Caring for the Living: Adult's and Children's Moral Judgments of Harm to Plants and Artifacts

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Abstract

Little is known about whether humans show moral concern for harmful actions toward non-human entities like plants, or if how others treat plants influences social preferences. It is also unclear when these possible concerns develop. We address these gaps in two studies: Study 1 with adults (n=153) and Study 2 with 3- to 6-year-old children (n=129). Participants watched a video of a plant restorer who restored a plant but knocked down a bucket, and a plant harmer who restored a bucket but knocked down a plant. Adults preferred the plant restorer over the plant harmer, chose the plant harmer as the bad guy, and evaluated it more positively for restoring the plant than the bucket. Children showed similar patterns—especially those with greater biology knowledge—but did not prefer the plant restorer. These findings help understand early moral reasoning regarding non-human nature and how people value living versus nonliving entities.

Keywords: Moral concern; social preferences; biology knowledge; plants; non-human nature

Introduction

Under many circumstances, humans express moral concern for others, including family, friends, and strangers. This tendency seems to begin early in life—toddlers and young children judge harming others as morally wrong and prefer individuals who act kindly toward others (Smetana et al., 2018; Van de Vondervoort & Hamlin, 2017; Woo et al., 2022). While decades of research has investigated humans' moral concern for other humans, less is known about whether people extend similar concern to other entities, including non-human animals or plants. Plants are an interesting test case of moral concern toward non-humans because of their distant phylogenetic relationship to humans and because they share very few physical features with humans compared to other animals. In this paper, we examine adults' and children's moral concern for non-human species, focusing on plants. To do so, we ask whether adults and children negatively evaluate actions that could result in harm toward plants, and whether they base their social evaluations on how others treat plants.

The relatively few studies that have investigated moral concern for the broader natural world have found that adults judge harming non-human nature negatively. For instance, adults say that polluting a river, polluting the air, or mistreating animals is wrong (Hussar & Horvath, 2011; Kahn & Lourenço, 2002; Pizza & Posada, 2020, 2025). Interestingly, moral concern for non-human natural entities varies across development. Compared to adults, children are more concerned about environmental harm (Pizza & Kelemen, 2023) and insect extinction (Kelemen et al., 2023), and are less willing to sacrifice a large number of non-human animals to save a single human (Wilks et al., 2021). More broadly, children seem to have a wider moral circle than adults, that is, they care for a wider variety of entities than adults (Marshall et al., 2025).

However, little is known about how children and adults think about harm toward plants. On the one hand, research on how children and adults evaluate harm toward outgroup members (McLoughlin et al., 2018; Zhou & Hare, 2022) suggests that people may not care about plants because they are phylogenetically very distantly related to humans. Moreover, children in the US—typically those younger than 6 years old—tend to group plants and artifacts together, often saying that plants are not alive because they do not move, similar to artifacts (Bascandziev et al., 2018; Carey, 1985; Leddon et al., 2008). Another reason to doubt that children would negatively evaluate harm toward plants is that previous research has suggested that cues such as eyes and self-generated motion, or more broadly the inference that entities have minds, increase moral concern toward non-human entities (Epley et al., 2007; Gray et al., 2012; Pizza & Kelemen, 2025; Waytz et al., 2010). Together, this suggests that, intuitively, people may be less morally concerned about harm to plants than about harm to people, putting them on par with artifacts.

On the other hand, infants seem to recognize plants as distinct from artifacts: they take longer to touch plants than they do artifacts, including dangerous objects like knives, and artifacts that share perceptual features with plants (Elsner & Wertz, 2019; Wertz, 2019; Wertz & Wynn, 2014). Also, infants engage in more social referencing—looking to caregivers for cues when presented with plants compared to artifacts (Elsner & Wertz, 2019). Additionally, even though children younger than 6 year olds group plants with artifacts, 4-year-old would recognize that plants but not artifacts can heal themselves and by the age of 5 to 6 years old children recognize that plants grow and need water (Anggoro et al., 2008; Backscheider et al., 1993; Inagaki & Hatano, 1996), which shows they have some basic biological understanding of plants, which might motivate greater moral consideration of plants compared to artifacts. In sum, although human

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infants recognize plants and distinguish them from artifacts, in many contexts, older children struggle to recognize that plants are alive and group them with artifacts as opposed to with animals and humans.

Thus, it is unclear whether children distinguish between harm toward plants compared to harm to artifacts, as well as to what extent understanding that plants in contrast to artifacts are alive matter for their reasoning. If children treat plants like artifacts (as prior concept-learning work may suggest), they should not differentiate harm to plants vs. artifacts. Alternatively, if even young children track living vs. nonliving status in moral contexts, they should judge harm to plants as worse. In this paper, we ask (1) whether adults and children judge harmful actions to plants as worse than equivalent actions to artifacts, and (2) whether they use others' treatment of plants to guide social preferences. We further test whether children's biological knowledge predicts these evaluations.

Study 1

We employed a method previously used in the literature to assess infants' and toddlers' preferences for prosocial versus antisocial actors. In this study, the actors performed the same actions, but the targets varied (kicking a backpack versus kicking a person; Buon et al., 2014). In our study, we presented participants videos that featured two puppets (large, furry monster puppets), the plant restorer and the plant harmer, each performed the same two actions. The plant restorer picked up a fallen plant and knocked down a bucket. The plant harmer picked up a fallen bucket and knocked down a plant. Participants were asked about their social preferences toward the puppets, their moral evaluations of the puppets, and their moral evaluations of each action. The methods and analysis approach were preregistered and available at this link: https://osf.io/6dsyj/o verview?view_only=9f73c47911544d55ade7b72cdebd7e65

Methods

Participants We recruited 153 adults (M Age = 36, SD = 7.79; 42% women) living in the United States on the Prolific platform. All participants were compensated and provided consent to participate in the study, in accordance with IRB guidelines. The final sample size matched the recommended size from a power analysis to detect Cohen's h = 0.26 with alpha = 0.05 in a binomial test, with 90% power.

Stimuli Each participant watched a video with four scenes described below (24 seconds each). The plant-restoring scene started with a plant lying on the table with soil spilled around it. Then a puppet entered, looked at the plant, said "hmmm," picked it up, and put the soil back into the pot. The puppet then left, leaving the restored plant on the table. The plant-harming scene started with a plant upright on the table. Then, a puppet entered, looked at the plant, said "hmmm," and knocked it over. The puppet then left, leaving the plant lying on the table with soil spilled around it. The artifact videos were identical, except that the plant was replaced with a bucket containing rocks. Moreover, the videos did not explicitly communicate the puppets' intentions, but they were designed to look intentional. Refer to Figure 1 for stills of these scenes. A single puppet's videos were always shown in succession (e.g., one puppet in the plant-harming video, then artifact-restoring video; then the other puppet in the plant-restoring video, then artifact-harming video).

We counterbalanced three factors: a) the color of the restorer puppet (Purple vs. Orange); b) the order in which the restorer actor was presented (first vs. second); and c) whether the restoring action was presented first or second. Participants were randomly assigned to one of these orders.

Procedure Participants watched each video at normal speed: two videos of one puppet (e.g., Mr. Purple), followed by two videos of the other (e.g., Mr. Orange). After watching two puppet videos, they completed a memory check (e.g., "What did Mr. Purple do?") to ensure they remembered what the puppet did. Each video was also followed by a question to verify their attention (e.g., "Select the best answers for both what you see and what you hear in the video you watched").

Next, participants saw stills of both puppets and answered three questions about their social preferences: a) Who do you trust more?; b) Who would you rather be a member of your community?; c) Who do you like more? They also answered two questions about moral evaluation: a) Who is the good guy?; b) Who is the bad guy? All five questions were presented in random order. We excluded participants from analysis if they chose the same puppet for both "Who is the bad guy?" and "Who is the good guy?" questions.

Subsequently, participants were asked about their moral judgments of each action (e.g., "Do you think it was okay or wrong that Mr. Purple picked up the plant?"). Depending on their response, they were then asked to indicate the extent of their judgment: if they thought the action was wrong, they rated how wrong it was (from "a little bit wrong" to "very, very wrong"); if they thought it was okay, they rated how okay it was (from "a little bit okay" to "very, very okay"). We converted these to a scale from 1 = *Very, very okay* to 6 = *Very, very wrong*.

Analysis To determine whether participants' social preference for the plant restorer significantly differed from chance (0.5), we conducted two-tailed binomial tests with each of the three social preference questions and the moral evaluation question. In all these analyses, we checked whether any of the counterbalanced factors influenced participants' answers using a mixed-effects model.

To test whether participants evaluated the actions toward the plant and bucket differently, we conducted two within-subjects paired t-tests. We also checked whether any of the counterbalanced factors influenced participants' moral evaluations of harm and restoration using a linear mixed-effects model, with the patient (plant or bucket) and the three counterbalanced factors as predictors, and participant ID as a random intercept.

Results and Discussion

Across all three social evaluation questions, adults preferred the plant-restorer puppet (see Figure 2). They said that they

liked him more (73%, Cohen's h = 0.47, p < .001), trusted him more (74%, Cohen's h = 0.50, p < .001), and would rather have him as a member of their community (76%, Cohen's h = 0.56, p < .001). None of the counterbalanced factors had affected their answers.

Most participants said the plant-harmer was the bad guy in comparison to the plant-restorer (75%, Cohen's h = 0.51, p < .001). None of the counterbalanced factors had affected participants' answers.

When we compared participants' judgments of the two harmful actions (see Figure 2). We found that adults judged harming the plant as worse (Mdn = 5) than harming the artifact (Mdn = 4) (V = 3452, r = 0.61, p < .001).

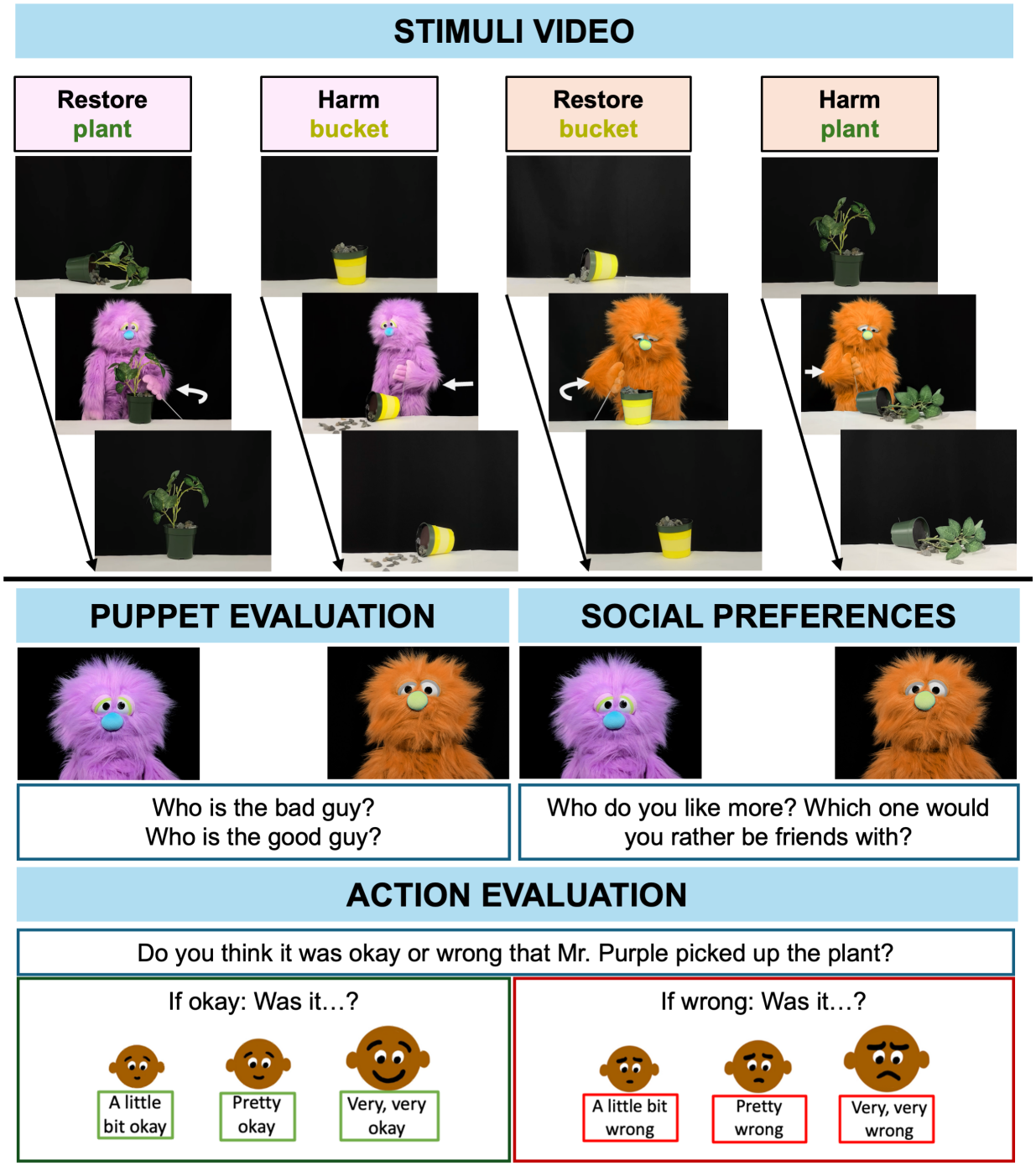

Figure 1: Stimuli used across experiments. [Top] Example stills from videos a single participant would see. Left side: plant restorer/bucket harmer. Right side: bucket restorer/plant harmer (colors, actions order, and puppets order were counterbalanced across participants). [Middle] Social evaluation measures. [Bottom] Action evaluation questions.

Likewise, adults said restoring the plant was better (Mdn = 1) than restoring the artifact (Mdn = 1), although the difference was moderate (V = 125, r = 0.47, p < .001). Again, none of the counterbalanced factors affected these results in the mixed effects models.

In sum, our findings demonstrate that adults prefer individuals who restore plants over those who harm plants. Participants also said the bad guy was the puppet who committed the harmful action toward the plant (see Figure 2). This was true even though both puppets did a harmful and a restorative action. Adults also judged harming plants as worse than harming objects and restoring plants as better than restoring objects. These results raise the question of whether these patterns will be found in young children and whether their knowledge that plants are alive will predict their judgments.

Study 2

To explore this question, we interviewed U.S. American children aged 3.5 to 6.5 years. We chose this age range because previous research in the United States shows that children's biological knowledge undergoes significant changes during this period, with many children around age 6 beginning to identify plants as living things. We used the same videos as in Study 1, but participants were interviewed over Zoom. We explain below some adjustments made to accommodate interviews with young children. The methods and analysis approach were preregistered and available at this link: https://osf.io/nv3z8/overview?view_only=6f0eb0babd164a12a71b08f2612ca6a1

Methods

Participants We recruited 129 children (M age = 4 years, SD = 0.98; 58% girls) living in the United States through our lab database, after excluding children who failed to recall the videos (N = 3) and those who chose the same actor as both good and bad (N = 7). Parents provided consent for their children's participation, and children were compensated with a $5 gift card in accordance with IRB guidelines. The final sample size was calculated using a power analysis to detect Cohen's h = 0.30 with alpha = 0.05 in a binomial test, with 90% power.

Stimuli Children watched the same videos from Study 1 with the same counterbalancing.

Procedure The procedure was similar to Study 1, however, we added memory check questions. After participants watched each scene, they were asked to recall what happened in the video (e.g., "What did Mr. Purple pick up?"). If they answered these questions incorrectly, they were shown the video a maximum of 2 more times. Additionally, after watching the two videos of a puppet, participants were shown pictures of the two actions the puppet did side by side and were asked what was picked up and what was knocked down (e.g., "In the movie, Mr. Purple knocked down something. Can you tell me what it was?"). After that, participants were shown the two puppets and thumbnails of their two actions, and they answered two questions about their social preferences: a) Who do you like more, Mr. Orange or Mr. Purple?; and b) Which one would you rather be friends with, Mr. Orange or Mr. Purple? As in Study 1, participants also answered "Who is the bad guy?" Finally, participants rated each action from *Very, very okay* to *Very, very wrong* using the procedure as described in Study 1.

In addition to the exclusion criteria from Study 1, participants who were unable to recall the videos after watching them three times were excluded from the analyses.

Finally, for exploratory hypotheses, we measured participants' biological knowledge of plants by asking two yes-or-no questions about whether plants can grow and die (e.g., "can plants grow?"), presented in random order. The same questions were asked about the bucket. Moreover, we asked them to choose what is alive between the plant and the bucket. A final score was computed by summing answers in which they recognized that plants are alive and subtracting the cases in which they attributed life to the artifact. In this task, we also included four control questions (e.g., "Do buckets have ears?"). Children who failed any of them (N = 7) were excluded from the final analyses with the biology knowledge score.

Analysis approach We used the same approach as in Study 1, with additional analyses that included age as a covariate. For exploratory purposes, we also conducted analyses examining the effect of biological knowledge on children's answers.

Results and Discussion

Similar to adults, children chose the puppet harming the plant as the bad guy (70%, Cohen's h = 0.41, p < .001). There was a positive effect of age, showing that the older the children, the more likely they were to identify the plant-harmer as the bad guy (OR = 1.04, p = .02), and there was no effect of the counterbalanced factors. However, children did not prefer (i.e., liking or wanting to befriend) the plant restorer puppet (see Figure 2). Additionally, we found that the puppet's color affected children's answers (ps = .04): children tended to choose the purple puppet. We did not find that age affected children's answers.

Finally, children judged restoring the plant as more positive than restoring the artifact (V = 656, p = 0.02), but they judged harming the plant and harming the artifact as similarly negative. However, we found a significant interaction between patient type and age (b = -0.03; SE = 0.01, t(127)= -2.01; p = .046), indicating that as children get older they tend to evaluate more wrong harm to the plant than to the artifact (even though for each patient, the relationship between age and judgments was not statistically significant). We next conducted exploratory analyses to examine the effect of biology knowledge on children's answers. Since, as anticipated, age and biology knowledge were highly correlated (r_s(127) = .55, p < .001), we used a mixed-effects model that included all counterbalanced factors, except age. This approach allowed us to avoid potential multicollinearity. We found that participants' biology knowledge score positively predicted their likelihood of choosing the plant

harmer as the bad guy (OR = 1.60, p = .006). Additionally, we found a significant interaction between patient type and biology knowledge in both models (ratings of harm: b = -0.36; SE = 0.13, t(120) = -2.88; p = .005; ratings of restoration: b = 0.29; SE = 0.13, t(120) = 2.30; p = .02). Specifically, as biology knowledge increases, children judge harming the artifact as less wrong than harming the plant, and they judge restoring the plant as increasingly better than restoring the artifact. Follow-up simple-slope analyses showed that greater biology knowledge was associated with rating harm to the artifact as less wrong (slope = -0.23, 95% CI [-0.44, -0.02], p = W), but had no effect on ratings for the plant. Also, children with more biology knowledge evaluated restoring the plant more positively (slope = -0.24, 95% CI [-0.42, -0.06]), with no such effect for the artifact. No effect of biology knowledge was found in the models predicting social preferences.

In sum, children did seem to distinguish harm toward plants and the same actions toward a bucket. They said that the plant harmer was the bad guy and evaluated restoring the plant more positively than restoring the artifact.

However, their social preferences did not seem to be influenced by the puppets' actions. Additionally, children

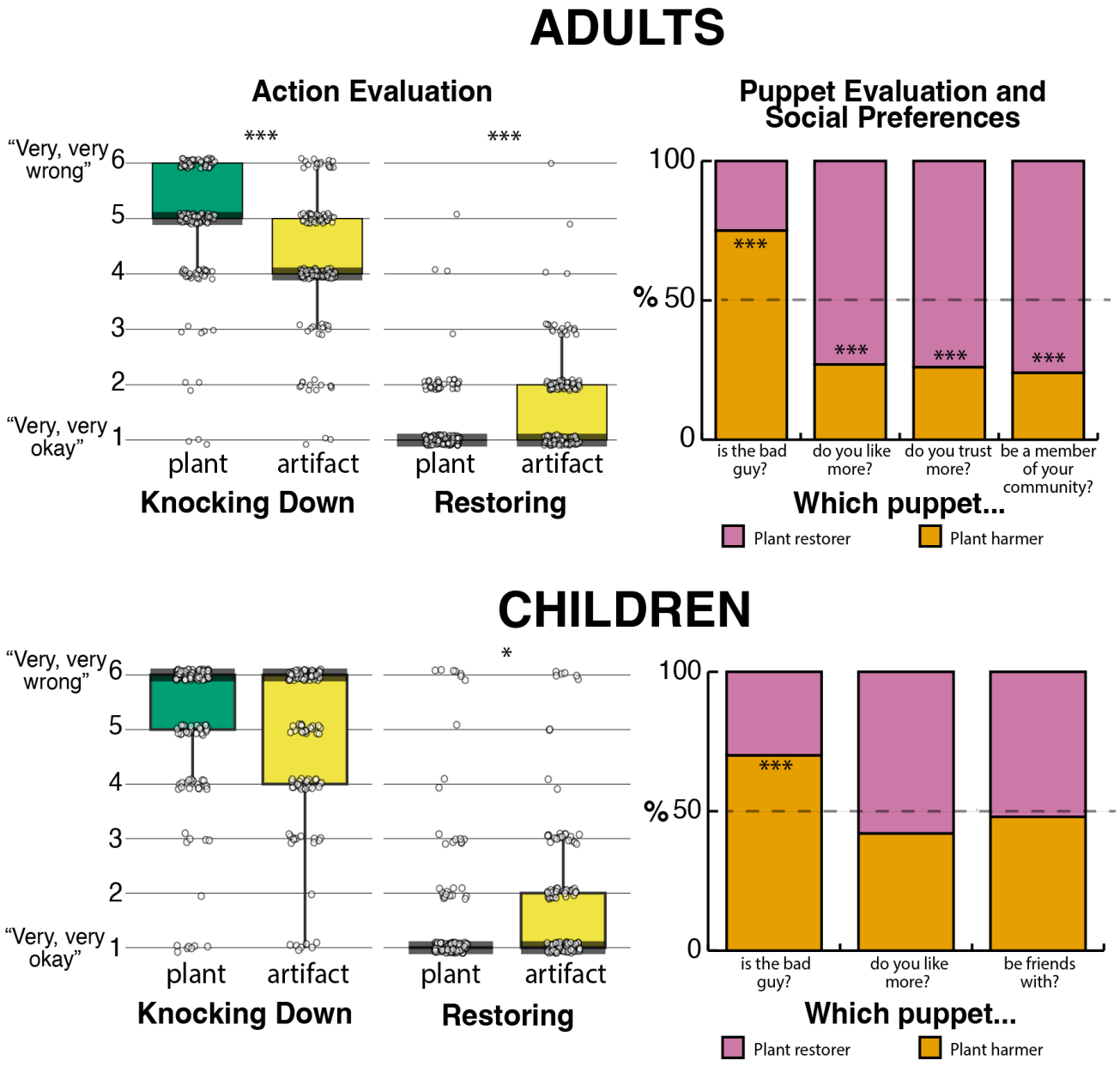

Figure 2: [Top] Adult data; [Bottom] Child data; [Left] Boxplots of participants' evaluations of restoring and harming actions. [Right]: Percentage of participants choosing the plant restorer (pink) or the plant harmer (orange) in social evaluation questions.

with more sophisticated biological knowledge were more like adults: they judged harm to the artifact as less wrong and judged restoring the plant as more positive than did children with less sophisticated biological knowledge.

General Discussion

These studies investigated whether both adults and children extend moral concern to non-human entities, specifically plants. We examined this question with children who are just beginning to say that plants can grow and die and who are starting—around age 6—to identify plants as living things. We found strong evidence that adults negatively evaluate actions that could potentially harm a plant, and mixed evidence on whether children do so. Adults and children alike said the plant-harmer was the 'bad guy' and that restoring the plant was better than restoring the bucket. Because all participants saw each puppet perform one harmful and one restorative action with the same apparent intention, these results cannot be explained by the valence of the actions alone, but also by the target of the actions. Moreover, the ownership of the plant or bucket was not specified—both could have been perceived as owned by someone. Therefore, the differences observed cannot be attributed to the ownership of the target.

Instead, these results suggest that US American adults and children in a controlled context were more concerned about potential harmful actions toward plants than toward artifacts. This was true even among US American children and adults who likely encounter more artifacts than plants in everyday life. One possible explanation is that humans perceive harm to living things as worse and more irreversible than harm to non-living things. This is supported by previous research showing that adults attribute intrinsic value to living, natural entities (often described as a biocentric moral reasoning), and show care for them (Hussar & Horvath, 2011; Kahn & Lourenço, 2002; Pizza & Kelemen, 2025; Ruckert, 2016). This idea is supported by our finding that children with more advanced biology knowledge were more likely to say the plant harmer was the bad guy and tended to judge restoring the plant as better than restoring the bucket. Additionally, some children spontaneously told us during interviews that knocking down the plant was worse than destroying the bucket, because "the plant is growing" or "buckets can't get hurt". However, it's important to note that we did not manipulate biology knowledge experimentally, so the link we observed between biology knowledge and behavior is not necessarily causal. That is, it's possible that other developmental trajectories, such as better working memory, lead children in our task to understand plant biology and perform as expected. It is also possible, though unlikely, that caring for plants motivates children to learn more about plants or biology. Moreover, some artifacts might be especially valuable—such as the Mona Lisa or someone's favorite stuffed animal—while some individual plants may be less valuable—such as a single blade of grass. Also, while most artifacts are built with a purpose, which might be easy for children and adults to detect, the benefit that plants give to humans is not always evident (e.g., most plants on Earth are not edible; Bundela et al., 2023), and the oxygen they produce is not visible). Therefore, more research is needed to determine whether participants' choices were primarily driven by the intrinsic value they might ascribe to living things, as opposed to artifacts.

A related explanation for our results is that, instead of attributing intrinsic value to the plant, individuals are calculating which action yields greater benefit to the actors and other humans (Jara-Ettinger et al., 2016). Our findings may indicate that people may view restoring actions toward plants as more valuable to their owners. Since both artifacts and plants are useful in everyday life, it would be worthwhile to investigate whether, across different scenarios and compared with other types of artifacts, plants are still perceived by most individuals as more beneficial to humans. It might also be worth exploring whether this perception is explicit or implicit. Future research could explore this further.

Finally, there is a low-level explanation: participants may have concentrated on the number of items knocked down and picked up, without paying attention to the type of patient involved in the action. The actions toward plants (whether harmful or restorative) involved a plant, the pot, and soil, whereas the actions toward the bucket involved only the bucket and soil. While our study design doesn't definitively rule out this explanation, the relationship with biological knowledge and the spontaneous explanations given by some participants suggest it is less probable. Nevertheless, future experiments should aim to definitively dismiss this possibility.

Regarding participants' social preferences, we found that although adults consider how others treat plants when deciding whom to trust, include in their community, and like, children seemed not to. In our study, they seemed to focus instead on the puppet's color. Children's biological knowledge also did not predict their answers, suggesting that children were not considering actions toward living things in their social preferences. Our task may have underestimated performance if children struggle to overcome choosing a favorite color, or do not consider monster puppets as viable social partners. We are currently running a similar study with human actors instead of monster puppets. Alternatively, it may be that how others treat plants becomes relevant only later in development when biological knowledge is more stable (Balding & Williams, 2016).

Despite these limitations, our current findings suggest that when many factors are held constant, adults and children believe that harming plants is worse than the same action directed toward artifacts. This suggests that they may care about plants more than objects across many situations. This research not only informs our basic understanding of moral reasoning and social relationships but also may help identify key factors to emphasize when encouraging both adults and children to conserve the natural environment, especially amid the ongoing environmental crisis.

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