revealed a main effect of Resource division, $F(1, 107) = 4.40, p = .04$. Participants were more likely to split in the easy-to-divide condition ($M = 4.93$, $SD = 2.02$) than in the difficult-to-divide condition ($M = 4.43$, $SD = 2.05$).[21]

There was no main effect of Subgroup division, $F(1, 107) = 1.10, p = .30$, however, there was a marginally significant Resource division x Subgroup division interaction, $F(1, 107) = 3.69, p = .06$ (see Table 6). Paired Samples T-Tests revealed that when newcomers were present in the group, fission preference did not differ between the easy and difficult-to-divide conditions, $t(51) = .23$, *ns*, although there was a significant difference in fission preference between the easy and difficult-to-divide conditions when the group consisted of all old-timers, $t(61) = 3.03, p = .004$. Furthermore, Independent Samples T-Tests revealed a marginally significant difference in fission preference when newcomers were present and absent in the group in the easy-to-divide resource, $t(111) = -1.92, p = .06$, but no significant differences were found in the difficult-to-divide resource, $t(111) = .13$, *ns*. Thus, participants were more likely to fission in the easy-to-divide condition when subgroups were not present, i.e., when participants shared a group with all old-timers. This was unexpected, and contradicted the findings of Experiment 5 where there was some suggestion that participants were more likely to fission in the easy-

[20] In the original analysis, the order of presentation of the resource division manipulation was included as an independent variable. However, the result was non-significant $F(1, 101) = .35, p = .56$, and thus order was collapsed across the design.

[21] A median split conducted on the fission preference measure allowed us to obtain the percentages of those who chose to fission in the easy and difficult-to-divide conditions. Participants who rated fission preference with a 4 were excluded (the midpoint of the scale), whereas participants who rated fission preference with 1 - 3 were considered unlikely to fission and ratings of 5 – 7 were considered likely to fission. In total, 71.4% of participants in the easy-to-divide condition chose to fission ($n = 98$) compared with 62.1% in the difficult-to-divide condition ($n = 95$).

to-divide condition when subgroups were present. Since the presence of subgroups did not increase fission preference, there was no support for the *strong* faultline hypothesis (Hypothesis 1a). However, we continued to find support that the physical faultline was a moderating factor in the fission process.

Furthermore, there was no main effect of Group size, $F(2, 107) = 1.38, p = .26$, thus there was no support for Hypothesis 3, which predicted that larger groups were more likely to split than smaller groups. Finally, there were no further significant interactions.

Table 6

Effects of Resource Division and Subgroup Division on Fission Preference

Condition	Mean	Std. Deviation
Subgroup		
Easy task	4.54[a]	2.02
Difficult task	4.46[a]	2.21
No-subgroup		
Easy task	5.26[b]	1.97
Difficult task	4.41[a]	1.93

Note. Participants' fission preferences were measured on a bipolar scale from 1 = *not at all* (likely to fission) to 7 = *very much so*. Values with different superscript letters differ significantly from one another at the level of $p < .05$, using Paired Samples T-Tests and Independent Samples T-Tests.

Composition of the Exit Group

Whether the presence of subgroup boundaries determines the formation of exit groups was examined using a repeated measures ANOVA on the exit group composition choice. This analysis was conducted three times, i.e., for those participants in the group size 4, 8, and 16 conditions. Participants' choices for break-away members were recoded to form one continuous dependent variable. This allowed us to measure the extent to which participants preferred members that they shared a history of successful interactions with over newcomers who had joined the group. Recall that in the group size four condition, Participant 4 was the only member with which the participant had worked successfully in previous trials in both the subgroup and no-subgroup conditions. Likewise, in the group size 8 condition participants believed that they had a history of successful interactions with Participants 4, 5, and 6 in both the subgroup and no-subgroup condition. And finally, in the group size 16 condition, participants believed that they shared a history of successful interactions with Participants 4, 5, 6, 7, 8, 9 and 10 in both the subgroup and no-subgroup conditions. Thus, we recoded the exit group composition preferences so that participants received a score of +1 if they selected all members with whom they shared a history to form a break-away group, a score of 0 if they selected a mixture of old-timers and newcomers, and a score of -1 if they selected only newcomers to form an exit group with. This analysis however failed to find a main effect of Subgroup division in either the group size 4 condition, $F(1, 35) = .88, p = .36$, the group size 8 condition, $F(1, 33) = .01, p = .91$, or the group size 16 condition, $F(1, 39) = .35, p = .56$.

Structural Solution versus Status Quo

Participants were given detailed information about a number of possible structural solutions (fission, leader, equal privatisation, harvest cap, sanction) that could be implemented to deal with the free-rider problem and what it would mean for the group if that option was employed for the next task (see Appendix 3). Following each description, participants were asked to choose between employing that option for the next task and continuing to select points from the common pool in the same format as the previous task (the status quo). The percentage of participants who selected each of the options as opposed to choosing the status quo was calculated (see Table 7).

Table 7

Participants' Preferences for Employing Structural Solutions over the Status Quo in the Easy and Difficult-to-Divide Conditions

Structural solution	Easy-to-divide condition	Difficult-to-divide condition
Fission	70.8% [a]	60.2% [b]
Elect a leader	56.6%	53.1%
Equal privatisation	61.9%	60.2%
Harvest cap	79.6%	84.1%
Sanction	68.1%	73.5%

Note. Values with different superscript letters are shown to be significantly different from one another, $p < .05$, using a McNemar Test.

A series of McNemar Tests were conducted on each of the options to see whether the likelihood of that structural solution being selected differed depending on whether the resource was easy or difficult to divide equally. The only significant difference was between the fission option in the easy and difficult-to-divide conditions ($p = .05$). In support of Hypothesis 4, participants were significantly more likely to select the fission choice as a means of dealing with the free-rider problem in the easy-to-divide condition (70.8%) than the difficult-to-divide condition (60.2%).

Preferred Structural Solution for Dealing with the Free-Rider Problem

Participants were also asked to vote for the one option that they would like to implement for the subsequent task. The percentage of participants who chose these structural solutions were calculated to allow us to see the popularity of each of the structural solutions for dealing with the free-rider problem and to compare the popularity of each choice in the easy and difficult-to-divide conditions (see Table 8).

Table 8

Preferred Structural Solution for Dealing with the Free-rider Problem

Structural solution	Easy-to-divide	Rank (easy)	Difficult-to-divide	Rank (difficult)
Fission	11.5%	4	7.1%	5
Leader	10.6%	5	10.6%	4
Equal privatisation	22.1%	2	16.8%	3
Harvest cap	35.4%	1	36.3%	1
Sanction	15.0%	3	23.0%	2
Status quo	5.3%	6	6.2%	6

Note. The above percentages are based on participants' choices of which one structural solution they would like to employ for the subsequent task.

In this study fission was not at all a popular choice for dealing with the free-rider problem in either the easy or difficult-to-divide condition, thus providing no support for Hypothesis 4. A series of McNemar Tests were conducted on each of the structural solutions which revealed no significant differences between the likelihood of any of the structural solutions being selected in the easy and difficult-to-divide conditions, thus also providing no support for Hypothesis 2. The table shows that the most popular choice for dealing with the free-rider problem in both the easy and difficult-to-divide conditions was to enforce a harvest cap, and the least popular choice in the easy and difficult-to-divide conditions was the status quo option.

Ranking the Effectiveness of Structural Solutions

Finally, participants were asked to rank the six structural solutions in terms of their effectiveness for dealing with the free-rider problem, ranging from 1 = *most effective option*, to 6 = *least effective option*. The absolute values were calculated for each option and the average was computed. Please note that a lower score implies that the option is more preferable than the other options for dealing with free-riders. Unlike Experiment 5, where fission was voted as the second most effective option in the easy-to-divide condition, and tied fourth most effective option in the difficult-to-divide condition, Wilcoxon Signed Ranks Tests revealed absolutely no significant differences between preferences for the different structural solutions in the easy and difficult conditions (see Table 9). Thus, in both the easy and difficult-to-divide conditions, participants believed that the most effective way of dealing with the free-rider problem was to enforce a harvest cap, followed by imposing sanctions, then equal privatisation, followed by electing a leader, then fission, and finally remaining with the status quo.

Table 9

The Effectiveness of Different Structural Solutions for Dealing with the Free-Rider Problem

Structural solution	Easy-to-divide Mean score	Rank (easy)	Difficult-to-divide Mean score	Rank (difficult)
Fission	3.80	5	3.89	5
Leader	3.63	4	3.81	4
Equal privatisation	3.27	3	3.31	3
Harvest cap	2.35	1	2.32	1
Sanction	3.12	2	3.02	2
Do nothing	4.84	6	4.82	6

Note. The above scores represent the average score of the absolute values of the ranked data (n = 113). Participants were asked to rank the effectiveness of each of the structural solutions, giving a score of 1 for the most effective option, 2 for the second most effective option, etc, with 6 being the least effective option. Thus, a lower score represents the most effective option, and a higher score represents the least effective option.

Summary

The results of Experiment 6 provided no support for either the *strong* or *weak* faultline hypotheses (Hypothesis 1a and1b, respectively). Subgroup division failed to exacerbate the likelihood of a fission when free-rider conflict was present, and was unable to determine the location of the split once a fission was imminent. The failure of our subgroup manipulation to highlight a superordinate identity when no subgroups were present, may account for these null findings.

As in Experiment 5, a significant interaction between resource division and subgroup division on fission preference was found, thus providing further evidence that the presence of a physical faultline, such as ease of resource division, can moderate the role of diversity faultlines in the fission process. However, unlike Experiment 5 where participants were shown to be slightly more likely to fission in the easy-to-divide condition when subgroups were present, the results of this study showed that participants were more likely to fission in the easy-to-divide condition when there were no subgroups present. Again, these unexpected findings may be due to the failure of our subgroup manipulation.

The results of this study also failed to find any support for Hypothesis 3. Larger groups were not shown to be any more likely to split than smaller groups, as we had predicted.

There was some support for Hypothesis 2, which claimed that fission would be more likely in the easy-to-divide condition than the difficult-to-divide condition, although this was fairly inconsistent. When comparing participants' preferences for employing each of the structural solutions (fission, leader, equal privatisation, harvest cap, sanction) against continuing with the status quo in the successive task, results showed that the fission option was more popular in the easy-to-divide condition than in the difficult-to-divide condition. However, we found no support for Hypothesis 2 when participants were asked to vote which one structural solution they would like to employ for the successive task and when participants ranked the effectiveness of each of the options for how well they could deal with the free-rider problem. Furthermore, in contrast to Experiment 5, we found no support for Hypothesis 4. The popularity of the fission option was low compared with the alternative structural solutions in both the easy (ranked 4th choice) and difficult-to-divide (ranked 5th choice) conditions and it was not considered particularly effective for dealing with the free-rider problem in either condition (ranked 5th out of the six options). Once again, the most popular option for dealing with the free-rider problem was to enforce a harvest cap (ranked 1st choice in the easy and difficult-to-divide conditions).

Part III Discussion and Conclusions

The aim of the studies in Part III of this thesis was to pit the *strong* faultline hypothesis against the *weak* faultline hypothesis. In addition, we extended the faultline hypothesis featured in Part II of this thesis to include two further potential risk factors that may promote a fission; ease of resource division (a physical faultline) and group size, to test their effects on fission preference. Participants in Experiments 5 and 6 were also offered a range of structural solutions for dealing with the free-rider problem to allow us to gage just how popular the fission choice was when other methods of solving the free-rider problem were available. Finally, the use of varied methodologies allowed us to test the robustness of our findings.

I shall start by mentioning that the results of our two studies were inconsistent in their support for the faultline hypotheses. This may have been due to the different methodologies used (role-playing methodology in Experiment 5 versus controlled laboratory experiment in Experiment 6), although it is more probable that the differences in results could be apportioned to the unsuccessful subgroup manipulation in Experiment 6. Our previous findings (Experiments 3 – 5) successfully showed that when subgroups were present in a group, a subgroup identity was salient, and when subgroups were absent, a superordinate identity was salient. Unfortunately, in Experiment 6 we found no support for this. The importance of this manipulation however is paramount when examining the fission phenomenon. For faultlines to have any effect in the fission process, whether as a potential cause of the split (*strong* faultline hypothesis) or in a facilitating role (*weak* faultline hypothesis), it is essential that individuals identify with their subgroups (in the subgroup condition) or the superordinate group (in the no-subgroup condition)(Sani & Todman, 2002), thus the unsuccessful manipulation was a major limitation of this study. However, it was encouraging to find in both studies that the presence of a physical faultline (ease of resource division) was a moderating variable in the fission process, as implied by the interactions found between our focal independent variable (subgroup division) and ease of resource division which specifies the appropriate conditions for its operation (Baron & Kenny, 1986).

The Strong and Weak Faultline Hypotheses

The results of Experiments 5 and 6 provided no support for the *weak* faultline hypothesis; the presence of subgroups did not determine the exit group composition once a fission was imminent, and participants did not show any preference for old-timers over newcomers in their selection of members to form a break-away group with. However, some support was found for the *strong* faultline hypothesis, but only in Experiment 5. This showed that if the resource could be divided equally into two, the presence of newcomers in the group made the group inherently less stable and subsequently more likely to fission, thus showing that subgroups can act as faultlines that break the group up when there is pressure imposed upon them via the easy-to-divide resource manipulation. Although the interaction between subgroup division and resource division on fission preference was also significant in Experiment 6, the means suggested that fission was more likely if the resource was easy to divide and there were no subgroups present in the group. However, the unsuccessful subgroup manipulation made us leery of this finding.

In both the *strong* and *weak* faultline hypotheses we expect participants to select members to form a break-away group with similar others, i.e., we expect them to split along the faultline. Thus, we expected in these studies for participants to select members with whom they shared a history over newcomers, and yet we found no main effect of subgroup division in either of our studies. One explanation for this is that participants did not remember, especially in the larger groups, who they shared a history with. However, analysis of the exit group composition with just those members in the group size four condition (where any computational difficulties would have been minimal) was still unable to obtain a significant main effect of subgroup division.

An alternative explanation may be due to our choice of faultline manipulation. The individuals in our studies may not have picked old-timers to form a breakaway group with because they wanted to mentor the newcomers in order to socialise them into the group (see Moreland & Levine, 2001) and/or to monitor them. Further exploration of participants' choices of break-away members is needed.

The results of our previous studies (Experiments 2 - 4) have found support for the *weak* faultline hypothesis. In these present studies we continued to expose individuals to a free-rider conflict and continued to manipulate the presence or absence of faultlines within the group and yet in these latter studies we have found no support for the *weak* faultline hypothesis. We suspect that the combination of multiple 'risk' factors used in Experiments 5 and 6 may have led to the support found in Experiment 5 for the *strong* faultline hypothesis as opposed to the *weak* faultline hypothesis. Our earlier studies that found support for the *weak* faultline hypothesis investigated free-rider conflict and a single faultline (gender, graduate status, attitude similarity). In these latter studies, we manipulated these same factors but in addition included group size and ease of resource division to the faultline hypothesis. Lau and Murnighan (1998) claimed that support for the *strong* faultline hypothesis would be more likely if there was an alignment of multiple characteristics, e.g., a student house containing males and females, where all the males were economists and all the females were psychologists. Although we found no effects of group size, the interaction between resource division and subgroup division in Experiment 5 suggests that a faultline like newcomers versus old-timers can become salient when an environmental cue such as the ease of resource division is activated, providing support for the *strong* faultline hypothesis. Thus, multiple alignments of characteristics, as suggested by Lau and Murnighan, is certainly not the only way to find support for the *strong* faultline hypothesis.

It may be that we found some support for the *strong* faultline hypothesis in Experiment 5, but not in Experiment 6, because participants believed that there was a connection between the cause of conflict (free-riders) and subgroup division (newcomers) (Oakes, 1987). Although participants were not explicitly told that the newcomers were taking more than their fair share of the vegetables from the allotment, participants made the link between the harmonious situation before newcomers arrived, and a decrease in the amount of vegetables they received for themselves once the newcomers arrived, and apportioned the blame to the newcomers. However, this was less clear in Experiment 6. In the computer based experiment it was essential that participants received the lowest possible share of the points from the common pool to ensure that they would be dissatisfied with the status quo. To do this, participants believed that the computer had selected them to be the final participant to select points from the common pool. This manipulation however may have been counterproductive. Although it ensured that members were dissatisfied that they received a less than equal share of the resource, it seems that individuals did not necessarily apportion the blame for the free-riding on the newcomers, even though they had a shared history of successful interactions with group members before the newcomers arrived. In Experiment 6, as in Experiment 5, participants could not tell which members were collecting points from the common pool as the feedback was labelled "the first person selected X points, the second person selected X points, etc." We expected participants to think that the newcomers were responsible for harvesting excessively but this was not the case. Instead, it seems that the sequence number determined by the computer distracted members' attention away from the newcomers as the position awarded to them by the computer was dependent on the luck of the draw. In a sense, these members with a privilege position to select points from the common pool could have been anyone and not necessarily newcomers as they had the prime opportunity to free-ride and get away with it – they were anonymous (Comer, 1995; Komorita & Parks, 1994). This could explain the unsuccessful subgroup manipulation in Experiment 6 and the inconsistencies in findings between Experiments 5 and 6. Future research should address this, perhaps by giving explicit feedback about who the free-riders were in the group, i.e., the newcomers are also free-riders, as in Experiment 4.

Diversity Faultlines and Fissions

In Experiment 5 our subgroup manipulation was successful and showed that if subgroups were present in the group individuals identified less with the overall group than if there were no subgroups present. We did not find this for Experiment 6, but interestingly the results of our manipulation questions regarding participants' satisfaction levels with the status quo and whether participants felt that they got a fair share of the points from the common pool during the task showed that the mere presence of subgroups had negative connotations for the group. Analysis revealed that participants in the subgroup condition reported being more dissatisfied with the status quo than members in the no-subgroup conditions and reported that they received a lower share of the points from the common pool in the subgroup compared with the no-subgroup condition (participants actually received an identical number of points in each condition). These findings support previous findings on the negative influence of subgroup formation, for example, Kramer and Brewer (1984; Exp. 2) showed that co-operation levels decrease in a resource dilemma task if subgroups are present; Tajfel and Turner's Social Identity Theory (1986) indicates that the mere presence of an out-subgroup can lead to discrimination against out-subgroup members; in our studies, we found that the mere presence of out-subgroup members increased the need to monitor the actions of other individuals (Experiment 4); and that there was less trust in members of the out-subgroup compared with in-subgroup members (Experiment 3). These findings further support Sani and Todman's Social Psychological Model of Schisms in Groups (2002) and Yzerbyt et al. (2000) who claim that individuals strive for uniformity in groups. Individuals are more content when a group is entitative, as in-group entitativity contributes to a secure sense of identity. On the other hand, groups that are less uniform are intrinsically less stable.

Ease of Resource Division

Previous research has claimed that when all group members occupy identical positions, i.e., all else is equal, individuals strive for equal final outcomes (Charlton, 1997; Allison & Messick, 1990; Van Dijk & Wilke, 1995). Since all members in our studies occupied identical positions, Hypothesis 2 predicted that individuals will be more likely to initiate a fission if a resource can be easily divided into two equal halves. The results of Experiments 5 and 6 both showed some support for this hypothesis. If the resource was easy to divide equally and fairly into two, participants were more likely to fission than if the resource was difficult to divide equally into two. In fact, if individuals could not receive an equal share of the resource if it were divided into two, this would actually undermine the group fission and participants would prefer to remain with the status quo.

To reiterate again, it was also encouraging to find in both studies that a moderating variable in the fission process was the physical faultline, i.e., the ease of resource division. The resource division interaction with subgroup division was apparent in both studies, showing that participants were more likely to fission when exposed to a resource that could easily be divided equally into two. These findings confirmed that the ease of resource division should be considered as a potential risk factor that will promote a fission when individuals strive for a norm of equality (when they are equal on all other relevant dimensions) and newcomers are present in the group.

Group Size

It was predicted that larger groups would be more likely to fission than smaller groups (Hypothesis 3) because larger groups are more likely to contain free-riders (Komorita & Lapworth, 1982) and because larger groups are more likely to contain subgroup divisions (Moreland & Levine, 1992). However, the results of Experiments 5 and 6 found no support for this hypothesis.

In retrospect, this may not be surprising. Although we varied group size (four, eight, or sixteen), free-riders were present in all groups, regardless of group size, and all members in the subgroup conditions were exposed to newcomers joining the group, again regardless of group size. Therefore, it may be argued that this hypothesis was not given a fair chance.

It is often the case that if newcomers join a group, the size of that group will increase, although in Experiments 5 and 6 this was not the case. New members replaced existing members meaning that group size always remained the same. The dynamics of membership change, including substitution of members and adding new members and thus increasing group size however may be different (Arrow & McGrath, 1995). Our justification for membership substitution rather than simply adding new members to the existing group was to enable us to decipher whether newcomers entering the group, group size, or both factors, affected fission preference. However, future research should address the effects of both adding newcomers to an existing group and thus increasing group size, and membership substitution where group size stays constant, on fission preference.

The Popularity of Fission as a Means of Dealing with the Free-rider Problem

It was also predicted that the fission option would be voted as the preferred choice for subsequent tasks and would be rated as more effective for dealing with the free-rider problem over alternative structural solutions (leader, equal privatisation, harvest cap, sanction) when the resource was easy-to-divide than when it was difficult-to-divide (Hypothesis 4). Support was found for this claim in Experiment 5 when participants rated the fission option as the second most effective solution for dealing with the free-rider problem in the easy-to-divide condition, beaten only by the harvest cap option. However, there was no support for Hypothesis 4 in Experiment 6, where participants ranked fission as their fourth preferred option in the easy-to-divide condition, fifth preferred option in the difficult-to-divide condition, and ranked it as the fifth most effective option for dealing with the free-rider problem. Once again, these inconsistent results between the popularity of the fission choice in Experiments 5 and 6 were unexpected and may be apportioned to the different methodologies used, or conversely the complexity of Experiment 6 which seems to have confused our participants. Future research should address the reasons for these inconsistencies.

While there were no overall hypothesis about which of the structural solutions would be most preferred for dealing with the free-rider problem, it is startling that the harvest cap option was so strongly endorsed in both of these studies. Samuelson (1993) claims that the preference for this structural solution may be because it "affords [individuals] a sense of personal control over resource use decisions" and that this system "allows for personal autonomy" (Samuelson, 1993, p320).

Conclusion

Finally, in Experiment 5, we found some support for *strong* faultline hypothesis. The results of this study showed that groups that contained newcomers were more likely to fission than groups without newcomers, but only if the resource was easy to divide equally and fairly. This moderating effect of resource division was also apparent in Experiment 6, although no support was offered for the *strong* faultline hypothesis as participants were unexpectedly shown to be more likely to fission if the group contained all old-timers.

Both experiments clearly indicate the importance of resource division in the fission process. When all else is equal, participants strive for equal final outcomes, thus, individuals are more likely to initiate a fission if the two resulting fission groups will get an equal share of the original resource. Thus, we can conclude that the ease of resource division is a physical faultline that becomes salient when a free-rider conflict is salient. Furthermore, when a resource is easy to divide equally and fairly into two, it becomes a risk factor that may promote a fission if there are faultlines within the group as a result of, for example, the admission of newcomers.

Our results suggest that investigating multiple risk factors that may promote a group fission simultaneously (i.e., adding physical faultlines to the original faultline hypothesis) increases the likelihood of finding support for the *strong* faultline hypothesis as opposed to the *weak* faultline hypothesis.

Part IV: FREE-RIDERS, FAULTLINES, AND FISSION: A GENERAL DISCUSSION

Chapter 6: General Discussion

The group fission phenomenon, described as the process whereby two or more members, in conjunction, exit their parent group to either establish a new group or join a different group, has been a largely neglected topic area. Most of the existing research on group processes and membership dynamics has focused on individual exits from the group, despite the widespread occurrence of group fissions (Moreland & Levine, 1982; Rusbult & Farrell, 1983; Van Vugt, Jepson, Hart, & De Cremer, 2004; Worchel, 1996; Ellemers, Spears, & Doosje, 1997). More recently however, researchers have recognised the importance of group splits, as demonstrated by Dyck and Starke (1999) who investigated group exits in religious congregations, and Sani and Reicher (1998, 1999, 2000), who investigated schisms in religious groups and political parties.

Although this research has raised interest in the group fission phenomenon the generalisability of the results so far could be considered limited, due to the focus solely on ideological groups that split as a result of opinion differences, which subvert group identity. The real world examples of fission discussed briefly in Chapter One, included organisational splits (Dyck, 1997), religious groups (Sani & Reicher, 1998, 1999, 2000; Dyck & Starke, 1999), political parties (Sani & Reicher, 1998), nation states (Bookman, 1994), traditional hunter-gatherer societies (Kelly, 1995; Barrett, Dunbar, & Lycett, 2002), and primates (Wilson, 1975). These examples feature both fissions that are driven by intragroup conflict over ideological beliefs *and* fissions that are precipitated by scarce resources. The focus of our present research has been specifically on those groups that split as a result of scarce resources, and in particular, free-rider conflict in groups. Since the social dilemma literature has suggested benefits of being in smaller rather than larger groups, such as increased levels of co-operation (Dawes, 1980; Hamburger, Guyer, & Fox, 1975; Komorita, Parks, & Hulbert, 1992), increased levels of intrapersonal trust as a result of being more identifiable and accountable to the group (Van Vugt, 1998), and feeling that your contribution is more critical to the group (Kerr, 1989), it makes inherent sense that fissions may be adaptive and considered as an alternative solution for dealing with the free-rider problem. This present research tested the hypothesis that fissions may also occur due to a perceived need to manage free-riding.

In addition to our belief that free-rider conflict may cause fission, we also acknowledge the importance of diversity faultlines (the alignment of demographic or psychological characteristics) caused by subgroup divisions within a group (Lau &

Murnighan, 1998). Most groups are internally divided into subgroups (Hornsey & Hogg, 2000; Kramer & Brewer, 1984). Furthermore, much research has demonstrated the negative influence of subgroup formation. For example, Kramer and Brewer (1984) showed how the salience of subgroups undermines group cohesion and within-group co-operation. Based on social identity principles (Tajfel & Turner, 1986), group members can define themselves at the level of the subgroup, in which case a subgroup identity is salient, or they can identify themselves at the group level, in which case a superordinate group identity is salient. According to such principles, group fissions may be more likely whenever a subgroup identity is salient, and it is perceived to be in conflict with the superordinate identity of the group. The present research tested this assumption.

Integrating these endogenous factors (free-rider conflict and faultlines) allowed us to develop hypotheses about the pathways leading from conflict to fission. The *weak* faultline hypothesis accords descriptive status to the presence of subgroups, that is, subgroups describe how, or along which lines the initial group splits and thus defines the structure of the exit group, but does not explain why the split occurs. In contrast, the *strong* faultline hypothesis accords explanatory status to subgroups. Subgroups act as a moderator, intensifying conflict if they are associated with it and therefore making fission more likely. Thus, both the *strong* and *weak* faultline hypotheses assume that free-rider conflict causes fission but diverge in their treatment of the subgroup factor. Since both pathways seemed plausible we investigated under what circumstances these pathways were more or less likely to be activated.

General Summary of Results

Table 10 provides a summary of the key findings from all six experiments presented in this thesis. It displays which experiments provided support for the faultline hypotheses as well as other interesting findings that were revealed in each of the experiments.

Table 10

Summary of Findings and Support for the Faultline Hypotheses

	Fission Likelihood				*Exit Group*		
Study	Main effect of Free-rider Conflict	Main effect of Subgroup Division	Main effect of Group Size	Main effect of Resource Division	Main effect of Subgroup Division	Support for Faultline Hypothesis	Other Interesting Findings
1	√	X	N/A	N/A	X	Neither	
2	√	X	N/A	N/A	√	Weak	
3	√	X	N/A	N/A	√	Weak	i) Participants contribute less of their endowments in the subgroup condition compared with the no-subgroup condition. ii) Out-subgroup members are trusted less than in-subgroup members. iii) Participants perceive greater efficacy in fission if there is a free-rider conflict present than when there is no free-rider conflict.

(Table continued on next page)

	Fission Likelihood				*Exit Group*		
Study	Main effect of Free-rider Conflict	Main effect of Subgroup Division	Main effect of Group Size	Main effect of Resource Division	Main effect of Subgroup Division	Support for Faultline Hypothesis	Other Interesting Findings
4	N/A	X	N/A	N/A	√	Weak	i) Participants are more aware of other group members' contributions in the subgroup compared with the no-subgroup condition. ii) There is a significant increase in investments following a fission.
5	N/A	X	X	√	X	Strong	i) Participants are more likely to fission if there are subgroups present in the group and the resource is easy-to-divide (i.e., there was a significant subgroup division x resource division interaction on fission likelihood). ii) The fission option is more popular if the resource is easy to divide than if it is difficult to divide.
6	N/A	X	X	√	X	Neither	

Note. In the above table, a '√' indicates the presence of a main effect whilst a 'X' indicates that no main effect was found.

Strong or Weak Faultlines? In six studies, we tested two alternative, yet not entirely incompatible versions of the faultline hypothesis. According to the *weak* faultline hypothesis, the free-rider conflict drives the fission and the presence of subgroups determines the exit group composition, but is not responsible for the split. In Experiments 2 – 4 support for the *weak* faultline hypothesis was pervasive. We found consistent findings which suggested that group fission can be conceived of as a serial process using different faultlines (graduate status and attitudinal similarity) and different methodologies (role-playing and laboratory experiment). That is, free-rider conflict produces cracks within the original group, which subsequently breaks along subgroup division lines.

According to the *strong* faultline hypothesis, the presence of clearly distinguishable subgroups in the original group increases the likelihood of fission in the face of free-rider conflict. Support for this prediction was shown in Experiment 5. An interaction between resource division and subgroup division revealed that fission preference was greatest if subgroups were present (i.e., there were newcomers in the group) and the resource was easy to divide equally into two fission groups.

There was no support for either the *weak* or *strong* faultline hypotheses in Experiments 1 and 6. However, Experiment 1 was our first attempt at investigating the antecedents of group fission and our choice of gender faultline was perhaps not optimal because members of mixed groups often report higher levels of in-group attraction and satisfaction (Levi, 2001). In addition, the fission option in this experiment only constituted a change to the acting group rather than to the standing group, which is arguably a less severe threat. With regards to the lack of support for the faultline hypotheses in Experiment 6, we can only conclude that the design of the experiment was too complex and participants found it very confusing. This was demonstrated by the failure of our subgroup manipulation, which had previously been successful (in Experiments 3 – 5).

Based on the above findings we shall now discuss each of the independent variables that were manipulated in our studies in turn and explain their effects on fission preference and the reasons for it. This is followed by a summary of how these variables interact in order to provide support for the *weak* or *strong* faultline hypotheses.

Free-rider Conflict and Fission

Our findings suggest that one of the causes for a fission is the need to control free-riding. This was demonstrated by the fact that group members were more likely to opt for a fission when free-riders were present in the group (as shown by Experiments 1 – 3).[22]

Moreover, in Experiment 3 participants confronted with a group conflict more strongly believed in the efficacy of the fission for dealing with the free-rider problem, i.e., they recognised the benefits of being in smaller groups. Finally, once the fission took place, the results of Experiment 4 showed that the overall level of co-operation increased. These findings provide support for the assumption that group fission may be quite an effective strategy for managing social dilemmas. If groups become too large to effectively control free-riding, it may be adaptive for individuals within these groups to initiate a fission.

Whether group fissions are also adaptive in a strictly evolutionary sense remains to be seen. Proof of this would require evidence that the capacity for humans to engage in flexible group associations has been selected for. In this regard, it is encouraging to find evidence for this capacity in studies of ancient and modern hunter-gatherer societies as well as in societies of our closest genetic relatives, non-human primates. Researchers in these fields have frequently observed fissions within populations, which they attribute to local shortages in resources, such as water, food, and mating opportunities. Such shortages create tensions within groups, which are frequently resolved after a collection of individuals depart the group, either for the duration of the shortage or as a permanent move (so-called fission-fusion societies; Kelly, 1995; Lee & Daly, 1999; Wilson, 1975).

Furthermore, Campbell's Realistic Conflict Theory (RCT) (1965) can be used to describe plausible mechanisms by which fissions may proceed when participants perceive the free-rider conflict as a real threat. According to RCT, group conflicts are rational in the sense that groups have incompatible goals and are in competition for scarce resources.

[22] Due to the massive success of this free-rider conflict in Experiments 1 – 3, where participants exposed to free-riders in the group were far more likely to fission than those who were not exposed to free-rider conflict, those participants in Experiments 4 - 6 were all exposed to a situation in which free-riding was prevalent in the group.

Real conflict of interests, past intergroup conflict, and/or the presence of a competitive outgroup, can cause the perception of threat. In terms of our studies, this threat was implied by the presence of free-riders in the group who either withheld their contributions or else harvested excessively. In both cases the presence of free-riders meant that our target participant would suffer as a result, either by failing to reach the provision point needed to obtain a bonus in addition to losing their endowment had they chosen to invest, or by receiving a low share of the resources from the common pool. RCT claims that this perceived threat causes hostility towards the source of threat. In our studies, it was implied (and in Experiment 4 explicitly highlighted) that the free-riders were also the members who were dissimilar to themselves (either in terms of gender, graduate status, attitude similarity, or sharing a history with the group members). Thus, the presence of the out-group was also the source of conflict. Accordingly, RCT claims that real threat causes in-group solidarity, increased awareness of own in-group identity, and an increased tightness of group boundaries. This was supported by our findings that participants identified more with the superordinate group if there were no subgroups present, but perceived themselves as two separate groups if subgroups were present in the group (Experiments 3 – 5; group identification manipulation check). Thus it seems that free-rider conflict was perceived in our studies as a real threat which in turn increased the salience of participants' subgroup identities (in the subgroup condition). The role of diversity faultlines in the fission process, which arise when subgroup boundaries and subgroup identities are salient, are discussed below.

Diversity Faultlines and Fissions

Both the *weak* and *strong* faultline hypothesis expect members to select similar others to form an exit group with over out-group members. In Experiments 2 – 4, participants selected members with whom they shared similarities (based on graduate status and attitude similarity) to form a break-away group with.[23] So, why do faultlines play a role in group fission? One explanation is based on the well-established finding that people

[23] This was not the case when gender and newcomer faultlines were manipulated in our studies (Experiments 1, 5 and 6) however we have previously proffered that gender may not have been a suitable faultline because members of mixed gender groups often report higher levels of satisfaction and in-group attraction than single gender groups (Levi, 2001) and because old-timers in Experiments 5 and 6 may have chosen to mentor newcomers in order to socialise them into the group (Moreland & Levine, 2001), hence explaining why participants did not select fellow old-timers to form an exit group with.

bond more easily with individuals who have similar values (Byrne, 1971; Newcomb, 1961). Thus, when similarity is made salient on a particular attribute, people use this as a heuristic for partitioning the group, perhaps based on the notion, it's "better the devil you know than the devil you don't!" This also follows from theories of social identity (Tajfel & Turner, 1986; Turner et al., 1987), which suggest that subgroup formation changes members' self identities from the superordinate group level to the subgroup level. Once a subgroup identity becomes salient, people become more attracted to their subgroup rather than to the group as a whole, and view in-subgroup members in more favourable terms than out-subgroup members (Hornsey & Hogg, 2000; Kramer & Brewer, 1984; Wit & Kerr, 2002). Consistent with these arguments, our findings revealed that in the subgroup conditions, participants identified less with the overall group.

Another explanation based on Coalition theory (Murnighan and Brass, 1991) suggests that individuals are likely to form coalitions when they have numerous similarities across a variety of demographic characteristics because they will tend to have pleasant interactions with one another and being with similar others will promote the flow of behaviour and decrease instances of intrapersonal conflict (Bukowski, Sippola, Newcomb, 2000; Thatcher et al., 2003). However, coalitions tend to perpetuate the notion of in-groups and out-groups leading to increases of conflict *between* or across subgroups (Bezrukova et al., 2001).

Furthermore, the salience of subgroup membership may be used as a cue for assigning trust to others. Supporting evidence for this proposition was shown in Experiment 3 where we found that participants anticipated greater co-operation from in-subgroup members than from out-subgroup members. This is in line with previous research which has also shown that when subgroups are salient, members' interpersonal evaluations of each other are biased toward individuals within their own subgroup in terms of their amount of trust (Messick et al., 1983). This is perhaps not surprising because in social dilemmas, participants should only co-operate if they expect their efforts to be reciprocated by others (i.e., reciprocal altruism; Trivers, 1971). Yet, without a history of interactions with other individuals, it is impossible to determine who can be trusted. Brewer (1981) referred to this as "depersonalised trust" in the sense that it is an assumption made in the absence of knowledge of individual members of the group. Hence, individuals often rely on (fallible) heuristics to search for cooperative partners. The experience of a common group membership may be one of the reciprocity heuristics that individuals apply (Gaertner & Insko, 2000; Van Vugt, Schaller, & Park, 2005).

Finally, the fact that we found evidence that exit groups are not just formed randomly, but that they are usually divided along kinship lines (Kelly, 1995) makes a lot of sense in evolutionary terms because any fission involves risks, and the newly formed small groups are only sustainable if there is a high degree of co-operation between members, which is characteristic of kin relations (Neyer & Lang, 2003).

In Part III of this thesis, we extended the group faultline hypothesis to include the additional risk factors, ease of resource division (physical faultline) and group size to investigate how these factors, in combination with free-rider conflict and the presence of faultlines, affected fission preference.

Physical Faultlines and Fissions

In Experiments 5 and 6 we found strong evidence that a fission is more likely to ensue if the resource is easy to divide equally into two. However, if the resource is difficult to divide equally into two, this undermines the fission, and participants are more likely to select alternative structural solutions for dealing with the free-rider problem. These findings support previous research which suggests that fairness concerns matter to participants and that when individuals are equal on certain dimensions, such as endowment, access, or interest in the public good, they strive to get an equal share of the resource (Charlton, 1997; Allison & Messick, 1990; Van Dijk & Wilke, 1995; Van Beest et al., 2003; Van Beest et al., 2004; Van de Kragt et al., 1986). Furthermore, the ease of resource division was shown to moderate the fission process by interacting with subgroup division in both studies. These current findings confirm that physical faultlines, such as the ease of resource division and the ability to get an equal share of the resource, is a potential risk factor that can affect fission preference. Hence, a protective factor that can undermine fission in instances where individuals are equal on relevant dimensions to the task is to make the resource difficult to divide fairly and equally.

Group Size and Fissions

Although we found no support in our studies that an increase in group size would augment fission preference, as we had predicted, this was probably due to the experimental design. All participants in our studies were exposed to a free-rider problem and subgroup divisions regardless of the size of the group they were in. Furthermore, the groups featured in Experiments 5 and 6 were of sizes four, eight and sixteen. Perhaps to find an effect of group size on fission preference, we need to further increase group size to perhaps 32 or 64 members. However, we still believe that that increasing group size will increase fission preference based on previous research. This previous social dilemma research has suggested that as the size of the group proliferates the chances that free-riders will be present in the group also increases. Furthermore, an increase in group size has been linked with a decrease in within-group co-operation (Komorita & Lapworth, 1982; Fox & Guyer, 1975), perhaps suggesting that free-riding is more prevalent in larger groups than smaller groups. In addition, Moreland and Levine (1992) claimed that increasing group size also increases the likelihood of subgroup divisions being present in a group. In line with the *strong* faultline hypothesis, we would expect this increased likeliness in subgroup divisions being present, in addition to the increased likelihood of free-riders being present in the group, to heighten the chances that participants will induce a fission. Future research should address the effects of group size on fission preference.

Popularity of the Fission Option

A limitation of the studies featured in Part II of this thesis was that participants were only given the option to either split or to take no action in the face of free-rider conflict. However, in real life individuals often have many options available to them if they are dissatisfied with the status quo. Thus in Experiments 5 and 6 we added extra structural solutions which could potentially solve the free-rider problem in the group and gave participants the chance to select which of these options they would prefer to enforce in future tasks. Thus based on the previous work of Samuelson (1995), we added the options to elect a leader, enforce equal privatisation, enforce a harvest cap, or to impose sanctions to the list of possible structural solutions for dealing with the free-rider problem. This allowed us to test how popular participants considered the fission option to be when other options were available. However, our results concerning the prevalence of the fission option were confusing. In Experiment 5, the results suggested that fission was more popular than other available options (with the exception of the harvest cap option) *if* the resource was easy to divide equally into two. The popularity of the fission option decreased however if the resource was difficult to divide. This seems to make inherent sense. However, these results were not repeated in Experiment 6, where fission was shown to be a fairly unpopular choice regardless of whether participants were in the easy or difficult to divide conditions. Thus, future research should address when individuals would prefer to fission (a relatively drastic option in comparison to other options) over other possible solutions.

Public Good Dilemmas versus Resource Dilemmas

Although this was not a manipulation as such it is also worth noting that our results in Part II of this thesis found support for the *weak* faultline hypothesis when participants were given a step-level public good dilemma task to complete, and in Part III we found some support for the *strong* faultline hypothesis where a resource dilemma task was employed. Although the other manipulations did not remain consistent throughout our studies in Part II and Part III, i.e., we added group size and resource division manipulations to the group faultline hypotheses in Part III, we can not eliminate the fact that the change in support for the faultline hypotheses may be (partially) due to the change in research paradigm. Future research should address this possibility.

When Is Fission Most Likely?

To summarise the findings of Experiments 1 – 6 in terms of when the fission option is most likely to be selected, we found support for the *weak* faultline hypothesis (in Experiments 2 – 4) when only a single diversity faultline (graduate status and attitudinal similarity) was used, when there was a free-rider conflict present in the group, and when a step-level public good dilemma comprised the task given to participants in order to induce the free-rider conflict.

In addition, we found some support for the *strong* faultline hypothesis (in Experiment 5) when a newcomer faultline was present in the group, when all participants were exposed to the free-rider problem, when we added a physical faultline (ease of resource division) to the faultline hypothesis and the resource was easy-to-divide, and when a resource dilemma was utilised in order to induce the free-rider problem. The implications of these findings are discussed later in the section on theoretical development.

Integration with Wider Research Area

Small group researchers have recently developed an interest in the dynamic processes underlying group performance and decision-making (Arrow, McGrath, & Berdahl, 2000; Kenrick et al., 2003; Vallacher, Read, & Novak, 2002). These studies on group fission reflect this interest. Our studies consider fission as a functional solution to the free-rider problem, which undermines the performance and satisfaction of groups. In addition, we have found some support for the suggestion that fissions do not occur randomly within a group, but occur along the dividing lines of subgroups. To use the metaphor of a plate: If a plate falls to the ground it may break, but where it breaks depends upon the internal structure of the plate.

Furthermore, our findings speak to an ongoing debate within the group dynamics field about the role of diversity (demographic, psychological, etc) within work teams. We have found mixed results regarding the effects of diversity on group stability. In contrast to what some organisational theorists suggest (Lau & Murnighan, 1998), our research in Part II shows that diversity by itself does not affect the likelihood of group members staying together. However, in our later studies, featured in Part III, we found supporting evidence that the presence of moderately diverse groups can indeed decrease group stability, subsequently making fission more likely, *if* the resource is easy-to-divide.

Finally, the studies reported here make a contribution to existing research on group processes and membership dynamics by specifying fission as an important example of a group transformation. This could be seen as a potential strength of our research. However, as discussed in Chapter One, the concept of group fission does not fit neatly into existing group development theories, for example, those by Tuckman (1965) or Worchel (1996). Including group fission as an example of a group transformation shows that groups that transform need not make a complete break from their past, that is, groups can transform into new systems at the end of their life-cycle. Instead of ending at a natural endpoint, some groups may undergo a radical transformation, such that group members may perceive it as a new group even though membership with the old group may be overlapping. Future group development theories should address this.

Limitations of the Research

Listed below are a number of limitations of the current research described in this thesis.

Incentives and Tangible Outcomes. The generalisability of our results could be considered limited to the extent that we used small incentives in our studies, and it is entirely possible that many of the contradictory results are due in part to participants being faced with outcomes that are trivial (Kollock, 1998). However, although this is perhaps especially true of our role-playing methodologies where there were no tangible outcomes associated with partaking in the study, it was encouraging to find that our results were often replicated when experimental studies were employed and monetary prizes were at stake.

The Methodology. A number of limitations of the methodology used in our experiments have already been discussed throughout the thesis, and as such we have tried to deal with them as the experiments progress. For example, in Experiments 1 – 4 participants were effectively forced to choose between one of two options; staying together or fission, which is not representative of individuals' available choices in real life situations. So, in Experiments 5 and 6, participants were given multiple solutions for dealing with the free-rider problem (equal privatisation, electing a leader, imposing sanctions, imposing a harvest cap).

Furthermore, the role-playing methodology in our earlier studies was criticised as it is subject to social desirability and self-presentational tendencies (Greenwood, 1985). However, the use of controlled laboratory experimentation in addition to the role-playing methodology, which provided complimentary findings, demonstrates the robustness of these findings.

In addition to the above criticisms of the methodology, there may also be some reservations concerning our main dependent measure. Participants could express their support for a fission through a vote. Although fissions can proceed in orderly ways, they are often characterised for being more chaotic, with individuals forming alliances to induce a change, the group resisting the pressure, until the group finally breaks up in acrimony (Dyck & Starke, 1999). To capture the richness of the fission process would require the use of interview, diary, and observational data of real interacting groups. However, because these studies may be lacking in internal validity, we think a combined approach, including controlled laboratory experimentation and role playing methodologies of the kind we presented in this thesis, is the best way forward at present. The experimental research offered here represents the first, necessary steps in addressing this relatively neglected research topic, and we believe that the level of control afforded in the laboratory is needed when (first) addressing causal issues. Nonetheless, the methodology used in these studies does limit testing a dynamic model of group fission, raising a number of interesting questions for future research. Eventually, field studies should be conducted in order to test the robustness of existing findings.

Lack of Interaction between Participants. A further limitation of our existing research is that although we have shown that fission is driven by free-rider conflict, participants in our studies were not given the opportunity to actually engage conflictually, because they did not interact. The participants in our studies never met face-to-face and all feedback in the laboratory studies was programmed by the experimenter. Although participants never raised any suspicions in our laboratory experiments that they were not actually engaging with others, this may be considered a criticism of this current work. In our defence, we wanted to be able to control for extraneous variables, bearing in mind that this particular research area is new and not well documented. However, we appreciate that in the privacy of one's own mind individuals can get on perfectly well with each other, regardless of how different they are from one another. The trouble develops in real life when individuals actually have to work with each other. Subsequent studies are necessary to see if and how the interactions of group members affect the fission process. In these studies participants should be given an opportunity to "consult" with other members of the group via simulated (computer-controlled) interaction to increase external validity. At the moment the lack of interaction implies that participants are still making an individual exit from the group.

Resource Division and Fairness Concerns. Our proposition that a participant's preference to fission when a resource is easy-to-divide is due to fairness concerns is just that, a postulation. Although it makes inherent sense that participants fission in the easy-to-divide condition because they received the lowest share of the resource and yet there was the possibility for all members to receive an equal share (whereas in the difficult-to-divide condition participants received the lowest share of the resource but restriction imposed by the physical layout of the resource prevented all members from receiving a fair share) we can provide no evidence to support this proposition. We failed to ask adequate manipulation questions concerning whether fairness concerns matter to participants. Although we did ask whether participants felt that they got a fair share of the resource we failed to ask whether they expected to get a fair share or how important it was to them to get a fair share (although this may be considered a demand characteristic).

Generalisability. Finally, in Chapter One we reviewed various real world examples of group fissions and identified two potential different causes of these group splits; intragroup conflict over ideological beliefs and opinion differences, and intragroup conflict caused by scarce resources. Our decision to focus on small task groups rather than large opinion groups naturally limits the generalisability of our results, however, previous research had begun to examine fissions within ideological groups (Sani & Reicher, 1998, 1999, 2000; Dyck & Starke, 1999) whilst research specifically regarding fissions and free-rider conflict was yet to be explored. Work groups exist to complete certain projects, which they can achieve more efficiently if they manage to solve the free-rider problem (Arrow et al., 2000; Levine & Thompson, 1996; Komorita & Parks, 1994). In opinion groups, such as political parties or church groups, free-riding is arguably a matter of less concern. We should expect fissions within these organisations to occur primarily because of conflicts over key opinions that are dividing the group (e.g., the ordainment of women priests in the Church of England; Sani & Reicher, 2000; Sani & Todman, 2002). But, insofar as there are subgroups present within these opinion groups, whose boundaries correspond to those of the opinion conflict we may find that group faultlines act in the same way as they did in Experiments 2 - 4, thus splitting the community along pre-existing subgroups so that the breakaway groups contain similar others. Whether the pathways leading to fission in opinion groups as opposed to task groups are the same remains to be seen. It is quite possible that the dynamics may be based on different factors.

In sum, we acknowledge that the free-rider problem is just one reason why a fission occurs and that there are many other reasons, including opinion conflicts, status differences, and power struggles, that may contribute to a fission which need to be investigated in future research.

Future Research

Throughout this discussion we have already highlighted certain aspects of our studies which could be developed and improved with subsequent research. In addition, this current research has also raised further considerations which could offer promising outlets for future research.

Taxonomy of Fissions. Our fission definition encompasses two seemingly different forms of exiting behaviour (forming new groups and joining existing groups) under the umbrella term fission, despite their obvious differences in intragroup and intergroup relations. The reasons for this being that both forms of exit involve a subgroup of members making a concerted effort to leave the parent group. Our current interests in fission lie in the processes by which the fission phenomenon occurs (what risk factors promote group fission) rather than the outcomes (what happens to the breakaway groups after they split). However, the research presented in this thesis has narrowly focused on the creation of two entirely new groups. How the fission process is affected when two or more individuals, in conjunction, leave their group to join an existing group remains to be seen and should be addressed in future research. On the one hand, the presence of alternative groups might make it easier for individuals to collectively exit the group (Moreland & Levine, 1982). On the other hand, attractive alternatives may decrease the likelihood of a fission, because individuals can pursue their goals through individual efforts rather than a subgroup effort.

Size of Subgroups. Groups with unequal subgroup size may have strikingly different group dynamics than groups whose subgroups are equal (Lau & Murnighan, 1998). In the current studies we created subgroups of equal size and power to increase the chance that subgroups would be more likely to experience polarisation (Lau & Murnighan, 1998). Equal size and status groups have equal opportunities to voice opinions, which is often not the case with majority and minority groups. This in turn can make negotiating and reaching consensus more difficult as both subgroups have equal status, and as a result it is predicted that these subgroups will perceive themselves as two separate entities rather than part of one group. However the proportions of subgroup members is a variable that probably affects the salience of the faultline and thus it may be interesting to vary these proportions in the future and examine the effects that majority and minority influence may have on the fission process.

Possible Risk Factors. We have examined a number of potential risk factors that may promote fission throughout this thesis, including free-rider conflict, diversity faultlines (gender, graduate status, attitude similarity, and newcomers entering the group), physical faultlines (ease of resource division) and group size. However, these studies have only just scratched the surface of identifying the possible antecedents of fission. Further risk factors and protective factors need to be identified. For example, other possible factors to consider include how a change in leadership may create a new faultline as it may divide the group into supporters of the old regime and new regime. As an example, many historians saw the death of Marshal Tito as the main catalyst for the break-up of Yugoslavia in the 1990s. Furthermore, internal and external group factors may inhibit the activation of faultlines leading to fission. For example, an abundance of group resources may decrease the urgency to tackle free-riding. Finally, the proximity of a strong, rival group may undermine a fission as the perception of this common threat may make subgroup divisions less salient (Wit & Kerr, 2002).

Theoretical Development

In developing the theory of group fission further, we should focus not only on what sets a fission apart from other types of group transformations, but also study different types of group fission, for example, fission when a subgroup of individuals leaves the parent group to join an existing group rather than forming a new group, and fissions that arise as a result of intragroup conflict other than free-riding, such as power and status struggles or conflict of opinions. In addition, it is important to identify the major similarities and differences among instances of group fission.

As previously identified as a target for future research, the theory of group fission should also provide a more exhaustive and comprehensive account of the range of risk and possible protective factors leading a group towards or away from fission. This knowledge would allow groups to structure themselves in such a way that fission would be unlikely, thus preventing the emotional and financial damage that fission can produce and the possible demise of the original group that is left behind after the subgroup of members depart. Once a comprehensive list of vulnerabilities has been established, it will be necessary to discuss how these forces are likely to interact and how this relates to different types of, or pathways toward fission. As shown from our own results, the addition of a physical faultline (ease of resource division) in Experiment 5 moderated the effect of the diversity faultline (newcomers/old-timers), such that groups were more likely to split if newcomers were present in the group *but* only if they were also in the easy-to-divide condition. Although the presence of faultlines in Experiments 1 – 4 did not actually magnify the impact of the free-rider conflict to make fission more likely, the presence of faultlines in Experiment 5 was a factor that decreased the stability of the group and thus increased fission preference via the ease of resource division manipulation. Thus, it was the interaction of resource division and the newcomer faultline being present in the group that allowed the *strong* faultline hypothesis to prevail. These interactions will need to be further examined to find which alignment of potential risk factors makes fission most likely.

Finally, it is essential to consider what other aspects of groups (composition, context, etc) might substantially modify the likelihood of fission or particular pathways toward or away from fission as an outcome, and tie these factors logically to the (hypothesised) causal forces involved.

This theory of group fission would allow us to place fission within the broader context of membership dynamics as part of the ongoing pattern of change and continuity in a group system.

Final Conclusions

Borrowing terminology from nuclear physics and geology, we introduced the concepts of group fissions and diversity faultlines to the study of membership dynamics and transformations in small social dilemma groups. In this thesis, we found that group fissions – the departure of two or more members from an original group – can be initiated by a free-rider conflict, and that diversity faultlines – salient subgroup divisions within the original groups – can both determine the composition of the exit groups whilst playing no part in determining whether a fission will ensue, as well as magnifying the impact of free-rider conflict to make fission more likely. Furthermore, the importance of a physical faultline – ease of resource division – was demonstrated as a moderating factor in the fission process. When all else is equal, individuals strive for equivalent outcomes, thus a resource that can be easily divided into equal parts will push individuals towards fission whereas a resource that can not be divided into equal parts will push individuals away from fission. Further research into the underlying causes and consequences of group fissions, as one particular type of group transformation, is needed to enhance our knowledge about the flexibility of human social organisations.

References

Allison, S. T., & Messick, D. M. (1990). Social decision heuristics in the use of shared resources. *Journal of Behavioral Decision Making, 3,* 195-204.

Andreoni, J., Brown, P. M., & Vesterlund, L. (2002). What makes an allocation fair? Some experimental evidence. *Games and Economic Behavior, 40*, 1-24.

Arrow, H., & McGrath, J. E. (1995). Membership dynamics in groups at work: A theoretical framework. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 17, pp. 373-411). Greenwich, CT: JAI.

Arrow, H., McGrath, J. E., & Berdahl, J. L. (2000). *Small groups as complex systems. Formation, coordination, development, and adaptation.* London: Sage Publications, Inc.

Axelrod, R. (1984). *The evolution of cooperation.* New York: Basic Books.

Balser, D. B. (1997). The impact of environmental factors on factionalism and schism in social movement organizations. *Social Forces, 76,* 199-228.

Barkow, J. H., Cosmides, L., & Tooby, J. (1992). *The adapted mind: Evolutionary psychology and the generation of culture.* Oxford: Oxford University Press.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(*6*), 1173-1182.

Barrett, L., Dunbar, R., & Lycett, J. (2002). *Human evolutionary psychology.* UK: Palgrave.

Batson, C. D., Duncan, B. D., Ackerman, P., Buckley, T., & Birch, K. (1981). Is empathic emotion a source of altruistic motivation? *Journal of Personality and Social Psychology, 40,* 290-302.

Bezrukova, K., Jehn, K., & Zanutto, E. (2003). *A field study of group faultlines, team identity, conflict, and performance in organizational groups.* Unpublished manuscript.

Bond, M. H., & Shiu, W. Y. F. (1997). The relationship between a group's personality resources and the two dimensions of its group process. *Small Group Research, 28(2),* 194-217.

Bookman, M. Z. (1994). War and peace: The divergent breakups of Yugoslavia and Czechoslovakia. *Journal of Peace Research, 31,* 175-187.

Bornstein, G. (1992). The free-rider problem in intergroup conflicts over step-level and continuous public goods. *Journal of Personality and Social Psychology, 62(4),* 597-606.

Brewer, M. B. (1981). Ethnocentrism and its role in interpersonal trust. In M. B. Brewer, & B. E. Collins (Eds.), *Scientific inquiry and the social sciences.* New York: Jossey-Bass.

Brewer, M. B., & Brown, R. J. (1998). Intergroup relations. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (Vol. 2, pp. 554-594). Boston, MA: McGraw-Hill.

Brosnan, S. F., & De Waal, F. B. M. (2003). Monkeys reject unequal pay. *Nature, 425,* 297-299.

Brown, R., Condor, S., Mathews, A., Wade, G., & Williams, J. (1986). Explaining intergroup differentiation in an industrial organization. *Journal of Occupational Psychology, 59,* 273-286.

Brown, W. M., & Moore, C. (2000). Is prospective altruist-detection an evolved solution to the adaptive problem of subtle cheating in cooperative ventures? Supportive evidence using the Watson selection task. *Evolution and Human Behavior, 21,* 25-38.

Bukowski, W. M., Sippola, L. K., & Newcomb, A. F. (2000). Variations in patterns of attraction to same- and other-sex peers during early adolescence. *Developmental Psychology, 36(2),* 147-154.

Buss, D. M. (1999). *Evolutionary psychology: The new science of the mind.* Boston: Allyn and Bacon.

Byrne, D. (1971). *The attraction paradigm.* New York: Academic Press.

Byrne, D., & Griffith, W. (1973). Interpersonal attraction. *Annual Review of Psychology,* 317-336.

Camerer, C. F. (2003). Behavioural studies of strategic thinking in games. *Trends in Cognitive Sciences, 7(5),* 225-231.

Campbell, D. T. (1965). Ethnocentric and other altruistic motives. In D. Levine (Ed.), *Nebraska symposium on motivation* (pp. 283-311). Lincoln, NE: University of Nebraska Press.

Cartwright, D., & Zander, A. (1953). *Group dynamics.* New York: Row, Peterson, and Company.

Charlton, B. G. (1997). The inequity of inequality: Egalitarian instincts and evolutionary psychology. *Journal of Health Psychology, 2,* 413-425.

Chen, X., & Komorita, S. (1994). The effects of communication and commitment in a public goods social dilemma. *Organizational Behavior and Human Decision Processes, 60,* 367-386.

Comer, D. (1995). A model of social loafing in real work groups. *Human Relations, 48(6),* 647-667.

Cosmides, L., & Tooby, J. (1992). Cognitive adaptations for social exchange. In J. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind* (pp. 163-228). New York: Oxford University Press.

Dawes, R. M. (1980). Social dilemmas. *Annual Review of Psychology, 31,* 169-193.

De Cremer, D., Snyder, M., & Dewitte, S. (2001). 'The less I trust, the less I contribute (or not)?' The effects of trust, accountability and self-monitoring in social dilemmas. *European Journal of Social Psychology, 31,* 93-107.

De Cremer, D., & Van Dijk, E. (2002). Perceived criticality and contributions in public good dilemmas: A matter of feeling responsible to all? *Group Processes and Intergroup Relations, 5(4)*, 319-332.

De Cremer, D., & Van Vugt, M. (1999). Social identification effects in social dilemmas: A transformation of motives. *European Journal of Social Psychology, 29*, 871- 893.

Dyck, B. (1997). Exploring organizational family trees: A multi-generational approach for studying organizational births. *Journal of Management Inquiry, 6,* 222-233.

Dyck, B., & Starke, F. A. (1999). The formation of breakaway organizations: Observations and a process model. *Administrative Science Quarterly, 44,* 792-822.

Ellemers, N., Spears, R., & Doosje, B. (1997). Sticking together or falling apart: Ingroup identification as a psychological determinant of group commitment versus individual mobility. *Journal of Personality and Social Psychology, 72(3),* 617-626.

Fehr, E., & Fischbacher, U. (2003). The nature of human altruism. *Nature, 425,* 785-791.

Fehr, E., & Gachter, S. (2002). Altruistic punishment in humans. *Nature, 415,* 137-140.

Fox, J., & Guyer, M. (1978). Public choice and cooperation in an n-person Prisoner's dilemma. *Journal of Conflict Resolution, 22,* 469-481.

Gaertner, L., & Insko, C. A. (2000). Intergroup discrimination in the minimal group paradigm: Categorization, reciprocation, or fear? *Journal of Personality and Social Psychology, 79(1),* 77-94.

Greenwood, J. (1983). Role-playing as an experimental strategy in social psychology. *European Journal of Social Psychology, 13(3),* 235-254.

Hamburger, H., Guyer, M., & Fox, J. (1975). Group size and cooperation. *Journal of Conflict Resolution*, *19(3),* 503-531.

Handgraaf, M. J. J., Van Dijk, E., Wilke, H. A. M., & Vermunt, R. C. (2004). Evaluability of outcomes in ultimatum bargaining. *Organizational Behavior and Human Decision Processes, 95,* 97-106.

Hardin, G. (1968). The tragedy of the commons. *Science, 162,* 1243-1248.

Hogg, M., & Tindale, R. S. (2001). *Group processes.* London: Blackwell Publishers.

Hornsey, M. J., & Hogg, M. A. (2000). Assimilation and diversity: An integrative model of subgroup relations. *Personality and Social Psychology Review, 4,* 143-156.

Jackson, S. E., Brett, J. F., Sessa, V. I., Cooper, D. M., Julin, J. A., & Peyronnin, K. (1991). Some differences make a difference: Individual dissimilarity and group heterogeneity as correlates of recruitment, promotion, and turnover. *Journal of Applied Psychology, 76*, 675-89.

Jetten, J., O' Brien, A., & Trindall, N. (2002). Changing identity: Predicting adjustment to organizational restructure as a function of subgroup and superordinate identification. *British Journal of Social Psychology, 41,* 281-297.

Kelly, R. L. (1995). *The foraging spectrum: Diversity in hunter-gatherer lifeways.* Washington, D. C.: Smithsonian Institutional Press.

Kenrick, D. T., Li, N. P., & Butner, J. (2003). Dynamical evolutionary psychology: Individual decision rules and emergent social norms. *Psychological Review, 110,* 3-28.

Kerr, N. (1989). Illusions of efficacy: The effects of group size on perceived efficacy in social dilemmas. *Journal of Experimental Social Psychology, 25(4),* 287-313.

Kerr, N. L. (1999). Anonymity and social control in social dilemmas. In M. Foddy, M. Smithson, S. Schneider, & M. A. Hogg (Eds.), *Resolving social dilemmas* (pp. 103-120). Philadelphia: Psychology Press.

Kerr, N. L., & Bruun, S. E. (1983). Dispensability of member effort and group motivation losses: Free-rider effects. *Journal of Personality and Social Psychology, 44(1),* 78-94.

Kollock, P. (1998). Social dilemmas: The anatomy of cooperation. *Annual Review of*

Sociology, 24, 183-241.

Komorita, S. S., & Chertkoff, J. M. (1973). A bargaining theory of coalition formation. *Psychological Review, 80,* 149-162.

Komorita, S. S., & Lapworth, C. W. (1982). Cooperative choice among individuals versus groups in an n-person dilemma situation. *Journal of Personality and Social Psychology, 42(3),* 487-496.

Komorita, S. S., & Parks, C. D. (1994). *Social dilemmas.* Dubuuque, IA: Brown & Benchmark.

Komorita, S. S., Parks, C. D., & Hulbert, L. G. (1992). Reciprocity and the induction of cooperation in social dilemmas. *Journal of Personality and Social Psychology, 62(4),* 607.

Kopelman, S., Weber, M., & Messick, D. M. (2002). Factors influencing cooperation in commons dilemmas: A review of experimental psychological research. In E. Ostrom, T. Dietz, N. Dolsak, P. C. Stern, S. Stonich, & E. U. Weber (Eds.), *The drama of the commons* (pp. 113-156). Washington DC: National Academy Press.

Kramer, R. M. (1991). Intergroup relations and organizational dilemmas: The role of categorization processes. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 13, pp. 191-227). Greenwich, CT: JAI.

Kramer, R. M. (1993). Cooperation and organizational identification. In J. K. Murnighan (Ed.), *Social psychology of organizations: Advances in theory and research* (pp. 244-268). Englewood Cliffs, NJ: Prentice Hall.

Kramer, R. M., & Brewer, M. B. (1984). Effects of group identity on resource use in a simulated commons dilemma. *Journal of Personality and Social Psychology, 46,* 1044-1057.

Lau, D. C., & Murninghan, J. K. (1998). Demographic diversity and faultlines: The compositional dynamics of organizational groups. *Academy of Management Review, 23,* 325-340.

Lau, D. C., & Murnighan, J. K. (in press). Interactions within groups and subgroups: The effects of demographic faultlines. *Academy of Management Journal.*

Lee, R. B., & Daly, R. (1999). Foragers and others. In R. B. Lee, & R. Daly (Eds.), *The Cambridge encyclopedia of hunters and gatherers* (pp. 1-19). Cambridge: Cambridge University Press.

Levi, D. (2001). *Group dynamics for teams.* USA: Sage Publications, Ltd.

Levine, J. M., & Moreland, R. L. (1990). Progress in small group research. *Annual*

Review of Psychology, 41, 585-634.

Levine, J. M., & Thompson, L. (1996). Conflict in groups. In E. Tory Higgins, & A. W. Kruglanski (Eds.), *Social psychology:Handbook of basic principles* (pp. 745-776). New York: Guildford Press.

Liebrand, W. B. (1984). The effect of social motives, communication and group size on behaviour in an N-person multi-stage mixed-motive game. *European Journal of Social Psychology, 14(3),* 239-264.

Macromedia Authorware 5.1 [computer software] (2000). San Francisco, CA: Macromedia, Inc.

Marwell, G. & Schmitt, D. R. (1972). Cooperation in a three-person Prisoner's Dilemma. *Journal of Personality and Social Psychology, 21(3),* 376-383.

Messick, D. M., & Brewer, M. B. (1983). Solving social dilemmas: A review. In L. Wheeler, & P. Shaver (Eds.), *Review of personality and social psychology* (Vol. 4, pp. 11- 44). Beverly Hills, CA: Sage.

Messick, D. M., Wilke, H., Brewer, M. B., Kramer, R. M., Zemke, P. E., & Lui, L. (1983). Individual adaptations and structural change as solutions to social dilemmas. *Journal of Personality and Social Psychology, 44,* 294-309.

Moreland, R. L. (1987). The formation of small groups. In C. Hendrick (Ed.), *Review of personality and social psychology* (Vol. 8, pp. 80-110). Newbury Park, CA.: Sage.

Moreland, R. L., & Levine, J. M. (1982). Socialization in small groups: Temporal changes in individual-group relations. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 15, pp. 137-192). New York: Academic Press.

Moreland, R. L., & Levine, J. M. (1992). The composition of small groups. In E. Lawler, B. Markovsky, C. Ridgeway, & H. Walker (Eds.), *Advances in group processes* (Vol. 9, pp. 237-280). Greenwich, CT: JAI Press.

Moreland, R. L., & Levine, J. M. (2001). Socialization in organizations and work groups. In M. Turner (Ed.), *Groups at work: Theory and research* (pp. 69-112). Mahwah, NJ: Erlbaum.

Moreland, R. L., Levine, J. M., & Wingert, M. L. (1996). Creating the ideal group: Group composition effects at work. In E. Witte, & J. David (Eds.), *Understanding group behavior* (Vol. 2, pp. 11-35). Hillsdale, NJ: Lawrence Erlbaum.

Murnighan, J. K. & Brass, D. J. (1991). Intraorganizational coalitions. In M. H.

Bazerman, R. J. Lewicki, & B. H. Sheppard (Eds.), *Research on Negotiations in Organizations*, Vol. 3. Greenwich, CT: JAI Press.

Newcomb, T. (1961). *The acquaintance process.* New York: Holt, Rinehart, & Winston.

Neyer, F. J., & Lang, F. R. (2003). Blood is thicker than water: Kinship orientation across adulthood. *Journal of Personality and Social Psychology, 84,* 310-321.

Oakes, P. (1987). The salience of social categories. In J. Turner (Ed.), *Rediscovering the social group: A self-categorization theory.* New York: Basil Blackwell.

Pondy, L. R. (1967). Organizational conflict: Concepts and models. *Administrative Science Quarterly, 12,* 296-320.

Prislin, R. (2003). Personal communication. 2 September 2003.

Rapoport, A. (1988). Provision of step-level public goods: Effects of inequality in resources. *Journal of Personality and Social Psychology, 54,* 432-440.

Rusbult, C. E., & Farrell, D. (1983). A longitudinal test of the investment model: The impact on job satisfaction, job commitment, and turnover of variations in rewards, costs, alternatives, and investments. *Journal of Applied Psychology, 68,* 429-438.

Samuelson, C. D. (1993). A multiattribute evaluation approach to structural change in resource dilemmas. *Organizational Behavior and Human Decision Processes, 55,* 298-324.

Samuelson, C. D., & Allison, S. T. (1994). Cognitive factors affecting the use of social decision heuristics in resource-sharing tasks. *Organizational Behaviour and Human Decision Processes, 58(1),* 1-27.

Samuelson, C. D., & Messick, D. M. (1995). When do people want to change the rules for allocating shared resources? In D. Schroeder (Ed.), *Social dilemmas. Perspectives on individuals and groups* (pp.143-162). New York: Praeger Publications.

Sani, F., & Reicher, S. (1998). When consensus fails: An analysis of the schism within the Italian Communist party (1991). *European Journal of Social Psychology, 28,* 623-645.

Sani, F., & Reicher, S. (1999). Identity, argument and schism: Two longitudinal studies of the split in the Church of England over the ordination of women priests. *Group Processes and Intergroup Relations, 2,* 279-300.

Sani, F., & Reicher, S. (2000). Contested identities and schisms in groups: Opposing the ordination of women as priests in the Church of England. *British Journal of*

Social Psychology, 39, 95-112.

Sani, F., & Todman, J. (2002). Should we stay or should we go? A social psychological model of schisms in groups. *Personality and Social Psychology Bulletin, 28,* 1647-1655.

Schroeder, D. (1995). *Social dilemmas. Perspectives on individuals and groups.* New York: Praeger.

Shankar, A., & Parvitt, C. (2002). Resource and public good dilemmas: A new issue for communication research. *The Review of Communication, 2(3),* 251-272.

Stryker, S. (1980). *Symbolic interactionism: A social structural version.* Menlo Park: Benjamin Cummings.

Tajfel, H., & Turner, J. C. (1986). The social identity theory of intergroup behavior. In S. Worchel, & W. Austin (Eds.) *Psychology of intergroup relations* (pp. 7-24). Chicago: Nelson-Hall.

Thatcher, S. M. B., Jehn, K. A., & Zanutto, E. (2003). Cracks in diversity research: The effects of diversity faultlines on conflict and performance. *Group Decision and Negotiation, 12(3),* 217-241.

Trivers, R. L. (1971). The evolution of reciprocal altruism. *Quarterly Review of Biology, 46,* 35-57.

Tuckman, B. W. (1965). Development sequence in small groups. *Psychological Bulletin, 63(6),* 384-399.

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., & Wetherell, M. (1987). *Rediscovering the social group: A self-categorization theory.* Oxford, England: Blackwell.

Vallacher, R. R., Read, S. J., & Nowak, A. (2002). The dynamical perspective in personality and social psychology. *Personality and Social Psychology Review, 6,* 264-273.

Van Beest, I., Van Dijk, E., & Wilke, H. (2004). Resources and alternatives in coalition formation: The effects on payoff, self-serving behaviour, and bargaining length. *European Journal of Social Psychology, 34,* 713-728.

Van Beest, I., Wilke, H., & Van Dijk, E. (2003). The excluded player on coalition formation. *Personality and Social Psychology Bulletin, 29(2),* 237-247.

Van de Kragt, A. J. C., Dawes, R. M., Orbell, J. M., Braver, S. R., & Wilson, L. A. (1986). Doing well and doing good as ways of resolving social dilemmas. In H. Wilke, D. Messick, & C. Rutte (Eds.), *Experimental social dilemmas* (pp. 177-

202). Frankfurt/Main, Germany: Lang GmbH.

Van Dijk, E., De Cremer, D., & Handgraaf, M. J. J. (2004). Social value orientations and the strategic use of fairness in ultimatum bargaining. *Journal of Experimental Social Psychology, 40,* 697-707.

Van Dijk, E., & Vermunt, R. (2000). Strategy and fairness in social decision making: Sometimes it pays to be powerless. *Journal of Experimental Social Psychology, 36,* 1-25.

Van Dijk, E., & Wilke, H. (1995). Coordination rules in asymmetric social dilemmas: A comparison between public good dilemmas and resource dilemmas. *Journal of Experimental Social Psychology, 31*, 1-27.

Van Knippenberg, D., Van Knippenberg, B., Monden, L., & De Lima, F. (2003). Organizational identification after a merger: A social identity perspective. *British Journal of Social Psychology, 41,* 233-252.

Van Vugt, M. (1998). The conflicts in modern society. *The Psychologist, 6,* 289-292.

Van Vugt, M. (2002). Central, individual or collective control? Social dilemma strategies for natural resource management. *American Behavioral Scientist, 45,* 783-800.

Van Vugt, M., & Hart, C. (2004). Social identity as social glue: Fostering loyalty and stability in groups. *Journal of Personality and Social Psychology, 86,* 585-598.

Van Vugt, M., Jepson, S., Hart, C., & De Cremer, D. (2004). Autocratic leadership in social dilemmas: A threat to group stability. *Journal of Experimental Social Psychology, 40,* 1-13.

Van Vugt, M., Schaller, M., & Park, J. (2005). *Kinship cues as a basis for prosocial behaviour in groups: Heuristic causes and consequences of familiarity.* Unpublished manuscript.

Van Vugt, M., Snyder, M., Tyler, T., & Biel A. (2000). *Cooperation in modern society:Promoting the welfare of communities, states, and organizations.* London, UK: Routledge.

Wilke, H. A. M. (1996). Status congruence in small groups. In E. Witte, & J. H. Davis (Eds.), *Understanding group behavior* (Volume 2, pp. 67-91), Mahwah, NJ: Erlbaum.

Wilson, E. O. (1975). *Sociobiology: The new synthesis*. Cambridge: Harvard University Press.

Wit, A. F., & Kerr, N. L. (2002). Me versus just us versus us all: Categorization and cooperation in nested social dilemmas. *Journal of Personality and Social Psychology, 83,* 616-637.

Worchel, S. (1996). Emphasizing the social nature of groups in a developmental framework. In J. L. Nye, & A. M. Brower (Eds.), *What's social about social cognition? Research on socially shared cognition in small groups* (pp. 261-282). Thousand Oaks, CA: Sage.

Wright, S. C., Taylor, D. M., & Moghaddam, F. M. (1990). Responding to membership in a disadvantaged group: From acceptance to collective protest. *Journal of Personality and Social Psychology, 58(6),* 994-1003.

Yamagishi, T. (1986). The structural goal/expectation theory of cooperation in social dilemmas. In E. Lawler (Ed.), *Advances in group processes* (Vol. 3, pp. 51–87). Greenwich, CT: JAI Press.

Yzerbyt, V., Castano, E., Leyens, J. –Ph., & Paladino, P. (2000). The primacy of the ingroup: The interplay of entitativity and identification. In W. Stroebe & M. Hewstone (Eds.), *European Review of Social Psychology* (Vol. 11, pp. 257-295). Chichester, UK: Wiley.

APPENDICES

Appendix 1: Example of Study 1 Scenarios and Questionnaire

SCENARIO: (Conflict, subgroup condition)

Background:

You live in a student house with two girls and three boys: Emma, Sarah, Daniel, Ben, and David.

Situation:

It was decided when you first moved into the student house that there should be a rota for cooking because the kitchen in the shared house is quite small and it would be too difficult for six people to try and cook individually. However, the cooking arrangements are starting to cause some **dissatisfaction** in the house! Different housemates keep trying to get out of preparing the dinner when the rota says that it is their turn to cook. There is also ill-feeling among the group as some housemates don't get back until late due to certain activities and there are mixed feelings about whether everyone should wait for them to get back to enable everyone to eat together. Furthermore, it is difficult trying to find a meal that everyone enjoys as some of the housemates are very fussy about what they eat and on a student budget it is too expensive to cook lots of different meals. This arrangement is clearly causing frustration and arguments among the group.

What next?

You have decided to hold a house meeting where you plan to discuss whether you think the rota is a good idea for the house. All the girls, Emma, Sarah, and yourself, and the boys, Daniel, Ben, and David will be present - so you can all have your say.

A suggestion .....

During the meeting one of the housemates suggested splitting up into two smaller groups of three to do the cooking. You have decided to take a vote on this.

I would now like to know your initial reaction to the scenario you have just read. Please complete the following questionnaire. Please do not hesitate too long about each question as I am interested in your first reaction.

SCENARIO: (Conflict, no-subgroup condition)

Background:

You live in a student house with five other girls: Emma, Sarah, Rebecca, Catherine, and Rachel.

Situation:

It was decided when you first moved into the student house that there should be a rota for cooking because the kitchen in the shared house is quite small and it would be too difficult for six people to try and cook individually. However, the cooking arrangements are starting to cause some **dissatisfaction** in the house! Different housemates keep trying to get out of preparing the dinner when the rota says that it is their turn to cook. There is also ill-feeling among the group as some housemates don't get back until late due to certain activities and there are mixed feelings about whether everyone should wait for them to get back to enable everyone to eat together. Furthermore, it is difficult trying to find a meal that everyone enjoys as some of the housemates are very fussy about what they eat and on a student budget it is too expensive to cook lots of different meals. This arrangement is clearly causing frustration and arguments among the group.

What next?

You have decided to hold a house meeting where you plan to discuss whether you think the rota is a good idea for the house. All the girls will be present – Emma, Sarah, Rebecca, Catherine, Rachel, and yourself so you can all have your say.

A suggestion .....

During the meeting one of the housemates suggested splitting up into two smaller groups of three to do the cooking. You have decided to take a vote on this.

I would now like to know your initial reaction to the scenario you have just read. Please complete the following questionnaire. Please do not hesitate too long about each question as I am interested in your first reaction.

SCENARIO: (No-conflict, no-subgroup condition)

Background:

You live in a student house with five other girls: Emma, Sarah, Rebecca, Catherine, and Rachel.

Situation:

It was decided when you first moved into the student house that there should be a rota for cooking because the kitchen in the shared house is quite small and it would be too difficult for six people to try and cook individually. So far, the rota seems to be working quite smoothly and if one of the housemates knows that they will not be available to cook on the day specified on the rota they have made alternative arrangements to swap with those housemates who can. All of your housemates, including yourself, seem **satisfied** with the current arrangements.

What next?

You have decided to hold a house meeting where you plan to discuss whether you think the rota is a good idea for the house. All the girls will be present – Emma, Sarah, Rebecca, Catherine, Rachel, and yourself, so you can all have your say.

A suggestion .....

During the meeting one of the housemates suggested splitting up into two smaller groups of three to do the cooking. You have decided to take a vote on this.

I would now like to know your initial reaction to the scenario you have just read. Please complete the following questionnaire. Please do not hesitate too long about each question as I am interested in your first reaction.

SCENARIO: (No-conflict, subgroup condition)

Background:

You live in a student house with two girls and three boys: Emma, Sarah, Daniel, Ben, and David.

Situation:

It was decided when you first moved into the student house that there should be a rota for cooking because the kitchen in the shared house is quite small and it would be too difficult for six people to try and cook individually. So far, the rota seems to be working quite smoothly and if one of the housemates knows that they will not be available to cook on the day specified on the rota they have made alternative arrangements to swap with those housemates who can. All of your housemates, including yourself, seem **satisfied** with the current arrangements.

What next?

You have decided to hold a house meeting where you plan to discuss whether you think the rota is a good idea for the house. All the girls, Emma, Sarah, and yourself, and the boys, Daniel, Ben, and David will all be present - so you can all have your say.

A suggestion .....

During the meeting one of the housemates suggested splitting up into two smaller groups of three to do the cooking. You have decided to take a vote on this.

I would now like to know your initial reaction to the scenario you have just read. Please complete the following questionnaire. Please do not hesitate too long about each question as I am interested in your first reaction.

Please remember:

- ***You live in a house with two girls and three boys: Emma, Sarah, Daniel, Ben, and David.***
- ***You have a cooking rota in your house.***
- ***These cooking arrangements seem to be working quite efficiently.***

Would you prefer changing the cooking arrangements so that you are split into two groups of three?

1 2 3 4 5 6 7

Not at all Very much so

Would you prefer leaving the cooking arrangements as they are, i.e., stay in a group of six?

1 2 3 4 5 6 7

Not at all Very much so

What would you prefer most: leave the cooking arrangements as they are and remain as a group of six, or split into two smaller groups of three?

1 2 3 4 5 6 7

Stay in group of six Split into smaller groups

Please now make a decision: (please tick)

☐ cook in current group

☐ split into smaller groups

Suppose the outcome of the discussion is that the house decides to split into smaller groups. You now have the choice of whom you wish to cook with. Please indicate your preference for each of the following people with whom you would like to form the new cooking group:

Emma

1 2 3 4 5 6 7

Very weak preference — Very strong preference

Sarah

1 2 3 4 5 6 7

Very weak preference — Very strong preference

Daniel

1 2 3 4 5 6 7

Very weak preference — Very strong preference

Ben

1 2 3 4 5 6 7

Very weak preference — Very strong preference

David

1 2 3 4 5 6 7

Very weak preference — Very strong preference

Please now rank the names (Emma, Sarah, Daniel, Ben, and David) in the order of preference of liking, with 1 being most favoured and 5 being least favoured:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

Please now choose any two housemates to become part of a smaller cooking group with: (Emma, Sarah, Daniel, Ben, David).

1st housemate: ______________________

2nd housemate: ______________________

Please explain why you have chosen these two housemates:

____

____

____

____

We are interested in the reasons why people would want to form a smaller cooking group and have put these possible reasons into a series of statements. Please indicate your preferences for the following statements:

It would be attractive to split the cooking arrangements into two smaller groups of three

1	2	3	4	5	6	7
Very strongly Disagree						Very strongly agree

It would be nicer to cook with a smaller group

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

It would be selfish to form a group of three to suit my needs

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

It would be more efficient to cook in smaller groups

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

Splitting into smaller groups would affect relations between housemates

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

Splitting into smaller groups would make it easier to please everyone

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

It would be more practical to split into smaller groups

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

Splitting into smaller groups would allow me to have more freedom in making decisions about cooking

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

I am committed to **all** of my housemates

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

I share similarities with the two people I have named to form a smaller cooking group with

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

I feel I have more in common with the two people I have named to form a smaller cooking group with than the rest of my housemates

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

I feel connected to the two people I have named to form a smaller cooking group with

1 2 3 4 5 6 7

Very strongly Disagree — Very strongly agree

Please state here any other reasons why you might like to form a smaller cooking group:

___

___

___

___

___

A quick check:

While reading the scenario how satisfied were you with the current rota situation in the house?

1 2 3 4 5 6 7

Not at all Very satisfied

Please recall from the scenarios, how many other females did you share the house with? ___

How many males did you share the house with? ___

And finally, some questions about you:

How old are you? ___

Do you/Have you live(d) in shared student accommodation?

□ Yes, still do

□ Yes, have done in the past

□ No, never

If you answered yes, still do or yes, have done in the past to the above question, with how many other people did you live?

___

Is/was the household made up of:

- ☐ All girls
- ☐ All boys
- ☐ Both girls and boys

Have you had any personal experiences with cooking rotas in your student household?

- ☐ Yes
- ☐ No

If yes, could you briefly describe whether or not this was successful:

____

____

____

____

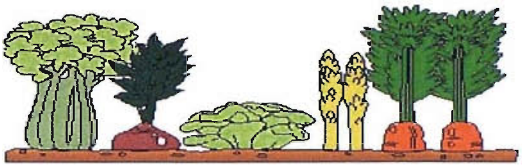
____

Are you close friends/related to anyone with the names: (please tick)

- ☐ Emma
- ☐ Sarah
- ☐ Daniel
- ☐ Ben
- ☐ David

Thank you for your participation!

Appendix 2: Example of Study 5 Scenario and Questionnaire (group size 4, no-subgroup, easy-to-divide resource condition first)



Vegetable Patch Study

Thank you for volunteering to participate in this study. Before we commence with the actual study, I would appreciate it if you could just provide us with the following details:

Age: ____________

Gender: _____________

The Task:

You will be asked to read **two** very similar scenarios in which you will have to imagine yourself and other people sharing a plot of land on an allotment. Please read each scenario carefully and then fill in the accompanying questionnaire before moving on to the next scenario.

Please read each scenario carefully and answer the questionnaire basing your answers on the scenario you have just read.

When you have finished reading this please turnover the page and read the first scenario.

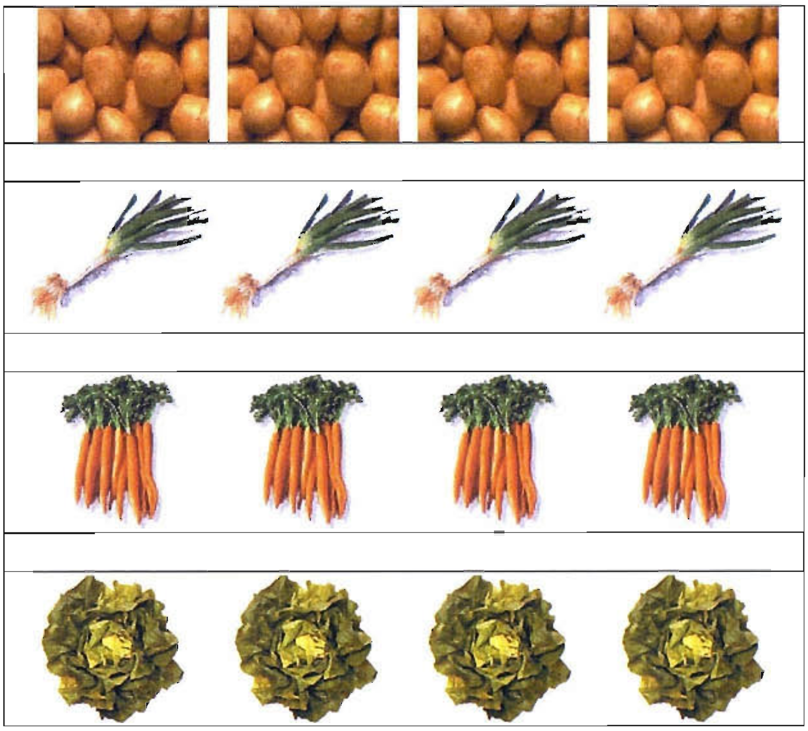
Scenario 1

Background:

In your spare time you (Person B) work on an allotment with three other people (Persons A, C, and D). You have all worked together on this plot of land for many years and as a result, you all know each other quite well.

You are currently growing potatoes, carrots, lettuces, and leeks, in the allotment space as shown in the diagram below.

Plan of the allotment:



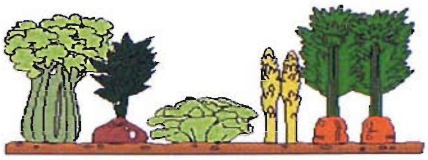
The allotment is divided into four rows, with each row containing a different vegetable.

The situation:

When the vegetables are ready to harvest, you all usually take as much as you want from the land for personal use, regardless of the amount of effort you have put into working on the allotment. This season there has been as much produce grown as in previous years and yet you have received fewer vegetables than in previous years! Thus it seems that some people are taking more than their fair share and are reaping more of the rewards than others.

You all enjoy working on the vegetable patch and want to continue doing so for as long as possible. However, due to the greediness of certain members, you have decided to meet to discuss the future of the vegetable patch.

When you have finished reading this, please turnover and answer Questionnaire 1.



Questionnaire 1

I would now like to know your initial reaction to the scenario you have just read. Please complete the following questionnaire.

Please remember that:

- You work on the allotment with three other people.
- You have worked together for many years and therefore know each other quite well.
- Some people are taking more than their fair share of the produce that you have grown as a group.

What steps do you think the group should take to prevent some people taking more than their fair share?

One possible option would be to divide the plot of land into two, so that two members would be responsible for one half of the land and the other two members would be responsible for the other half. In this case, both groups would only be able to collect the produce from their own plots.

Using the plan of the allotment below we would like you to assess the ease with which this could be done (i.e., how easy it would be to divide the land into two and how fairly the produce could be distributed).

Please draw a **single** divide line on the diagram below to demonstrate how you think the land should be **divided into two**, in the easiest and fairest way. Please remember that the two members designated to each new plot would only be able to harvest from their own plot of land.

Potatoes
Leeks
Carrots
Lettuce

On the scale below, please indicate whether you would consider dividing the land into two and have two groups working on the separate plots? (Please circle ONE number)

1 2 3 4 5 6 7

Not at all Very much so

Would you consider dividing the land into two? (Please tick one answer)

Yes

No

Some other options which may prevent some members taking more than their fair share of the vegetables are listed below. From the following list, please choose the ONE option that you feel would be most effective for your current situation (please tick one):

Appoint one person to be in charge of the plot of land and to decide how much produce each person can take for personal use.

Divide the land up into four smaller private vegetable patches of equal size, so that members can only use the produce from their own plot of land.

Agree amongst yourselves on a maximum limit of how much produce each person can take for personal use.

Impose a fine on any person who takes more than their fair share.

Do nothing and hope that the situation will sort itself out.

Now, please rank these options for how effective you feel they would be for dealing with the problem of some people taking more than their fair share from the vegetable patch (where 1 = *most preferable* option to 6 = *least preferable* option).

Option	**Rank**
Split the land into two	----------
Appoint someone to be in charge	----------
Split the land into four and work alone	----------
Agree on a maximum limit of produce you can take	----------
Impose a fine if you take more than your fair share	----------
Do nothing	----------

During the group discussion, suppose the majority of the group decide to split the land into two …

From the list of fellow co-owners below, whom would you choose to work with on the smaller plot of land? (Please tick one):

Person A

Person C

Person D

Please explain why you have chosen this person to work on the smaller plot of land with.

____

____

____

____

____

***And finally, some questions to check your understanding of the scenario*:**

How many people, NOT including yourself, worked on the allotment?

Please circle ONE number on the scale which best represents your viewpoint:

How satisfied were you with the current arrangement on the allotment that everybody was free to take as much produce as they wanted for themselves?

1 2 3 4 5 6 7

Not at all Very satisfied

Did you feel that all members, including yourself, belonged to one group?

1 2 3 4 5 6 7

Not at all Very much so

How easy was it to divide the vegetable patch equally and fairly into two?

1 2 3 4 5 6 7

Not at all easy Very easy

Once you have completed this questionnaire, please turn the page and read through Scenario 2.

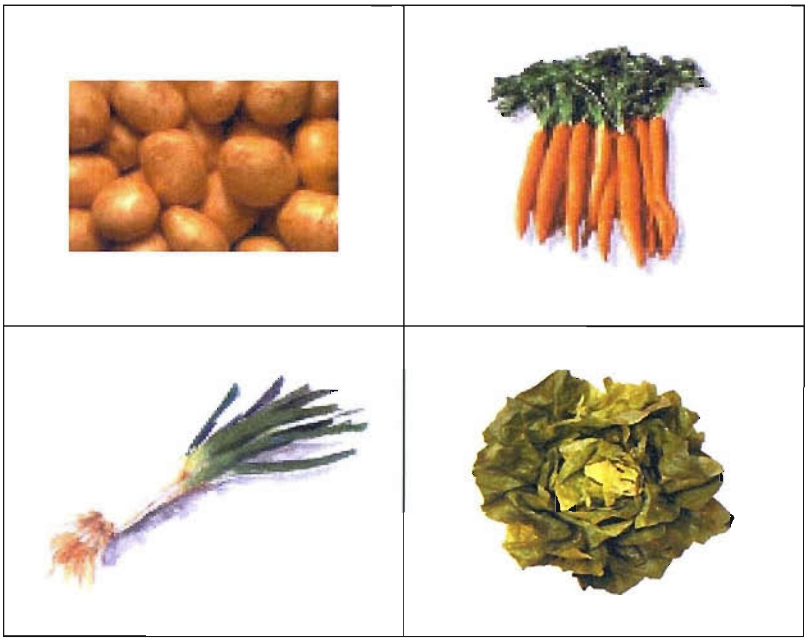
Thank you

Background:

In your spare time you (Person B) work on an allotment with three other people (Persons A, C, and D). You have all worked together on this plot of land for many years and as a result, you all know each other quite well.

You are currently growing potatoes, carrots, lettuces, and leeks, in the allotment space as shown in the diagram below.

Plan of the allotment:



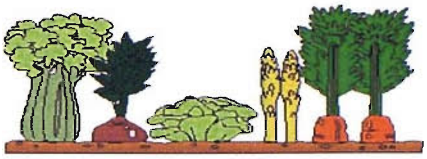
The allotment is divided into four with a different vegetable growing in each quadrant.

The situation:

When the vegetables are ready to harvest, you all usually take as much as you want from the land for personal use, regardless of the amount of effort you have put into working on the allotment. This season there has been as much produce grown as in previous years and yet you have received fewer vegetables than in previous years! Thus it seems that some people are taking more than their fair share and are reaping more of the rewards than others.

You all enjoy working on the vegetable patch and want to continue doing so for as long as possible. However, due to the greediness of certain members, you have decided to meet to discuss the future of the vegetable patch.

When you have finished reading this, please turnover and answer Questionnaire 2.



Questionnaire 2

I would now like to know your initial reaction to the scenario you have just read. Please complete the following questionnaire.

Please remember that:

- You work on the allotment with three other people.
- You have worked together for many years and therefore know each other quite well.
- Some people are taking more than their fair share of the produce that you have grown as a group.

What steps do you think the group should take to prevent some people taking more than their fair share?

One possible option would be to divide the plot of land into two, so that two members would be responsible for one half of the land and the other two members would be responsible for the other half. In this case, both groups would only be able to collect the produce from their own plots.

Using the plan of the allotment below we would like you to assess the ease with which this could be done (i.e., how easy it would be to divide the land into two and how fairly the produce could be distributed).

Please draw a **single** divide line on the diagram below to demonstrate how you think the land should be **divided into two**, in the easiest and fairest way. Please remember that the two members designated to each new plot would only be able to harvest from their own plot of land.

Potatoes	Carrots
Leeks	Lettuce

On the scale below, please indicate whether you would consider dividing the land into two and have two groups working on the separate plots? (Please circle ONE number)

1 2 3 4 5 6 7

Not at all Very much so

Would you consider dividing the land into two? (Please tick one answer)

Yes

No

Some other options which may prevent some members taking more than their fair share of the vegetables are listed below. From the following list, please choose the ONE option that you feel would be most effective for your current situation (please tick one):

Appoint one person to be in charge of the plot of land and to decide how much produce each person can take for personal use.

Divide the land up into four smaller private vegetable patches of equal size, so that members can only use the produce from their own plot of land.

Agree amongst yourselves on a maximum limit of how much produce each person can take for personal use.

Impose a fine on any person who takes more than their fair share.

Do nothing and hope that the situation will sort itself out.

Now, please rank these options for how effective you feel they would be for dealing with the problem of some people taking more than their fair share from the vegetable patch (where 1 = *most preferable* option to 6 = *least preferable* option).

Option	**Rank**
Split the land into two	----------
Appoint someone to be in charge	----------
Split the land into four and work alone	----------
Agree on a maximum limit of produce you can take	----------
Impose a fine if you take more than your fair share	----------
Do nothing	----------

During the group discussion, suppose the majority of the group decide to split the land into two …

From the list of fellow co-owners below, whom would you choose to work with on the smaller plot of land? (Please tick one):

Person A

Person C

Person D

Please explain why you have chosen this person to work on the smaller plot of land with.

***And finally, some questions to check your understanding of the scenario*:**

How many people, NOT including yourself, worked on the allotment?

Please circle ONE number on the scale which best represents your viewpoint:

How satisfied were you with the current arrangement on the allotment that everybody was free to take as much produce as they wanted for themselves?

1 2 3 4 5 6 7

Not at all Very satisfied

Did you feel that all members, including yourself, belonged to one group?

1 2 3 4 5 6 7

Not at all Very much so

How easy was it to divide the vegetable patch equally and fairly into two?

1 2 3 4 5 6 7

Not at all easy Very easy

Thank you

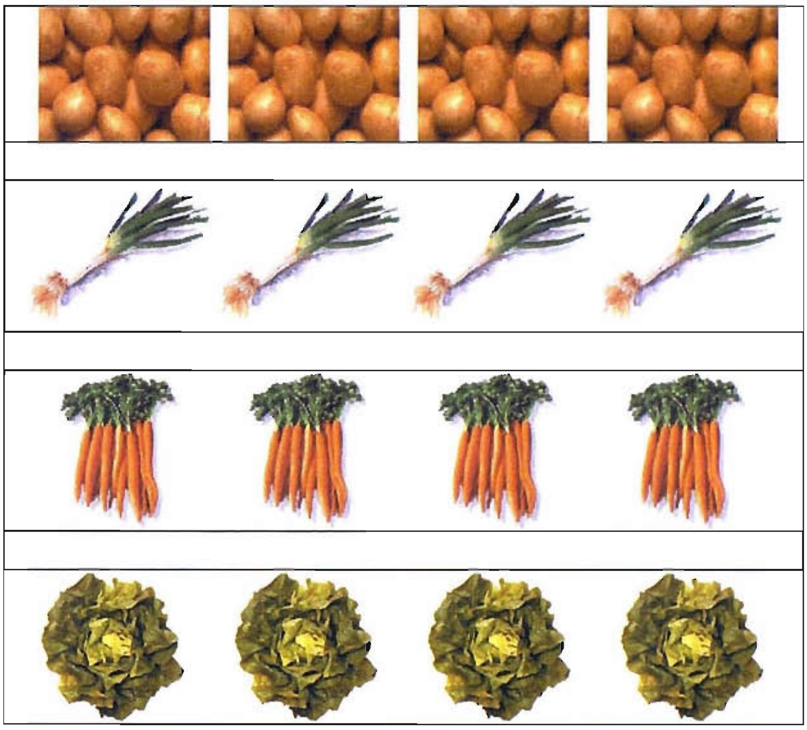
Appendix 2: Example of Scenarios
(group size 4, subgroup, easy-to-divide resource condition first)

Background:

In your spare time you (Person B) work on an allotment with three other people (Persons A, C, and D). Every six months people can apply to work on the allotment and 50% of existing members are substituted for new members joining, therefore people do not always get to know each other that well. Recently, the lottery was drawn to decide which members get to stay or leave. You and one other (Person A) were chosen at random to stay and two new members joined (Persons C and D).

You are currently growing potatoes, carrots, lettuces, and leeks, in the allotment space as shown in the diagram below.

Plan of the allotment:



The allotment is divided into four rows, with each row containing a different vegetable.

The situation:

When the vegetables are ready to harvest, you all usually take as much as you want from the land for personal use, regardless of the amount of effort you have put into working on the allotment. This season there has been as much produce grown as in previous years and yet you have received fewer vegetables than in previous years! Thus it seems that some people are taking more than their fair share and are reaping more of the rewards than others.

You all enjoy working on the vegetable patch and want to continue doing so for as long as possible. However, due to the greediness of certain members, you have decided to meet to discuss the future of the vegetable patch.

When you have finished reading this, please turnover and answer Questionnaire 1.

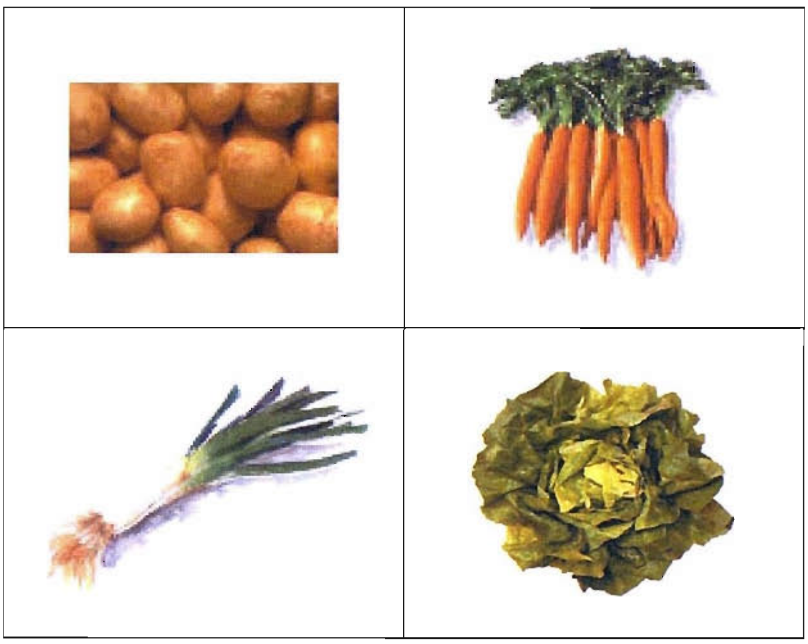
Scenario 2

Background:

In your spare time you (Person B) work on an allotment with three other people (Persons A, C, and D). Every six months people can apply to work on the allotment and 50% of existing members are substituted for new members joining, therefore people do not always get to know each other that well. Recently, the lottery was drawn to decide which members get to stay or leave. You and one other (Person A) were chosen at random to stay and two new members joined (Persons C and D).

You are currently growing potatoes, carrots, lettuces, and leeks, in the allotment space as shown in the diagram below.

Plan of the allotment:



The allotment is divided into four with a different vegetable growing in each quadrant.

The situation:

When the vegetables are ready to harvest, you all usually take as much as you want from the land for personal use, regardless of the amount of effort you have put into working on the allotment. This season there has been as much produce grown as in previous years and yet you have received fewer vegetables than in previous years! Thus it seems that some people are taking more than their fair share and are reaping more of the rewards than others.

You all enjoy working on the vegetable patch and want to continue doing so for as long as possible. However, due to the greediness of certain members, you have decided to meet to discuss the future of the vegetable patch.

When you have finished reading this, please turnover and answer
Questionnaire 2.

Appendix 3: Structural Solutions for Dealing with the Free-rider Problem

In Experiment 6, the following six options were presented to participants as potential ways of dealing with the free-rider problem.

Option 1: The **SPLIT** option involves dividing the common pool into two. You will work in groups of two, rather than groups of four and these two new groups will work entirely independently of one another. You will decide which one group member you want to work with in the smaller group. The computer will randomly allocate which group will collect points from each of the two smaller common pools.

Option 2: The **LEADER** option involves electing one group member to be in charge of the common pool. This member will be responsible for allocating points to each of the group members, including themselves. Group members who are not chosen for the leader role will have to accept the number of points allocated to them by the leader. All members will be asked to vote for the person they would like to be in charge of the common pool. In the event of a tie, the computer shall randomly pick a leader.

Option 3: The **WORK ALONE** option involves the computer dividing the common pool into four separate common pools, each containing only four squares. The computer will randomly allocate one of these smaller common pools to each of the group members. You will no longer be working with the other members of your group.

Option 4: The **MAXIMUM LIMIT** option involves deciding, as a group, a maximum amount of points that can be taken from the common pool. So, for example, if the group decides the maximum amount that any member can take is 14 points, group members must be careful when selecting points from the pool to pick 4 adjacent squares *and* ensure that the total number of points does not exceed the limit of 14. If the points total exceeds 14 points, the computer will ask the participant to make another selection. To determine the maximum amount to be taken, each group member will be asked to state what they believe the maximum amount should be and an average of all group members suggestions will be taken and enforced.

Option 5: The **IMPOSE A FINE** option involves taking away points from members who have taken more than their fair share of points. At the end of the task, each member will vote whether they think the other members in the group have been greedy or not. If ALL members agree that participant X has been greedy, a fine of 10 points will be deducted from that member's points total. More than one participant may be fined per task! Please note these points will NOT then be available for other participants to take!

Option 6: The **STAY AS IT IS** option. You will remain in your existing group. You will keep the sequence position for collecting points that was randomly allocated to you by the computer. Each member is free to take as many points as they wish from the common pool, providing they select four adjacent squares.