EFFECTS OF NATURE ON COOPERATION IN A COMMONS DILEMMA: IMPLICATIONS FOR SUSTAINABILITY

by
Raelyne L. Dopko
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Abstract

There is evidence to suggest that exposure to nature is beneficial for people. Studies have shown that nature exposure is able to increase positive affect and state levels of generosity while decreasing negative affect (Weinstein, Przybylski, & Ryan, 2009). The primary aim of this research was to examine whether nature exposure could increase cooperation in an environmental context. To measure participants' cooperation, a fishing commons dilemma was employed where participants chose between the community benefit (restraining harvesting to possibly sustain the resource) and immediate self-interest (harvesting for quick profit). Participants ($N = 111$) were randomly assigned to view either a nature or an urban video. The participants exposed to nature harvested less per round and sustained the resource for longer, thus demonstrating cooperation. However, this relationship did not depend on nature relatedness, trust, or affect. These results may provide an insight into how we can more effectively manage environmental resources.

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Effects of Nature on Cooperation in a Commons Dilemma: Implications for Sustainability

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People seem to enjoy spending their leisure time in areas that offer scenic views of nature such as national parks, or areas with access to outdoor sports like hiking and kayaking. In Canada and the United States, more people visit zoos than the major sports combined (Wilson, 1993). At a very broad level, there seems to be something about nature that is "good" for us. Research has shown that nature offers benefits to people such as relaxation (Hartig, Mang, & Evans, 1991; Ulrich, 1993), and restoration (Kaplan & Kaplan, 1989). A recent study has demonstrated that the benefits derived from nature can be extended to how we interact with others. For example, exposure to nature and feeling connected to nature can influence how we associate with others by increasing state levels of generosity and encouraging more pro-social aspirations (Weinstein, Przybylski, & Ryan, 2009). Although this positive relationship exists, research has not examined if nature exposure can facilitate cooperation in an environmental context.

Individuals may be missing out on these benefits due to the disconnection we have from our natural environment. In recent years people have begun spending the majority of their time indoors and consequently, living increasingly separate from nature. This disconnection from nature may explain why individuals do not always behave in environmentally friendly ways. Nature exposure and experiences with nature are related to environmental concern and behaviours (Kals, Schumacher, & Montada, 1999; Mayer & Frantz, 2004; Nisbet, Zelenski, & Murphy, 2009). Therefore, by increasing people's exposure to nature we may be able to motivate more pro-environmental behaivours.

Given the current state of the natural environment, it is essential to research solutions to improve the health of nature. Cooperation may be one of these solutions. People working together to improve the state of the environment may have better outcomes than an individual attempting to do it alone. Also, there may be more motivation to change environmental behaviours when people believe that everyone else is cooperating (Buckley, Burns, & Meeker, 1974; Goldstein, Griskevicius, & Cialdini, 2007; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008; Schultz, 1999). The present study examined whether nature exposure could increase cooperative behaviours in an environmental context. In addition, variables such as affect, subjective nature relatedness (state and trait), and trust (state and trait) were examined as potential processes that may explain part of this relationship.

Human-Nature Connection

Our desire to be involved with nature may be understood through evolutionary theory and biophilia. Biophilia is the "innate tendency to focus on life and lifelike processes" (Wilson, 1984; p. 1). This biophilic responding is inherited, meaning those people who lived closely connected to nature throughout our evolutionary history would have had better access to food and fresh water, thus allowing them advantages in survival. These genes and preferences could then be passed down to their offspring. Since people have lived closely connected to nature and animals for over 99 percent of our history, it is unlikely that this learning has been erased (Wilson, 1984). Although evolutionary theory is hard to test, the popularity of zoos (Wilson, 1993), camping, and gardening provide support for this theory. Evidence also suggests that individuals may be more motivated to seek out these natural environments. For instance, Bringslimark,

Hartig, and Patil (2011) found that windowless workers were three to five times more likely to bring photos of nature and plants into their workplace.

The benefits of nature can range from increased vitality (Ryan, Weinstein, Bernstein, Brown, & Gagné, 2010), to faster recoveries from illness (Ulrich, 1984). Nature has also been shown to restore our cognitive resources and improve health. In particular, short exposures to nature (approximately fifteen minutes) have been found to increase our attentional capacity (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). Longer exposures to nature have been shown to provide restorative benefits such as directed attention (see Kaplan, 1995; Kaplan & Kaplan, 1989 for reviews). Having a view of nature from a hospital room (in comparison to a view of urban environments) has also been found to lower negative affect and complications after medical surgery (Ulrich, 1984). According to Ulrich, these benefits associated with involvement in nature may be due to a positive shift in emotion, which then leads to more positive changes in physiological activity such as lower blood pressure. These changes may then make it easier to reduce negative affect or possibly increase well-being.

The benefits that people derive from nature may depend on how connected an individual feels to nature. Trait nature relatedness (or nature connectedness) is the extent that individuals' include nature as part of themselves (Schultz, 2002). It is an individual's understanding of nature and everything it is comprised of, including the parts that are not pleasing (Nisbet et al., 2009). Nature connectedness is made up of three components: cognitive, affective, and behavioural (Schultz, 2002). The cognitive component is the core of nature connectedness and refers to how integrated individuals feel with nature. The affective component is feeling a sense of intimacy or care for nature. Lastly, the

behavioural component is a commitment to protect the natural environment. Although trait nature relatedness can vary between individuals, it remains relatively consistent over time (Mayer & Frantz, 2004; Nisbet et al., 2009). Nature connectedness is related to how people treat the environment (Nisbet et al., 2009), their concern for the environment (Nisbet et al., 2009; Schultz, 2002), and their identity as an environmentalist (Mayer & Frantz, 2004). Trait nature relatedness is associated with many benefits such as higher life satisfaction (Mayer & Frantz, 2004); psychological, social, and emotional well-being (Howell, Dopko, Passmore, & Buro, 2011); as well as autonomy, and environmental mastery (Nisbet, Zelenski, & Murphy, 2010). Even though these studies were correlational, they are suggestive of a causal path between nature and pro-environmental behaviours.

Although nature relatedness is a stable individual trait, it can change based on experience with nature (Vinning, Merrick, & Price, 2008); the more time an individual spends in nature, the more connected they feel to nature and the more concern they may have for nature (Kals et al., 1999; Mayer et al., 2009; Nisbet et al., 2009). Feeling connected to nature at a state level has many benefits as well. Studies have found that relatively short exposures to nature improve affect (Mayer & Frantz, 2004; Mayer et al., 2009; Nisbet et al., 2009; Nisbet, et al., 2010; van den Berg, Koole, & van der Wulp, 2003). Exposure to nature, and feeling connected to nature, has also been found to increase participants' ability to reflect or solve a life problem (Mayer et al., 2009). In this study, participants were instructed to think about a problem in their lives while either walking in nature or an urban environment. Participants in the nature condition indicated they felt more prepared to tie up their problem at the end of the walk than participants in

the urban condition. These studies provide evidence that nature, at both the state and trait levels, is beneficial for people.

Although people seem to derive benefits from nature, our modern lifestyles have caused us to disconnect from the natural environment and spend significantly more time indoors. This disconnection from nature may have a negative impact on people because we are missing out on some of the benefits of nature. For example, Kellert (1997) believes that a relationship with nature is able to provide well-being benefits by increasing meaning and value in our lives. But since we are less connected to nature in the present world, we may also feel less responsibility to protect this environment (Schultz, 2002). A relatively new branch of psychology called ecopsychology is the study of the "human psyche within the larger systems of which it is a part" (Conn, 1998, p. 180). This theory posits that the needs of people and nature are interdependent so human health suffers if nature does (Conn, 1998). According to Conn, ecopyschology aims to encourage people to act more interdependent and connected to their community and earth. Ecopsychology predicts that individuals who are connected to nature will not only behave in more environmentally friendly ways but also have higher levels of well-being.

Although research has examined nature in relation to environmental behaviours, few studies have used an experimental design to determine causality. Research is needed to experimentally investigate how nature may increase environmentally responsible behaviours and explore the variables that may interact with or mediate this relationship. Cooperation is an unexplored area in this research and may be one way to improve the state of our environment by allowing better management of resources (Dawes, 1980; Edney, 1980; Gifford & Gifford, 2000; Gifford & Hine, 1997).

Cooperation

Cooperation is defined as working with others to achieve a shared objective (Tov & Diener, 2009). Cooperating with others may help alleviate some of the current environmental issues because they can produce larger effects than an individual working alone. Cooperating with others may also be more encouraging than trying to achieve the same goal on your own (Stanne, Johnson, & Johnson, 1999). In this meta-analysis, studies that used cooperation (in comparison to competitive or individualistic efforts) had higher achievement and better performance in a motor skill task. Cooperation also improved interpersonal attraction, social support, and self-esteem. Although this meta-analysis was not researching pro-environmental behaviours, it provides support for the idea that cooperation may increase performance in a different context, possibly with environmental resources.

Behaviours in the real world that count as cooperation can include working with your teammates in sports, your co-workers at the office, or with your neighbours to keep the streets clear of garbage. Although these behaviours appear pro-social, cooperation may not always be. Cooperation can be done for selfish reasons such as working with others to receive a better grade, to win a game, or to avoid a fine (by not littering). This study examined cooperation in an environmental context as it related to nature exposure, but not necessarily separating selfish cooperation from pro-social cooperation. For example, some people may cooperate only to earn more money for themselves but not necessarily because they want to help their community or environment.

One way to examine cooperation in an environmental context is to use a commons dilemma. A commons dilemma is "the difficult choice whether to act in self-

interest or in the public interest" (Gifford, 1997, p. 347). A real world example may be asking individuals to lower their thermostats at night to conserve fuel (Dawes, 1980). The drawback would be slightly colder temperatures in homes, but if everyone makes this sacrifice then everyone may be better off because more fuel is saved for the future. Alternatively, if only one person turns down their thermostat, that person is worse off because they are cold and this may not impact the fuel supply. However, if nobody turns down their thermostats, then everyone is worse off because the fuel may run out and everyone freezes.

The concept of a commons dilemma can be traced back to Hardin's (1968) well-known and highly cited article on the 'tragedy of the commons'. In this paper, the commons was an open pasture in a town that everyone had access to. Each farmer wanted to keep as many cattle as they could on the land for personal gain but the pasture could only support a limited amount of cattle. As farmers put more cattle on the land, the commons resource depletes. Unfortunately in this original article, Hardin did not propose any solutions to fix this problem. Researchers have since studied various solutions to this problem such as rewarding cooperative behaviours, or changing the norms (see Dawes, 1980 for a review) but research has not yet examined the role that nature exposure may have.

This study employed a commons dilemma that follows the same pattern as the pasture example Hardin used. In this version of the commons dilemma (FISH; Gifford & Gifford, 2000), participants enter a micro-world where they act as fishers deciding whether to harvest the resource and catch fish (for personal gain) or to refrain from catching fish (possibly for community benefit or to sustain the resource). After every

season or round, the fish regenerate depending on how many were left at the end of the previous round. Then the next season begins (as long as the resource is not exhausted). When participants over-fish in the simulation they are thought to possibly be exploiting the resource and not cooperating. When participants restrain their harvests, they may be acting in a more selfless manner and possibly cooperating (although determining participants' reasons for harvesting is very difficult). However on average, participants who harvested less fish per round, and proceeded into more rounds of fishing were considered to be more cooperative. These are generally considered to be more cooperative because participants may be working towards the common goal of sustaining the resource by restraining their harvests. In the fish simulation, there are variables that measure participants' restraint and efficiency. Individual restraint is the proportion of fish taken by that person. Individual efficiency is the proportion of fish taken by that person but considering the regeneration rates. At the end of the simulation, each participant is given cash depending on the number of fish they caught. According to Gifford (1997), the simulation can produce three different pay-offs. First, if an individual exploits the resource while everyone else cooperates, that individual receives the highest pay-off. Second, if everyone in the simulation cooperates, then everyone receives more money in the long term than if everyone exploited the resource. Third, if everyone exploits the resource, the resource is destroyed and everyone is worse off. This makes cooperating difficult because individuals may receive more money for not cooperating (or defecting) than if they cooperated and caught less fish, but everyone receives a higher pay-off when everyone cooperates (Dawes, 1980).

This commons dilemma may have implications for the environmental and over-

consumption problems we are currently facing. Although this commons dilemma is a simulation, the same problems are occurring with regards to air pollution, oil, and water shortages (Gifford, 1997). It may be easier to pollute for the individual gain than to dispose of some materials properly for the community benefit. Currently, people may be more concerned with getting short-term profits than the long-term consequences. This commons dilemma offers a unique way to study how we make decisions about limited resources, but in a more controlled lab setting. This dilemma also allows researchers to manipulate specific aspects of the game (regeneration rates of fish or greed of computer fishers) to empirically examine how individuals make decisions about cooperation.

Many variables have been examined in the commons dilemma. Group size has been found to significantly affect how individuals harvest the resource. Generally as group size increases, cooperation declines (Brewer & Kramer, 1986; Dawes, 1980; Komorita & Lapworth, 1982). This seems to occur because larger groups make it easier to be anonymous. Larger groups may also split the negative consequences of an uncooperative decision among all group members so that everyone takes a portion of it. However, the individual who made the uncooperative decision does not have to split the benefits of the uncooperative decision or their profits (Dawes, 1980; Gifford & Hine, 1997). Larger groups may also have a more difficult time communicating and coordinating (Kollock, 1998).

Allowing communication in a commons dilemma game has been shown to improve cooperation and resource management (Dawes, McTavish, & Shaklee, 1977; Gifford, 1997). Communication may reduce distrust between individuals, enhance group identity, and clarify the payoffs (Gifford, 1997). However, in the real world cooperation

is not always possible; for example, individuals cannot discuss biking to work instead of driving with everyone across the province or country. In this study of the commons dilemma, communication will not be allowed between participants to isolate the effects of nature exposure on cooperation.

Cooperation also depends on how much of the resource is left. Usually as the resource decreases or approaches extinction, participants cooperate in an effort to save the resource (Rubenstein, Watzke, Doktor, & Dana, 1975). Participants appear to pay more attention to the amount of the resource left once it starts declining (Hine & Gifford, 1997). This study (Hine & Gifford, 1997) found that participants adjusted their harvesting styles to match the size of the resource that was left. It should be mentioned that these results were found in an experimental setting using simulations; how participants harvest resources in the real world may be different.

Field studies have shown that real world communities can manage their own resources without policies and government intervention (Ostrom, 2000b; Ostrom, Burger, Field, Norgaard, & Policansky, 1999). This seems to be achieved by face-to-face interactions and by allowing individuals to modify the rules if needed. Being able to self-organize themselves appears to be vital for this to work as well. When issues need to be resolved, Ostrom (2000) believes there should be low-cost and local courts available to allow a speedier resolution at a lower expense. This supports the idea of researching ways to encourage individuals to manage their own resources by examining conditions that facilitate cooperative harvests at the individual level and without policies.

The personality of the individual harvesters also impacts how they harvest the resource. Not surprisingly, people who hold cooperative values restrain their harvesting

(Balliet, Parks, & Joireman, 2009; Hine & Gifford, 1996). A personality trait of particular interest in this study is trust. Trust offers reassurance to individuals that someone else will not take advantage of his/her cooperation (Tov & Diener, 2009). It is the anticipation that an individual's risky behaviour (i.e. taking less for themselves in an effort to benefit the community) may be shared by other members of the group (Brann & Foddy, 1987). Studies have found that trust significantly impacts how participants harvest a resource. Participants who trusted that their peers (or other players in the simulation) would restrain their harvesting behaviours in the commons dilemma, also harvested less (Mosler, 1993). In another study, participants who had high levels of state trust were found to take less of the resource once it started deteriorating. In comparison, low trusting individuals did not change their harvesting habits (Brann & Foddy, 1987). Social norms, and social capital such as trust, have also been found to enhance cooperation and increase collective action (Dietz, Ostrom, Stern, 2003; Ostrom, 2000a). This was found in regards to individual trust as well as government trust. Although trust is expected to relate to cooperation, in a meta-analysis Hine & Gifford (1991, as cited in Gifford, 1997) found that trust had little effect on cooperation. The meta-analysis suggested that trust is only important in smaller group sizes and when participants know if others are cooperating or not. In the current study, trust is expected to predict cooperation because the groups are small and participants can see how many fish others are harvesting.

Nature and Cooperation

There are a few reasons to possibly expect a relationship between nature exposure and cooperation. Across 4 studies, Weinstein et al. (2009) demonstrated that exposure to nature increased intrinsic goals whereas exposure to built or urban environments

decreased intrinsic goals. Intrinsic goals are those that are rewarding in and of themselves such as social relationships. Extrinsic goals focus on external rewards such as money or fame that are rewarding for the benefits they bring to that individual. Intrinsic goals may be supportive of the conditions necessary to cooperate (i.e. valuing social relationships and community goals to act in more pro-social and cooperative ways). Participants may be more likely to cooperate if they choose the community interest over self-interest. Weinstein et al.'s results also found that exposure to natural environments decreased extrinsic aspirations while exposure to urban environments increased extrinsic goals. Being immersed in these environments magnified the effects of extrinsic or intrinsic goals (nature exposure depended on immersion). Immersion in nature was also found to impact how much participants felt a part of nature and how autonomous they felt. Autonomy and nature relatedness then acted as mediators to participant's valued intrinsic aspirations or extrinsic aspirations. These results were found to be significant even when controlling for positive affect. Therefore, even though the results here depended on immersion, they did not depend on positive affect (participants self-reported more intrinsic aspirations but not simply because they were experiencing more positive affect).

Individuals who have an extrinsic value orientation (at a trait level) have been shown to harvest more in a commons dilemma compared to individuals who possessed more of an intrinsic value orientation (Sheldon & McGregor, 2000). This seems to occur because extrinsically valued individuals are more concerned with showing signs of wealth and self-worth. Interestingly, the extrinsic groups actually harvested less than groups of intrinsic individuals because their resource extinguished more rapidly. Therefore, in the long term, individuals who harvest more per round in a commons

dilemma may actually receive less overall.

Weinstein et al. (2009) also found that participants who viewed natural photographs were more generous when deciding to give money away to other students. In this task, participants were each given $5. The participants then decided whether they wanted to keep the money or give it to another student so the money could be doubled. The second participant could then decide whether to give the original $5 back or keep the full $10. In this example there is nothing to gain if the first participant decided to give away $5 but they could potentially lose their earnings by being generous. Even so, participants in the nature conditions gave their money away significantly more often than participants in the urban environments condition. Generosity may be a building block to cooperative behaviours in the commons dilemma because individuals might contribute more to the community goal (rather than focus on self-interest). They may also be more likely to leave resources for others (or in the resource pool) rather than harvest for themselves.

Mediating Roles of State Variables

In addition to investigating nature exposure and cooperation, this study sought to examine the potential processes of this relationship. There were three hypothesized mediators: *state* trust, *state* nature relatedness, and affect. I hypothesized that nature exposure would increase state levels of trust in participants. This is built upon Weinstein et al.'s (2009) finding that participants were more generous in the nature condition compared to the urban condition. It may be that participants in the nature condition trusted that the other participant would give back the money, which then increased the likelihood that they would give the money away. However, Weinstein et al. (2009) did

not test this hypothesis with a trust measure. This study will extend this hypothesis and test whether state trust affects how individuals make decisions about cooperation.

Nature exposure may also influence participants to act in more cooperative ways in the commons dilemma through nature relatedness. In the Weinstein et al (2009) study, nature relatedness was found to mediate the relationship between nature exposure and intrinsic aspirations. The pro-social benefits that Weinstein reported (i.e. higher value on community wellness, less value on self) may also be important for increasing cooperation. These individuals who value their community may try to conserve resources and harvest less for themselves to improve their community. Thus, it is also expected here that state nature relatedness will mediate the relationship in this study between nature exposure and cooperation.

Finally, nature exposure may also increase cooperation in the commons dilemma through affect (in particular, positive affect). A consistent finding in environmental research is that nature can improve affect (higher positive affect and lower negative affect; Mayer et al, 2009; Nisbet, et al, 2009; Nisbet, et al, 2010). In social psychology, research has also demonstrated that positive affect may be able to motivate more helping and cooperative behaviours (Eisenberg, 1991). This may imply that nature can facilitate cooperation through positive affect. For instance, Bierhoff and Muller (1999) found that individuals experiencing more positive affect and in a positive group atmosphere cooperated more in a group setting compared to individuals feeling less positive affect and group atmospheres. In another study, negative affect was associated with less cooperation and participants were less successful at playing the commons dilemma simulation (Knapp & Clark, 1991). According to Knapp and Clark (1991) participants

who are already in positive affect states should have little or no desire to improve their affect. Therefore, delaying gratification in the commons dilemma and sustaining the environmental resource longer should be easier. In comparison, individuals experiencing more negative or neutral affect may be less able to delay gratification because they are more motivated to improve their current affect. People in positive affective states might also be more willing to cooperate (and engage in more pro-social behaviours) because they want to maintain their current affect (Clark & Isen, 1982). By cooperating, the more positive behavioural response, instead of behaving in uncooperative ways, they may be able to maintain their positive affect (although positive affect may not always simply lead to more cooperation, it is hypothesized to in this study). The influence of positive affect may also depend on other factors in commons dilemmas. In one study, positive affect increased cooperation only when the current norm of the group was also cooperative (Hertel, Neuhof, Theuer, & Kerr, 2000). This means that positive affect could increase cooperation but only when other members are acting cooperatively. In the current study, the fish simulation had two out of the three computer fishers act in a moderately cooperative manner with all the participants and one computer fisher harvest fish slightly more greedily.

Interactions of Trait Variables

To examine if the relationship between nature exposure and cooperation is dependent upon personality traits, I examined trait nature relatedness and trait trust. Since trait nature relatedness has been shown to predict how people treat the environment (Nisbet et al., 2009), concern for the environment (Nisbet et al., 2009; Schultz, 2002) and identity as an environmentalist (Mayer & Frantz, 2004), I also expected it to predict

restraining harvesting behaviours in the commons dilemma. More specifically, I expected an interaction between condition and trait nature relatedness such that individuals who had high levels of nature relatedness may cooperate (or conserve resources in the commons dilemma) but low nature relatedness individuals would only cooperate if exposed to nature. Low nature related individuals may require the exposure to nature to increase their cooperative behaviours. Next, I also expected that trait trust would interact with nature exposure to predict cooperation in the commons dilemma. As already discussed, trust may reassure individuals that other participants will not take advantage of his/her cooperation (Tov & Diener, 2009), thus individuals who are high in trust cooperate (regardless of condition). However, individuals low in trust only cooperate if exposed to nature. This may be important in the commons dilemma when participants are assessing whether to harvest more for themselves in an effort to sustain the resource or try to conserve the resource.

Rationale of Study

This study examined the relationship between nature exposure and cooperation. The literature discussed suggests that nature exposure may be able to encourage cooperation in a commons dilemma. This study also had participants complete personality measures (about trait nature relatedness and trait trust) to examine how these variables relate to nature exposure and cooperation. The participants were then randomly assigned to view either a nature video or an urban (built) video. Although participants were not physically "in" nature, previous research suggests that virtual nature can still influence behaviour and affect (Mayer et al., 2009, Weinstein et al., 2009). After the video, participants completed measures on their affect, subjective feeling of

connectedness to nature, and trust. By examining these variables at a state level, the causal relationship between nature exposure and cooperation could be assessed. Finally, participants took part in a commons dilemma about sustaining a fish resource to measure their cooperation.

Hypotheses

Hypothesis 1: Participants would feel more connected to nature (higher state nature relatedness) after watching the video of nature compared to participants who watched the urban video.

Hypothesis 2: Participants in the nature condition, compared to participants in the urban condition, would have higher positive affect, and pleasant affect (words that have been associated with nature such as fascination and relaxed, further explained in the method section) and lower negative affect.

Hypothesis 3: Participants in the nature condition would be more likely to cooperate with others in the commons dilemma. That is, participants would take fewer fish per round, and advance into more rounds of fishing. Also, their harvest restraint (proportion of fish taken by the individual; where higher scores mean more restraint) would be higher for the nature condition. Their harvest efficiency (taking an optimal amount of fish so they can regenerate between seasons; again where higher scores mean higher efficiency) may be higher or lower for the nature condition. It may be higher because they harvest less fish, which means the fish can regenerate between seasons, or it may be lower because they harvest too little fish that makes it inefficient. Similarly, the amount of profits that participants could make may be higher or lower for the nature condition. It may be higher because the participants would proceed into more rounds of fishing, which gives them

more opportunity to fish and hence make a profit. Alternatively, the profits that participants in the nature condition make may be lower because they harvest more cooperatively and take less fish per round. The total number of fish that participants harvested was an ambiguous indicator since it does not measure whether these fish were harvested slowly over time or rather quickly (depleted in one or two seasons).

Hypothesis 4: Participants in the nature condition would evaluate other subjects (the other players in the commons dilemma simulation) as more trustworthy (higher state trust).

Hypothesis 5: The effect of nature on cooperation would depend on trait trust. Although exploratory, analyses examined the nature of this relationship. It may be that individuals who are high on trait trust would be cooperative (regardless of condition) while individuals with low trust would only be cooperative if they were exposed to nature.

Hypothesis 6: The effect of nature on cooperation would depend on trait nature relatedness. Again although this hypothesis was exploratory, analyses examined the type of interaction. It may be that individuals high on nature relatedness will be cooperative (regardless of condition) while individuals with low nature relatedness will be cooperative only if they were exposed to nature.

Hypothesis 7: State nature relatedness, affect (positive affect), and state trust would mediate the relationship between nature exposure and cooperation.

Hypothesis 8: When all three mediators are entered into the equation together, nature relatedness would be the strongest path to cooperation because of its sensitivity to nature exposure.

Method

Participants

A total of 111 undergraduate students participated in this study. They were recruited via Psychology Department's online sign-up system (SONA) for a study advertised as "Personality and Media." The entire study was completed in the testing booths and on the computers in Carleton University Happy Lab (CUHL). In exchange for participating (1 hour of their time), students were granted 1 credit toward their introductory psychology final grade. Most participants were female (70.3%), with a mean age of 20.81, SD = 3.10, and 59.5% were in their first year of study.

Materials

Big Five Inventory (BFI; John & Srivastave, 1999). This 44-item scale measured extraversion, agreeableness, conscientiousness, neuroticism, and openness. Individuals rate how much each question is like them from 1 (disagree strongly) to 5 (agree strongly). The five subscales show acceptable reliability: extraversion (alpha = .86), agreeableness (alpha = .76), conscientiousness (alpha = .81), neuroticism (alpha = .85), and openness to experience (alpha = .79). There are no specific hypotheses about the big five personality traits; this scale is included to hide the narrower personality traits such as trust and nature relatedness (these are indicated in brackets in Appendix A).

Trust at a trait level (Faith in People Scale (trait trust); Rosenberg, 1957). This 5-item trust scale will be added to the 44-item BFI from above. The Faith in People Scale asks participants to rate whether they agree or disagree with the descriptive statements (e.g., "human nature is fundamentally cooperative", and "if you don't watch yourself, people will take advantage of you"). This scale showed a slightly lower internal consistency (alpha = .62).

Nature Relatedness at a trait level (Nature Relatedness Scale; Nisbet, Zelenski,

& Murphy, 2009). This 6-item scale is a brief measure from the original 21-item measure that was hidden in the BFI so participants did not become suspicious of the cover story. The nature relatedness scale measures how connected to nature participants feel at a trait level. Participants are asked to rate how much they agree with the statements listed (e.g., "Ideal vacation spot would be a remote wilderness area."). This scale shows good reliability, alpha = .82.

Inclusion of Nature in Self or state nature relatedness (INS; Schultz, 2002). This single item question was designed to measure the extent that individuals include nature as a part of their identity. This measure uses a pair of circles with one circle labeled *self* and the other circle labeled *nature*. Participants are asked to choose the pair of circles that best describes their relationship with the natural environment. There are seven pairs of circles that differ on the extent that they overlap. Individuals who are very connected to nature choose the pair of circles that completely overlap (scored as a 7) while individuals who are not connected to nature choose circles that are non-overlapping (scored as a 1). This scale has been shown to correlate positively with trait attitudes such as biospheric attitudes, self-reported behavior, nature relatedness, and simply walking in nature. In the present study, participants were asked to "Please circle the picture below that best describes your relationship with the natural environment at this moment in time. How interconnected are you with nature right now?" In addition to indicating how connected to nature participants feel (our main focus), participants also indicated how connected they felt to other *people, family, friends, community, an urban center,* and *to all humanity* (as distractor questions).

Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988).

This scale measures positive and negative affect by asking subjects to rate a list of adjectives on how they feel at the present moment. Participants rated the 20 adjectives (10 positive affect items and 10 negative affect items) on a Likert scale from 1 (*very slightly or not at all*) to 5 (*extremely*). The PANAS scale is brief, easy to administer, and has good reliability ($\alpha = .85$ for positive affect and $\alpha = .81$ for negative affect). In addition, six more adjectives that measure other pleasant affects that have been associated with nature effects were added (*fascination, peaceful, content, in awe, curious,* and *relaxed*). These six items were added to assess more low arousal affect as the positive affect subscale typically measures high arousal. These six items were referred to as pleasant nature affects and scored the same as the positive and negative items. These items showed acceptable reliability, $\alpha = .79$.

Fish 3.1[1] (Gifford & Gifford, 2000) is a computer simulation designed to study how individuals and groups manage limited resources. This commons dilemma has participants act as ocean fishers trying to maximize their profits (they are paid $0.10 per fish caught) without depleting the resource. But participants also have expenses; it costs $0.05 to go out to sea and $0.05 to return; however, it did not cost money to "be at sea" (this was explained to participants). Participants could see the common pool of fish deplete or replenish after each round and adjust their fishing as they wish. Rounds of fishing began and continued for a pre-determined number of fishing seasons (15 rounds) or until the fish resource was exhausted. Participants did not know the set number of rounds the simulation could progress into, but they knew the simulation would end if the resource was exhausted at any point in time. At the end of the game participants received

[1] For the FISH homepage: http://web.uvic.ca/~rgifford/fish/

their earnings. Participants were told they would be playing with another student in the other testing booths (although they could not see or communicate with them) and/or with people online. In reality the participants were playing against the computer. In Fish 3.1 the researcher is able to adjust the amount of fish available, the greed of the other fishers, the regeneration rate of the fish, the uncertainty of the resource, etc. For purposes of this study, all parameters of the simulation remained the same to isolate the effects of nature on cooperation. Only one of the computer fishers was set to fish slightly more competitively (to a setting of .6, where 0 is no greed and 1 is greed). The other computer fishers (whether it was one or two depending on if there was one or two students being ran through the study) played cooperatively (to a setting of .4 and .5). The dilemma always began with 50 fish and a regeneration rate of 1.5, although the fish population could never increase over 50 (which was explained to participants). The researcher also gave examples of a typical fish round (if there are 50 fish in the ocean and the four fishers each harvest 5 fish, then there would be 45 fish available for next round because 30 fish harvested multiplied by 1.5 equals 45). The participants first completed a practice round to FISH, before they begin the "real" FISH simulation. The FISH simulation gave the following output (all of which were used for analyses): amount of time spent fishing (number of seasons), number of fish caught (both overall in the dilemma and then broken down per round), and the profits of fishing (for each individual fisher). It also calculates the fisher's restraint and efficiency during the simulation. The restraint measure reported on the proportion of fish that were taken, while the efficiency measure reported on the proportion of fish that were taken but with the regeneration rates factored in.

Trust at a state level: participants were asked to complete three questions on how they feel about the other members of their group after they play the practice round of FISH ("I expect that my group members will be trustworthy, I expect that my group members will act in a cooperative manner, I expect this game will go well with the group I have"). The participants were asked to indicate how much they agree with these statements from 1 (strongly disagree) to 5 (strongly agree). This measure showed acceptable reliability, $\alpha = .79$. After they completed these 5 questions, the real FISH simulation will begin.

Video Clips: Two videos (a nature environment video and an urban environment video) that were 12 minutes long were prepared for the participants. The nature video consisted of footage from the Planet Earth series, produced in 2006 by the BBC Natural History Unit. This video began in the tundra forest with images of trees and animals from that area. It then proceeded around the world and showcased the plants and animals native to those areas before ending in the jungle. The video was educational complete with narration and music. The urban video was comprised of an architecture segment in New York City. It is from the Walks with an Architect series, which was produced in 2005 by Landmark Media. This video offers an in-depth look at the buildings in New York along with their locations. This video is educational and also has narration and music. Both videos are similar in terms of colour, music, and when they were produced. The videos were viewed on individual desktop computers with 17-inch screens. Headphones will also be provided for the participants to listen to the video.

Demographic Questionnaire: Participants also completed a demographic questionnaire where they indicated their sex, age, major, where they grew up and where

they live today (urban or rural). They were also be asked about their political views (liberal versus conservative), how they got to campus (bus, walk, drove), whether they walked through the indoor tunnels or outdoors to the study, and whether they saw or knew the other participant in their condition. Lastly, participants were asked if they have ever played a commons dilemma game before and what they learned from the commons game.

Procedure

Participants met at the lab (Carleton University Happy Lab) on campus. Participants were told they are completing a study called "Personality and Media." The researcher broadly explained the purpose of the study was to examine how personality affects their perception of different types of media. The researcher than explained the order of questionnaires and videos (i.e. first you will be completing a personality questionnaire, then watching a movie, stating your reaction to the movie, and then playing an online simulation, and stating your reaction to the simulation). Every session was completed with one or two students. If a student who signed up for the study did not arrive, the session was still completed (as students arrived at the lab they were escorted to the testing booth furthest from the door so that participants could not see one another). After giving informed consent, participants completed a big-five personality measure with trust and nature relatedness items added. Participants were then randomly assigned to watch either a nature video or an urban environmental video. After watching this 12-minute video clip of scenery, participants completed measures of how connected to nature they felt (as well as other distractor questions about how connected they feel to other people, their community, etc.) and a measure of positive and negative affect. They

also completed a questionnaire of how much they liked the video (to reinforce the cover story, not used for analyses). The participants were then told they were starting the next media section of the study and began reading the instructions to the commons dilemma simulation (FISH 3.1). The researcher explained how the simulation worked and demonstrated an example of how the fish replenish (with the regeneration rate). Participants were allowed one practice round before they began to play the game. After the practice round, participants were asked to complete a state measure of trust. The game proceeded into fifteen determined seasons (rounds) or until the resource was depleted (approximately15 minutes of time spent in FISH). After the fishing simulation, participants again stated their reactions to FISH (to reinforce the cover story not used for the analyses). The participants then completed the demographic form and a 5-item measure that probed for suspicions (i.e. what do you think the study was about?). Next, the researcher explained the true purpose of the study (how nature exposure affects their behaviour in the commons dilemma), and gave them a copy of the debriefing form to keep. Participants were asked if they had any questions about the study before they signed a secondary consent form. The participants signed this secondary consent form if they consented to submitting their responses after hearing the true purposes of the study (if they did not sign it, their responses were not used). Finally, participants were paid the profits they earned in FISH and dismissed.

Results

Missing Data and Outliers

There was less than 5 % missing data on all variables. The data were visually inspected through graphs and normality tests for outliers and normality. In the fish

simulation, z-scores that were generally above 3 or grouped together around 3 were subsequently filtered out. This resulted in approximately 4 scores on each of the 5 fish dependent measures being filtered out in the analyses. None of the other variables had z-scores above of 3 and therefore remain unfiltered. The dependent measures of the fish simulation were skewed; therefore, both parametric and non-parametric statistics were employed. The results between parametric and non-parametric tests were consistent and are described in further detail in hypothesis three. On the trait trust and trait nature relatedness measures there was one multivariate outlier that was subsequently filtered out in analyses.

State Effects of Nature Exposure

The first hypothesis was that participants in the nature condition would experience more positive and pleasant affect (pleasant nature affect) while experiencing less negative affect. An independent t-test demonstrated that people in the nature condition did not experience more positive affect than those in the urban condition, $t(108) = .74$, $p = .46$, $d = .14$. The descriptives for these variables are portrayed in Table 1. Participants exposed to the nature video did experience more pleasant nature affect than participants who were exposed to the urban environment video, $t(108) = 3.07$, $p = .003$, $d = .59$. Participants exposed to the nature video experienced less negative affect than participants exposed to the urban videos, $t(87.79) = -2.66$, $p = .009$, $d = -.57$.

The second hypothesis was that participants in the nature condition would experience higher state levels of nature connectedness (INS-Nature). This was not supported by an independent t-test, $t(109) = .96$, $p = .34$, $d = .18$. However, participants who watched the urban environment video felt more connected to an urban center (INS-

Urban) than participants who watched the nature video, $t(109) = -2.26$, $p = .03$, $d = -.43$. The other distracter circles (how connected do you feel to your friends, family, community, etc.) did not differ between conditions. The descriptives for these variables are portrayed in Table 1. Thus, the nature video elicited higher pleasant nature affect and lower negative affect (compared to the urban video) but had no effect on positive affect. The videos did not differ in the participants' subjective sense of connectedness to nature; however, the built videos did make participants feel more connected to an urban center.

Next, I hypothesized that participants in the nature condition would evaluate the other subjects as more trustworthy before the fish simulation began. An independent t-test between conditions revealed that participants in the nature condition did not evaluate the other subjects as more trustworthy than the urban environment condition, $t(104.58) = -1.33$, $p = .19$, $d = -.26$.

Table 1

Means and Standard Deviations of Affect between Conditions

	Nature (n = 56)		Urban (n = 55)	
Variable	M	SD	M	SD
Positive affect	2.90	.70	2.79	.82
Negative affect	1.28**	.33	1.51**	.55
Pleasant affect	3.59**	.81	3.13**	.74
INS-Nature	3.54	1.55	3.27	1.34
INS-Urban	2.93*	1.61	3.62*	1.62
State trust	3.39	.83	3.57	.66

* $p < .05$. ** $p < .01$

Cooperation Differences[2]

Hypothesis three was that participants in the nature condition would cooperate more in the fishing simulation as measured mainly by the number of seasons the simulation progressed into and the average number of fish harvested per season. The other indices, the total number of fish participants harvested, the profits participants made, and their restraint and efficiency measured cooperation less directly. For example, the profits participants earned are more dependent on the rules of the game and how many seasons the game can last (more in discussion).

There were two different ways of measuring the amount of fish participants harvested. One way was the total number of fish participants harvested, in other words, all the fish added up together from every season. The other way, was the average number of fish participants harvested per season (total number of fish harvested divided by the number of seasons the simulation progressed into). Each of the fish indices are discussed separately below.

Number of seasons the fish game proceeded into. I hypothesized that participants who watched the nature video would proceed into more fishing seasons than participants who watched the urban environment video. An independent t-test demonstrated that participants in the nature condition went significantly longer (M =

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[2] The results were generally consistent across various methods of filtering out extreme scores across dependent measure. The results reported herein are filtered to exclude those participants that were outliers on any one of the fish measures. When the filters exclude only those participants that were outliers on that particular fish measure, two of the six fish measures drop to marginal significance. More specifically, the profits that participants made becomes marginally significant, $t(107) = -1.80, p = .07, d = .35$ and individual restraint also becomes marginally significant, $t(108) = 1.67, p = .097, d = .32$. The rest of the fish variables remain significant regardless of which outliers are filtered out.

13.61, SD = 3.35) than participants in the urban condition (M = 10.90, SD = 5.02), $t(86.02) = 3.13$, $p = .002$, $d = .67$.

This hypothesis was also examined with a chi-squared test because of a ceiling effect with the number of seasons participants proceeded into (in this study 62% of the sample proceeded to the end of the simulation or season 15). Because of this imbalance, the number of seasons were collapsed into two categories, the first being those participants that went from season 1 to 14, and the second group being those participants that proceeded to the end of the simulation or season 15. There was a significant difference between condition in whether the participants progressed into season 15, $\chi^2(1) = 8.59$, $p = .003$. Based on the odds ratio, the odds of participants proceeding into season 15 were 3.81 times higher if they had watched the nature video than if they watched the urban video.

Average number of fish harvested per season. Participants in the nature condition were also hypothesized to harvest less fish per season than participants in the urban condition. Participants in the nature condition harvested significantly less fish than participants in the urban condition, $t(78.50) = -3.01$, $p = .004$, $d = -.68$. Figure 1 depicts the overall trend in how conditions differed in their harvests per season. The means and standard deviations are displayed in Table 2.

This was also tested with a Mann-Whitney non-parametric test due to the skewness and kurtosis. The results are again consistent, participants in the nature condition harvested less fish per season (Mdn = 2.5) than participants in the urban condition (Mdn = 2.78), U = 679.5, $z = -3.46$, $p = .001$, $r = -.35$.

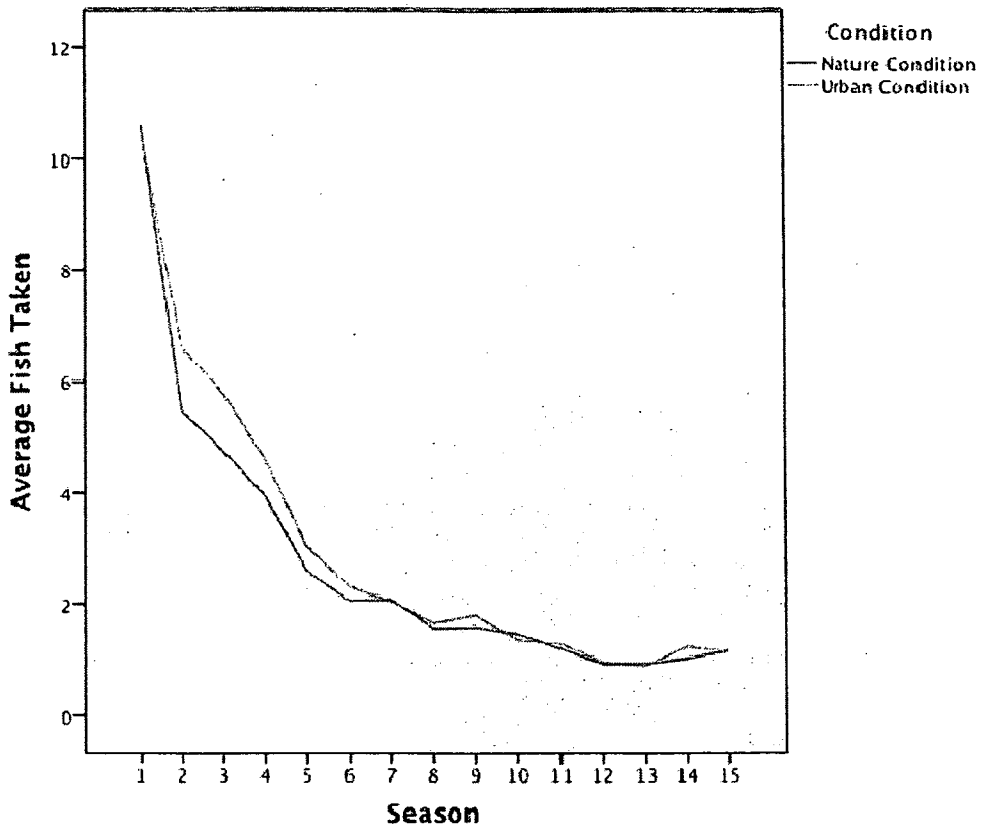

Figure 1. Average number of fish harvested per season between nature and urban groups. Although t-tests indicated there were no significant differences for an individual season, the trend of the nature group harvesting less and decreasing their harvests earlier than the urban group can be observed.

Total number of fish harvested. This variable is an ambiguous indicator since it does not indicate whether the fish were harvested slowly over time or rather quickly. There was no significant differences between conditions on this variable, $t(94) = -1.56$, $p = .122$, $d = -.32$. Participants in the nature condition did not harvest more or less fish than participants in the urban condition. The means and standard deviations are displayed in Table 2.

The total number of fish harvested was also tested with non-parametric statistics due to the skewness and kurtosis of the data. The results are consistent between a non-parametric Mann-Whitney test and a parametric independent t-test. Participants in the nature condition did not harvest more or less fish as a sum (Mdn = 37) compared to participants in the urban condition (Mdn = 37), U = 949.5, $z = -1.48$, $p = .14$, $r = -.15$ (r is used here as a measure of effect size of the Mann-Whitney test as recommended by Fields, 2009).

Profits made. Participants in the nature condition made significantly less profits than participants in the urban condition, $t(94) = -2.58$, $p = .01$, $d = -.53$. The means and standard deviations are portrayed in Table 2. This variable could have been significantly higher or lower for participants in the nature condition. As already stated, the profits may have been higher for participants who were harvesting cooperatively (because the resource would be sustained for more seasons) or it could have been lower because the participants were harvesting less fish.

This was also tested with a Mann-Whitney non-parametric test, and the results are again consistent. Participants in the nature condition made significantly less money while fishing (Mdn = 2.4) compared to participants in the urban condition (Mdn = 2.78), U = 829, $z = -2.36$, $p = .02$, $r = -.24$.

Individual restraint and individual efficiency. Participants in the nature condition were hypothesized to show more restraint and efficiency. Participants in the nature condition did exhibit more restraint when it came to harvesting compared to those participants in the urban condition, $t(79.63) = 3.74$, $p < .001$, $d = .84$. The means and standard deviations are displayed in Table 2. A Mann-Whitney non-parametric test also

demonstrated that participants in the nature condition showed more restraint (Mdn = .55) compared to participants in the urban condition (Mdn = .25), U = 678, z = -3.46, p = .001, r = -.35.

The same result was demonstrated with individual efficiency, where participants in the nature condition demonstrated more efficient harvesting behaviours compared to participants in the urban condition, $t(77.73) = 3.73$, p = .000, d =.39. The means and standard deviations are displayed in Table 2. A Mann-Whitney non-parametric test also demonstrated that participants in the nature condition harvested more efficiently (Mdn = .57) compared to participants in the urban condition (Mdn = .24), U = 681, z = -3.44, p = .001, r = -.35.

Table 2

Descriptives of Fish Variables by Condition

	Nature (n = 46)		Urban (n = 50)	
Variable	M	SD	M	SD
Fish total	36.52	3.30	37.44	2.43
Fish average	3.16**	2.06	4.97**	3.66
Profits	2.50*	.46	2.73*	.45
Restraint	.39**	.38	-.02**	.66
Efficiency	.42**	.39	-.002**	.70

*p < .05. **p < .01

Interactions with Trait Variables

Despite the significant between group differences, trait trust and nature relatedness did not relate to cooperation (although trait nature relatedness negatively correlated with the profit participants made). The means, standard deviations, and correlations are displayed in Table 3. The effect of nature did not depend on trait trust or nature relatedness (the interaction are demonstrated in Table 4 and 5). Trust and nature

relatedness were tested as moderators on all dependent measures of the fish game; however, the only one reported below is the average number of fish harvested per season. This fish index was chosen because it represents cooperation more directly than the other variables, and all moderation models were consistent in their results that trust and nature relatedness did not interact with nature exposure to significantly predict cooperation.

Table 3

Correlations among Trait Measures and Fish Variables

			Correlations						
Variable	M	SD	1	2	3	4	5	6	7
1. Trait trust	3.44	.64	-						
2. Trait NR	2.83	.82	.21*	-					
3. Seasons	12.20	4.48	-.09	.16	-				
4. Fish total	37.00	2.90	.02	-.05	.08	-			
5. Fish average	4.10	3.11	.12	-.17	-.94**	-.10	-		
6. Profit	2.62	.47	.01	-.27**	-.77**	.36**	.69**	-	
7. Restraint	.18	.58	-.07	.16	.89**	-.16	-.89**	-.77**	-
8. Efficiency	.20	.61	-.07	.16	.87**	-.15	-.89**	-.76**	.99**

$N = 96$. * $p < .05$. ** $p < .01$

Table 4

Interactions of Trust with Nature Exposure predicting the number of Fish harvested per season

Variables entered	R^2	F	ΔR^2	β	sr^2	*p*
Step 1:	.11	5.56	.11			
Nature exposure				.31	.09	.003
Trait trust				-.18	.03	.07
Step 2:	.11	3.75	.002			
Trait T x nature exposure				-.15	.002	.63

Outcome variable: Fish harvested (average) per season, $N = 95$.

Table 5

Interactions of Nature Relatedness with Nature Exposure predicting the number of Fish harvested per season

Variables entered	R^2	F	ΔR^2	β	sr^2	*p*
Step 1:	.11	5.48	.11			
Nature exposure				.31	.09	.003
Trait nature relatedness				-.18	.03	.08
Step 2:	.12	4.10	.01			
Trait NR x nature exposure				.17	.01	.26

Outcome variable: Fish harvested (average), $N = 95$

Mediational Analyses with State Variables

I hypothesized that positive affect, state nature relatedness, and state trust would act as mediators, but since they were unrelated to the fish indices this was not tested (since mediation is impossible if the mediator is not related to the outcome). The correlations between all the state variables and fish indices are presented in Table 7. Both negative affect and how connected participants felt to an urban centre did related to the fish indices and were subsequently tested as mediators with condition being the independent variable and the cooperation indices as the dependent variables. These mediations, tested by bootstrapping (Preacher & Hayes, 2004), were not significant, because zero is contained in all confidence intervals (see Table 6). Therefore, even though the videos are impacting the participants fishing behaviours in this study, it does not appear to be through the hypothesized paths of nature relatedness, trust, or affect.

Table 6

Mediations of INS-Urban and Negative Affect predicting Fish Variables

	95% CI for INS-Urban	M(SE)	95% CI for Negative affect	M(SE)
Fish taken total	-.37, .29	-.04(.15)	-.30, .16	-.07(.12)
Fish taken average	-.34, .38	.02(.18)	-.07, .65	.20(.18)
Profits	-.05, .06	.003(.03)	-.03, .06	.01(.02)
Restraint	-.12, .02	-.04(.03)	-.14, .01	-.04(.04)
Efficiency	-.13, .02	-.04(.04)	-.14, .02	-.05(.04)

N = 96.

Table 7

Correlations between State Variables and Fish Outcomes

	Correlations										
Variable	1	2	3	4	5	6	7	8	9	10	11
1. Positive Affect	-										
2. Negative Affect	.11	-									
3. Pleasant Affect	.71**	-.14	-								
4. INS-Nature	.21*	-.12	.16	-							
5. INS-Urban	.04	.08	-.16	.27**	-						
6. Trust	.11	.01	.14	.23*	.05	-					
7. Seasons	.03	-.19	.07	.11	-.13	.14	-				
8. Fish Total	.09	-.02	-.19	.00	.02	.08	.08	-			
9. Fish Average	.05	.20	-.03	-.16	.09	-.15	-.94**	-.10	-		
10. Profit	-.11	.12	-.11	-.16	.08	-.04	-.76**	.36**	.69**	-	
11. Restraint	-.08	-.24*	.05	.11	-.21*	.09	.89**	-.16	-.86**	.77**	-
12. Efficient	-.10	-.24*	.04	.11	-.21*	.10	.87**	-.15	-.89**	-.76**	.99**

$N = 96$. $^{*}p < .05$. $^{**}p < .01$

Demographic Variables

In terms of demographics, the age of participants did not correlate with the average number of fish harvested, $r = -.02$ (all demographics were examined with the average number of fish harvested per season because this variable represents cooperation and sustainability more directly than the other measures). Gender marginally predicted the average number of fish harvested with females harvesting slightly less fish per round than males, $t(38.71) = 1.84, p = .07$. The way participants traveled to campus (outdoor versus indoor route or a mix of the two) did not predict the average number of fish harvested, $F(4, 90) = .41, p = .80$. Finally, where participants live now (urban versus rural or a mix between the two) did not predict the average number of fish harvested, $F(4, 91) = .21, p = .93$.

Discussion

Nature exposure seems to provide psychological benefits to individuals such as higher positive affect and lower negative affect (Nisbet et al., 2009; Weinstein et al., 2009). This study sought to replicate these findings and extend this research by examining the relationship between nature exposure and cooperation. Cooperation, as measured by a commons dilemma, may have implications for pro-environmental behaviours since common dilemmas exist all around (i.e. forests, oil, and animal species; Gifford & Hine, 1997). Cooperation may be one possible way to improve the state of the environment because everyone is working towards the same goal. By having more people working together the payoffs may be greater as well. Other variables have been investigated to improve the state of the environments such as nature relatedness, but most of this research is correlational. This was one of the first experimental studies to

systematically manipulate nature exposure and measure cooperation, thus examining causality more closely. The main hypothesis in this study was that participants in the nature condition would cooperate more in the commons dilemma than participants in the urban condition. The secondary purpose of this study was to examine how nature exposure may influence cooperation in an environmental context by examining potential mediators (state trust, affect, state nature connectedness) and interactions (trait trust, trait nature relatedness).

The main hypothesis that participants exposed to nature would cooperate more in the commons dilemma than participants exposed to urban environments was largely supported. Almost all the cooperative indices of the fish simulation were significantly higher for the nature condition than the urban condition. The secondary purpose of this study (testing the causal mechanisms of this relationship) produced less conclusive results. State nature connectedness, trust, and affect did not mediate the relationship between video type and cooperation. In addition, trait trust and nature connectedness did not interact with video type to predict cooperation (although trait nature connectedness did negatively correlate with the profits participants made).

Nature Exposure and Cooperation

Overall, this study provided support for the idea that nature exposure can increase cooperation. These results are novel, but consistent with Weinstein et al. (2009) where nature exposure was shown to increase generosity among participants and self-reports of intrinsic aspirations (e.g., personal growth). This is especially intriguing as relatively little research has examined the outcome of nature exposure on how we interact with others (most of the research completed in this area focused on individual benefits such as

well-being, affect, and relaxation). This study extended the Weinstein et al. (2009) study by measuring participants' behavior in the commons dilemma rather than using self-reports. This behavioural measure may provide a less biased way to measure cooperation (rather than using self-reports). Also, where the nature manipulation depended on immersion in Weinstein et al. (2009), the nature exposure used in this study did not depend on affect, trust, or nature relatedness. Although these results may have depended on immersion in this study (had it been measured), the results still demonstrate that there appears to be a significant relationship here without the immersion interaction. This may occur because the nature video used in this study was more immersive than the photos used in Weinstein et al. (2009). Thus, it may be that less engaging nature manipulations such as photos depend on immersion but more immersive manipulations do not.

In the commons dilemma there were two fish variables of particular importance; the number of seasons the simulation progressed into, and the average number of fish participants harvested per season. These two indices demonstrate sustainable behaviours more directly than the other indices (the profits participants received could represent more or less cooperative behaviours depending on the rules of the game, but not necessarily cooperation). The researcher can program the other fishers to act more or less cooperatively (although in this game the rules were held constant and the participants played against computer fishers to ensure they all responded to the same situation). Since both the number of seasons and the number of fish participants harvested significantly differed between conditions, these results offer preliminary support for the idea that nature exposure can facilitate cooperation in an environmental context, and suggests a promising line of research for other areas of environmental behaviour. The nature

condition cooperated more than the urban condition even though the rewards for not cooperating may have been higher than the rewards for cooperating. That is, participants may have made more money if they exhausted the fish resource on round one rather than restrain harvests. This has important implications because the earth is full of common dilemmas (Gifford & Hine, 1997) such as endangered animals and non-renewable resources. If individuals are willing to take less for themselves, this may be applied to managing other resources to improve the state of the environment.

An alternative explanation for the positive relationship found between nature exposure and cooperation may be priming. It is possible that participants were simply primed in the nature condition with seeing the environment and animals (after the video) so when it came time to harvest resources, thoughts of the environment and animals were more accessible (or at the forefront of their minds). This may have increased participants' cooperation in the nature condition. In comparison, participants in the urban condition may not have cooperated as much (or harvested more fish) because they did not have this nature prime. Instead they watched a video about architecture, shopping malls, and observed people walking around the busy streets of New York City. Future research may wish to further investigate these possible priming effects of nature and urban environments. For instance, Weinstein et al. (2009) demonstrated that urban environments increased extrinsic goals (such as money and fame). The same may have occurred here with participants in the urban environment thinking more of money (compared to participants in the nature condition), which then increased their harvests. Participants in the nature condition may have been thinking more about the animals, which then decreased their harvests. Future research may also wish to use a non-

environmental commons dilemma (one that does not focus on environmental resources) to examine cooperation alone without nature possibly priming people through nature. For instance, participants would still be exposed to nature but then play a commons dilemma about managing non-environmental resources so that the effects of nature on cooperation (not in an environmental context) can be isolated. Thus, the animals and environment seen in the nature video could not prime participants when dealing with an animal or fish resource in the commons dilemma.

In terms of past research, this study did not replicate the finding that nature exposure increases positive affect (Mayer & Frantz, 2004; Mayer et al., 2009; Nisbet et al., 2009; Nisbet, et al., 2010; van den Berg et al., 2003). This may be due to the lesser degree of immersion required to watch a video, although since the nature manipulation was enough to impact cooperation, this explanation seems less likely. Instead, it may be an error with the sensitivity of the measure. The positive affect words used in the affect measure contain mostly active words (i.e. active, excited, enthusiastic), which might not be consistent with sitting in a closet watching a video. Both pleasant nature affect and negative affect did significantly differ between conditions, which is consistent with the previous research mentioned above. This provides support to the finding that nature videos may provide psychological benefits through affect. This may be useful and practical for people who cannot always access nature such as the elderly, people with physical disabilities, or acute care patients.

This study did not replicate the finding that nature exposure increases nature connectedness or relatedness. Although past research has demonstrated that feeling connected to nature at the trait level is related to pro-environmental behaviours (Nisbet et

al., 2009; Mayer & Frantz, 2004; Schultz, 2002), this study supports the idea that nature exposure alone may be able to increase pro-environmental behaviours by promoting cooperation. It also suggests that consciously feeling connected to nature may not be vital to this relationship. Participants in the nature condition did not indicate they were any more connected to nature than participants in the urban condition, but they still cooperated more in the commons dilemma. However, it is possible that even though participants did not consciously feel more connected to nature, they were more implicitly (or less consciously aware) that they were more connected. For instance, individuals may have felt slightly more connected to nature but then when they were asked to consciously evaluate how connected they felt, they did not perceive a connection. This could be researched further by using an implicit awareness test (such as the Implicit Association Test (IAT; Bruni & Schultz (2010); Greenwald, McGhee, & Schwartz, 1998). Additionally, it may be that the measure used in this study to assess nature connectedness (Inclusion of Nature in Self Scale) did not detect any difference because it was only comprised of one question. Although short questionnaires can be very useful, a more sensitive measure (or longer measure) may be useful for the next study.

In terms of the causal mechanisms of this relationship, state nature relatedness, state trust, and affect did not mediate the relationship from nature exposure to cooperation. State nature relatedness and trust did not differ between the conditions; therefore, they were not mediators. Although nature provided some affective benefits (higher pleasant nature affect and lower negative affect), those did not mediate the relationship from nature exposure to cooperation either. This lack of mediation demonstrates that cooperation (in this study) was not simply due to affective benefits

gained from the nature video. Although past research has demonstrated that positive affect and positive group atmospheres increased cooperation (Bierhoff & Muller, 1999; Hertel et al., 2000), positive affect was not needed in this study for cooperation to occur. Thus, there appears to be something about nature that seems to be increasing cooperation but it is unknown from the results of this study. Other potential mediators may be investigated in future research such as restoration. According to Attention Restoration Theory (Kaplan, 1995; Kaplan & Kaplan, 1989) nature is able to restore our cognitive resources (such as directed attention) because it provides "soft fascination." Thus, participants in the nature condition may have performed better in the commons dilemma because they had restored cognitive resources and were able to think through the dilemma more than someone who may have been in the urban condition. The commons dilemma used in this study did require participants to use some cognitive resources, e.g., "how many fish will be left next season if I take five this season," especially when practicing the game. Another potential mediator that may be evaluated with regards to nature exposure and cooperation may be stress. Previous research (Stress Recovery Theory, Ulrich, 1984) has demonstrated that subjects may be less stressed after nature exposure. It may be that participants in the nature condition felt less stressed after the nature video so they were able to perform better. Given that this study was completed with students who are coming and going from classes or work, this seems like a possible explanation. Future research may wish to examine these two variables as mediators between nature exposure and cooperation.

Trait trust in this study had no effect on cooperation. High trusting individuals did not cooperate more or less than low trusting individuals (when exposed to nature).

Previous research (Brann & Foddy, 1987; Hine & Gifford, 1991, as cited in Gifford, 1997; Mosler, 1993) is mixed as to whether trust predicts cooperation. One study found that trust was important when subjects could see what other subjects were doing (as they would have been able to do in this study); otherwise high trusting individuals perform the same as low trusting individuals (Sato, 1989). Another study found that high trusting individuals decreased their harvests (of sheep) when the resource started to decline, compared to low trusting individuals (Brann & Foddy, 1987). However, they also found that high trusting individuals harvested more sheep when the resource was at an optimal level and before deterioration. The present study supports the meta-analyses completed by Hine & Gifford (1991, as cited in Gifford, 1997) that trust does not impact cooperation.

Trait nature relatedness only correlated significantly with one of the variables from the commons dilemma. The participants who felt more connected to nature (regardless of condition) tended to make less profit than participants lower in trait nature relatedness. However, as already mentioned above, profits could have been higher or lower depending on how the simulation was structured. Nature relatedness did not correlate with any of the other fish variables suggesting this is a weaker relationship. Individuals who are highly connected to nature may not have cooperated in this environmental context because they knew it was a simulation of environmental resources and not real resources. Maybe in a commons dilemma in the real world (i.e. lowering your thermostat to conserve fuel) they do cooperate but in a lab study do not.

Neither trait nature relatedness nor trust interacted with nature exposure to produce cooperation. Again this seems to imply that nature exposure (on its own) does

not depend on the variables examined in this study such as trait trust and nature relatedness. Future research may examine other personality traits such as the role of intrinsic versus extrinsic value orientation and whether this increases cooperation. As already described, Sheldon & McGregor (2000) found that individuals who were more extrinsically orientated (more concerned with acquiring money and fame) harvested more and their resource depleted more quickly than individuals who were more intrinsically orientated (more concerned with community and intimacy). Thus, it may be that individuals who hold a more intrinsic orientation cooperate more (regardless of condition) because they are more concerned with community goals and social relationships. In comparison someone who is more extrinsically orientated may be more concerned with making a profit from the commons dilemma so they harvest more when they are reminded of this (in the urban condition). When they are exposed to nature however, this may motivate more intrinsic aspirations (as it did in Weinstein et al., 2009) which makes them more likely to cooperate.

Strengths, Limitations, and Future Directions

Despite the null findings reported with mediators and interactions, this study does provide evidence that a significant relationship exists between the nature exposure and cooperation. An important strength to this study was the experimental design. Participants were randomly assigned to condition (urban versus nature) and then the outcome variable was measured (in this case cooperation). This increases the internal validity of the study and lowers the probability that a third variable may have been responsible for the outcome (instead of the independent variable). However, a limitation to using an in-lab study is that participants are all from the undergraduate sample. It is

unknown (from this study) if these results will generalize to different ages, ethnic groups, or geographical areas. Another drawback to experimental research is the lower external validity compared to studies completed in the real world. Future research could address this concern by using different exposures to nature (actual nature) and different video clips for the nature and urban manipulation. This would allow researchers to examine the generalizability of these results and whether they hold for any nature video. It is also possible that the results found in this study may be due to a difference between the videos. For example, the nature video (the Planet Earth clip) is more well-known and participants may have been more excited by it than the New York video. Although New York City is also an exciting destination so this seems less likely. Finally, the dose-response relationship should be further examined. For instance, what is the difference between nature videos, nature photographs, murals, or real nature on cooperation? Is there a threshold of nature immersion that must be met to observe effects such as cooperation or affective benefits?

In this study, cooperation was measured in the short term immediately after nature exposure. It is unknown how these results would translate long term or how long this effect lasts. It may be that individuals are primed in the short term to act cooperatively but the results only last a short period of time. This study supports the idea that nature exposure increases cooperation in the short term (in an experiment). A nature intervention could be investigated in the future to establish the length of the effect and whether the effect of nature works as effectively the second or third time participants are exposed to it.

As mentioned, the results from this study should be investigated and evaluated in the real world even though the commons dilemma employed in this study was designed to be as real as possible; i.e. participants could make real money and the computer fishers were programmed to act moderately cooperatively. Nonetheless, the simulation did reach a ceiling effect (60% of participants proceeded into season 15), a longer simulation may be able to provide more variability among participants and uncover different patterns. Also the payoffs were smaller in this study, it may be that as the payoffs get larger participants are not willing to act in a cooperative manner. It may be that these results extend past the lab and can be used in society for encouraging more cooperation and pro-environmental behaviours. Thus, by increasing the amount of nature participants see on a daily basis, behaviours that require cooperation can be increased. This can be accomplished by adding more nature to public spaces (such as more images, window views, sounds of nature, videos of nature) to increase cooperation. Public schools and workplaces may especially benefit from more nature since it also improves affect (higher pleasant affect, lower negative affect). This study is consistent with past research that demonstrates more nature exposure and feeling connected to nature at a trait level is correlated with helping to improve our environment as measured with self-report ecological behaviour and environmentalism (Mayer & Frantz, 2004) at the same time that we receive benefits (affective benefits; Mayer & Frantz, 2004; Mayer et al., 2009; Nisbet et al., 2009; Nisbet, et al., 2010; van den Berg et al., 2003). Environmental organizations such as Nature Canada or World Wildlife Fund (WWF) may be able to increase the effectiveness of their advertisements by incorporating more nature into their messages, especially for environmental behaviours where cooperation may be beneficial. Lastly,

this study highlights the importance of keeping city spaces and nature accessible for all people so that everyone can reap these benefits.

Finally, future research should also examine why participants chose to cooperate in the commons dilemma. Did they choose to cooperate for pro-social reasons (to sustain the resource) or did they cooperate for more selfish reason (to sustain the resource for a longer period of time in order to earn themselves higher profits)? This could be examined through questionnaires at the end of a commons dilemma. Alternatively, researchers may also wish to manipulate more parameters of the simulation so that certain choices (i.e. more selfish cooperative choices or more pro-social choices) are more profitable than others. These manipulations may help distinguish between reasons for cooperating. This may be important if these results were to be applied to the real world (or as an intervention). Knowing this information may help advertisers focus on which ads work best for which reasons. It may be that participants who cooperate for more pro-social reasons are motivated by a different type of advertisement compared to participants who cooperated for more selfish reasons.

Conclusion

Overall, this study provides support to the idea that nature exposure can influence affect and behaviour. Even though the nature manipulation was a short exposure to nature (around ten minutes), participants still experienced more pleasant nature affect and less negative affect compared to participants in the urban condition. This nature exposure also increased participants' cooperation, and improved the way they managed environmental resources, compared to the urban condition. Although a ten-minute nature exposure will not change the world, it may still be able to provide a step in the right direction of

cooperation and more environmental behaviours. This provides a promising direction in researching different ways we can promote environmental sustainability. Thus, integrating more nature into our daily lives may be of critical value in today's world.

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Appendix A: Big Five Factor Inventory (BFFI)

Instructions: For each of the characteristics listed below, rate how descriptive each characteristic is of you using the scale from 1 to 5 as shown below:

1	2	3	4	5
Disagree strongly	Disagree a little	Neither Agree or disagree	Agree a little	Agree strongly

I see myself as someone who/whose . . .

1. Is talkative _____
2. Tends to find fault with others _____
3. Trusts other people (trust) _____
4. Does a thorough job _____
5. Is depressed, blue _____
6. Is original, comes up with new ideas _____
7. Is reserved _____
8. Is helpful and unselfish with others _____
9. Can be somewhat careless _____
10. Is relaxed, handles stress well _____
11. Is curious about many different things _____
12. Is full of energy _____
13. Starts quarrels with others _____
14. Is a reliable worker _____
15. Believes other people are inclined to help others and not simply look out for themselves (trust) _____
16. Can be tense _____
17. Is ingenious, a deep thinker _____
18. Generates a lot of enthusiasm _____
19. Takes notice of wildlife wherever I am (nature relatedness) _____
20. Has a forgiving nature _____
21. Tends to be disorganized _____
22. Believes others will take advantage of you (trust) _____
23. Worries a lot _____

24. Has an active imagination _____
25. Tends to be quiet _____
26. Is generally trusting _____
27. Tends to be lazy _____
28. Is emotionally stable, not easily upset _____
29. Ideal vacation spot would be a remote, wilderness area (nature relatedness) _____
30. Is inventive _____
31. Has an assertive personality _____
32. Can be cold and aloof _____
33. Perseveres until the task is finished _____
34. Always thinks about how my actions affect the environment (nature relatedness) _____
35. Can be moody _____
36. Values artistic, aesthetic experiences _____
37. Is sometimes shy, inhibited _____
38. Is considerate and kind to almost everyone _____
39. Believes human nature is fundamentally cooperative (trust) _____
40. Does things efficiently _____
41. Remains calm in tense situations _____
42. Prefers work that is routine _____
43. Feels very connected to all living things and the earth (nature relatedness) _____
44. Is outgoing, sociable _____
45. Believes other people care about you (trust) _____
46. Is sometimes rude to others _____
47. Makes plans and follows through with them _____
48. Gets nervous easily _____
49. Connection to nature and the environment is a part of my spirituality (nature relatedness) _____
50. Likes to reflect, play with ideas _____
51. Has few artistic interests _____
52. Relationship to nature is an important part of who I am (nature relatedness) _____

53. Likes to cooperate with others _____
54. Is easily distracted _____
55. Is sophisticated in art, music, or literature _____

Appendix B: Trust Measure (State)

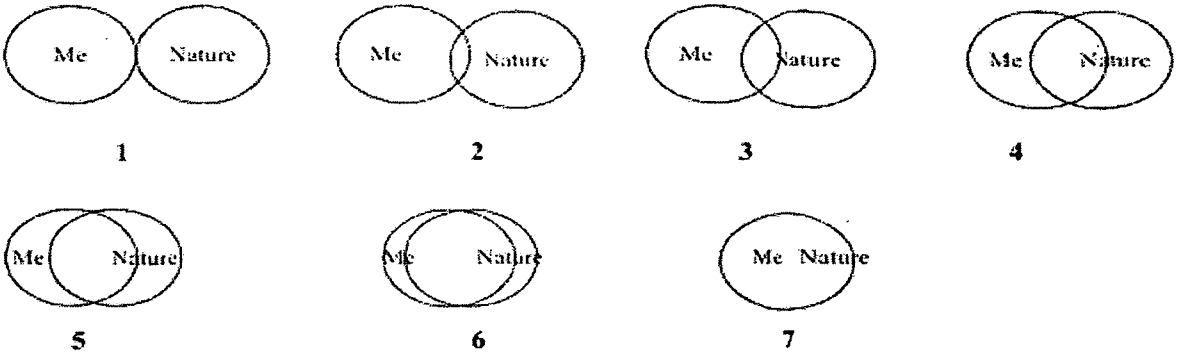
Instructions: Please indicate your agreement with the following scale to each of the questions listed below.

1	2	3	4	5
Disagree strongly	Disagree a little	Neither Agree or disagree	Agree a little	Agree strongly

1. I expect that my group members will be trustworthy _____
2. I expect that my group members will act in a cooperative manner _____
3. I expect this game will go well with the group I have _____

Appendix C: Inclusion with nature in self scale[3]

Please circle the picture below that best describes your relationship with the natural environment at this moment in time. How interconnected are you with nature right now?



[3] For the questions that ask participants to rate how connected they feel with other people, family, friends, community, etc., the second circle (currently labeled nature) was replaced.

Appendix D: Positive and Negative Affect Scale (PANAS)

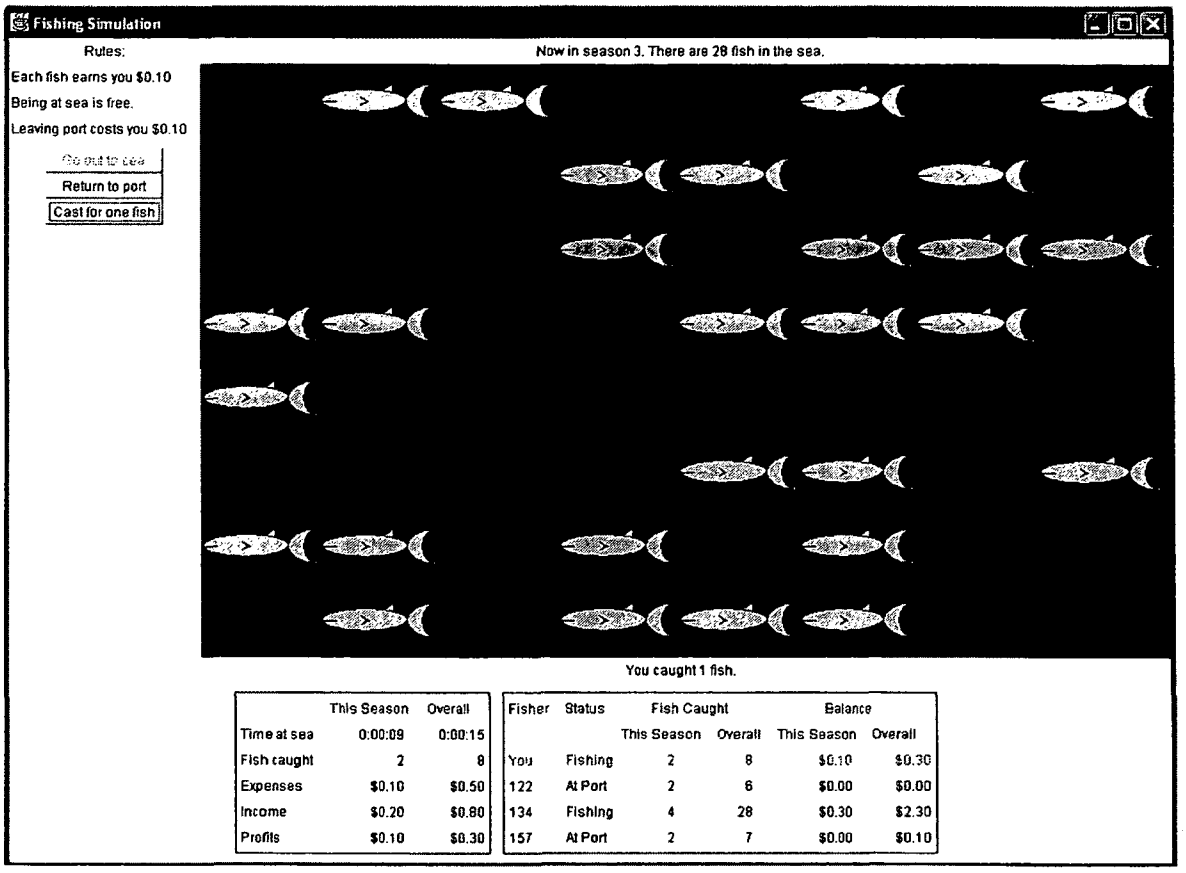
Below is a scale which consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now. Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	**a little**	**moderately**	**quite a bit**	**extremely**

_____	interested		_____	irritable
_____	distressed		_____	alert
_____	excited		_____	ashamed
_____	upset		_____	inspired
_____	strong		_____	nervous
_____	guilty		_____	determined
_____	scared		_____	attentive
_____	hostile		_____	jittery
_____	enthusiastic		_____	active
_____	proud		_____	afraid
_____	fascinated		_____	in awe
_____	curious		_____	sad
_____	relaxed		_____	joyful

Appendix E: Fish 3

Below is a screen shot of how the commons dilemma appeared for participants. On the right-hand side, participants can cast for one fish and decide when they want to return to port. At the bottom, participants can view their profits and expenses as well as see other group members' harvests during the seasons.



Appendix F: General Information

Please think back to where you were just before you came to participate in the study.

Were you already on campus? ___ yes ___ no

If 'yes,' where (e.g., building/location)? _____

If 'no', how did you get to campus (e.g., car, bus, walk)?

_____

When travelling across campus to the study (6111 HCI), was your route ___ ?

1	2	3	4	5
Completely Indoors		An even mix of In & Outdoors		Completely Outdoors

Sex: Female/ Male (please circle one)

Age:_____

What is your current year of study at Carleton University?

_____ 1st year (undergraduate) _____ 2nd year (undergraduate)

_____ 3rd year (undergraduate) _____ 4th year (undergraduate)

_____ master's _____ doctoral

What is your major: _____

Where did you spend the most time while growing up? (please choose only one response from the options below)

___ city ___ small town ___ rural or farm

___ other (please specify: _____)

Where do you live now?

___ campus residence ___ small town

___ city ___ rural or farm

___ other (please specify: _____)

Overall, where would you place yourself, on the following scale of liberalism-conservatism?

1	2	3	4	5
Extremely Liberal				Extremely Conservative

In terms of social and cultural issues (e.g., abortion, separation of church and state, affirmative action), where would you place yourself on the following scale?

1	2	3	4	5
Extremely Liberal				Extremely Conservative

In terms of economic issues (e.g., taxation, welfare, privatization), where would you place yourself on the following scale?

1	2	3	4	5
Extremely Liberal				Extremely Conservative

Appendix G: General Assessment

INSTRUCTIONS: Please answer the following questions very briefly in the space provided.

1. Do you have any questions that you would like answered about the study so far? If so, what?

2. Has there been anything about the study so far that was disrupting, puzzling, or that you wondered about?

3. Please describe in your own words what you think the study is about.

4. Have you had cause to wonder whether or not there might be aspects of the study that have not been explained to you? If so, what have you had cause to wonder about?