

# Leveraging social cognition to promote effective climate change mitigation

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## Abstract:

Effective climate change mitigation is a social dilemma: the benefits are shared collectively while the costs are often private. To solve this dilemma, we argue that we must pay close attention to the nature and workings of human cooperation. We review three social cognition mechanisms that regulate cooperation: norm detection, reputation management, and fairness computation. We show that each of these cognitive mechanisms can stand in the way of pro-environmental behaviors and limit the impact of environmental policies. At the same time, the very same mechanisms can be leveraged as powerful solutions for effective climate change mitigation.

26 Over the past three decades, a number of reasons have been put forward to explain the absence of  
27 behavioral change to address climate change. Behavioral scientists have studied issues related to  
28 risk perception<sup>1,2</sup>, misinformation<sup>3,4</sup>, time discounting<sup>5,6</sup>, and social identity<sup>7</sup>, among others to  
29 explain people’s collective apathy<sup>8</sup>. Indeed, climate change is in part hard to address because it  
30 is a complex, long-term, and diffused phenomenon. Yet, individual climate engagement around  
31 the world has now hit an inflection point. Today, a majority of people believe that climate  
32 change is a serious threat<sup>9,10</sup>, that it is already happening<sup>11</sup>, and that more should be done to  
33 curb CO2 emissions<sup>12-14</sup>. Despite such increasing levels of climate change awareness, mitigation  
34 efforts have been disappointing<sup>15</sup>. People often fail to adopt behaviors that would be impactful,  
35 such as saving home energy or reducing air travel, even when they have access to personalized  
36 information about their carbon footprint<sup>16</sup>. Given the high level of concern around climate  
37 change, what other factors are keeping people from adopting behaviors or supporting policies  
38 that effectively reduce CO2 emissions?

39  
40 Empirical evidence has shown that the social dimension of climate change mitigation partly  
41 accounts for the absence of behavioral change and offers potential solutions<sup>19-21</sup>. Climate  
42 change is a large-scale collective action problem where outcomes are shared but the cost of  
43 behavioral change is often individual. Thus, people must resist the urge to free-ride on the  
44 sacrifices of others while enjoying collective benefits without making any effort. One might  
45 initially think that humans’ unique capacities to cooperate provide fertile ground to address the  
46 collective action problems posed by climate change. Yet, the cognitive mechanisms supporting  
47 cooperation evolved to increase individual fitness, not to maximize total social welfare<sup>22</sup>. As a  
48 result, the cognitive mechanisms involved in regulating cooperation do not necessarily lead to  
49 the most effective outcome from a societal standpoint.

50  
51 Evolutionary biology has demonstrated that cooperation can only evolve if it is conditional: for  
52 individuals, the only evolutionary stable strategy is to cooperate if others cooperate, and stop  
53 cooperating when others do not cooperate<sup>23,24</sup>. The consequence of this constraint is that humans  
54 must develop cognitive mechanisms to detect social norms (i.e. whether the norm is to cooperate  
55 in my environment), to manage their reputation (i.e. to convince others that I am cooperating),  
56 and to compute what is fair and what is not (i.e. to assess whether my benefits are proportionate  
57 to my contribution, and to others’ contribution). In this review, we present evidence that these  
58 three mechanisms - norm detection, reputation management, and fairness computation - push  
59 people to favor reciprocity, observability, and equity over effectiveness in climate change  
60 mitigation. We contrast this with the behavior that people would adopt if they acted as “effective  
61 altruists” (see Box 1 for a definition of effective altruism). We then show that the very same  
62 cognitive mechanisms can be leveraged to be part of the solution, as shown in Table 1. By  
63 carefully considering the social dynamics involved, policy makers can make climate change  
64 mitigation efforts more effective.

65

66 **Norm detection**

67 To contribute to a collective effort, people need to have sufficient evidence that others will also  
68 take action. In fact, people's perception of the right thing to do very much depends on what  
69 others are actually doing. Far from acting as strict moral consequentialists who maximize the  
70 positive impact of their actions, people often rely on what others believe to determine what is  
71 appropriate<sup>25-27</sup>. For example, although people may know that traveling by plane or eating meat  
72 is detrimental to the climate, they may continue to engage in these behaviors if they see others  
73 doing so<sup>28</sup>. Previous studies have shown that social norms have a large influence on people's  
74 pro-environmental behavior<sup>29</sup>. Yet, social norms have also been shown to be ineffective or even  
75 to backfire in the context of pro-environmental behaviors<sup>30-32</sup>. Drawing on recent research, we  
76 discuss three aspects of norm detection that can be both a problem and a solution for the  
77 emergence of effective climate-friendly social norms.

78

79 **Pluralistic ignorance**

80 Because of the costs associated with cooperating with a cheater, people's cheater detection  
81 mechanism functions as a smoke detector: people minimize the risk of false negatives (not  
82 detecting a cheater) while allowing more false positives to occur (mistaking a cooperative  
83 individual for a cheater)<sup>33</sup>. This means that people are likely to believe that others are not  
84 cooperating. This can lead to pluralistic ignorance, a situation in which people privately reject a  
85 norm (such as driving SUVs) but go along with it because they falsely assume that most others  
86 accept it. For example, Americans hold the inaccurate belief that a majority of their fellow  
87 citizens do not care much about mitigating climate change<sup>34</sup>, and are overly pessimistic about  
88 the views of conservatives on climate change<sup>35</sup>. A study conducted with a representative sample  
89 in the USA suggests that part of the reason why the poorest individuals and ethnic minorities are  
90 underrepresented in environmental organizations and US government environmental agencies is  
91 the widespread false belief that they are not interested in environmental protection<sup>36</sup>. Because  
92 people are very sensitive to cheating, a few visible cheaters may also be enough to make an  
93 entire cooperative system collapse<sup>37,38</sup>. By identifying important areas of pluralistic ignorance,  
94 governments and other entities can promote cooperation through simple information campaigns  
95<sup>39,40</sup>. However, correcting pluralistic ignorance may not be enough to change behavior if other  
96 barriers remain<sup>41</sup> such that more research is warranted in this domain.

97

98 **Credibility of norms**

99 For a social norm to be effective in promoting cooperative behavior, people must find it credible.  
100 Credibility comes both from the source promoting the social norm and from the content of the  
101 norm<sup>42</sup>. People are more sensitive to social norms when they are promoted by leaders in their  
102 community<sup>34</sup> or when the individuals promoting the norm have themselves adopted the  
103 behavior. For example, a study of a programme that promotes residential solar panel installation  
104 in 58 towns in the United States found that community organizers who themselves installed  
105 panels through the programme recruited 62.8% more residents to install solar panels than

106 community organizers who did not<sup>43</sup>. For governments to effectively promote social norms, they  
107 must first earn the trust of their constituents. In addition, norms about behaviors tend to be more  
108 effective than simple injunctive norms, such as telling people what most others approve of<sup>44,45</sup>.  
109 For example, saying that most people recycle their waste is more effective than saying that most  
110 people *approve of* recycling waste. Finally, in some situations norms are more effective if they  
111 do not appear as coercive<sup>46,47</sup>. Normative appeals that seem to limit people's freedom may have  
112 the opposite effect because of 'psychological reactance' - a negative feeling arising from threats  
113 to one's freedom. For example, telling people to "have fewer children, do your part" may be  
114 counter productive. Policy makers can leverage credible sources such as the scientific  
115 community to promote norms, and make sure that the content of a norm is descriptive and  
116 describes a behavior that people willingly engage in. Finally, people are more likely to respect  
117 social norms within a group that they expect to cooperate with again in the future. The more  
118 local a social norm is, the more effective it will be<sup>48,49</sup>.

119

### 120 **Dynamic norms**

121 People care not only about current social norms, they also anticipate what will be normative in  
122 the future. Hence, they are more likely to adopt a new behavior if they anticipate the change to  
123 persist than if they believe the change is a passing fad. Many behaviors that fuel climate change  
124 such as driving alone, eating meat, flying, or having multiple children, are currently the norm. In  
125 such cases, using normal social norm messaging will fail to promote change as the norm is  
126 indeed unsustainable<sup>50</sup>. Evidence shows that instead, communicating about the dynamic norm --  
127 that is the current direction of change in people's behavior -- can have a major impact<sup>51-53</sup>. For  
128 example, researchers have shown that by conveying to people a dynamic norm about using a  
129 reusable coffee cup rather than a disposable one ("Our guests are changing their behavior: More  
130 and more are switching from the to-go-cup to a sustainable alternative."), the proportion of  
131 consumers using reusable cups increased by 17.3%<sup>54</sup>. This component of people's norm  
132 detection mechanism provides a powerful tool for policy makers. However, evidence is limited  
133 to a handful of papers and further research is needed to assess the effectiveness of dynamic  
134 norms in different contexts.

135

### 136 **Reputation management**

137 Given the high benefit of collective actions, being perceived as a good cooperater is crucial for  
138 humans. Thanks to their reputation management system, people can anticipate how others will  
139 perceive their actions and act accordingly. Having a good reputation is considered so important  
140 that people often would prefer enduring physical injury (e.g. losing their dominant hand), rather  
141 than having people believe that they are not trustworthy (e.g. becoming known as a Nazi)<sup>55</sup>.  
142 Beyond being simply perceived as trustworthy, people compete on traits that signal their  
143 willingness or ability to confer benefits upon others such as intelligence, athleticism, but also  
144 generosity and benevolence<sup>56</sup>. Indeed, cooperation takes place in a competitive social market,  
145 such that people can abandon a cooperation partner in favor of another. When deciding between

146 different options, people take into account both their direct costs and benefits and their indirect  
147 reputational costs and benefits, often without any conscious awareness of such considerations.  
148 When indirect reputational benefits are larger, people are more likely to be cooperative. For  
149 example, studies show that people adopt more pro-environmental behaviors when such behaviors  
150 are directly observable or even when their behavior will be known to future generations<sup>57-59</sup>. It  
151 is however important to distinguish between the ultimate advantages of having a good reputation  
152 and the proximate psychological level. Far from being Machiavellian, evidence shows that  
153 people genuinely enjoy helping others, without any conscious representation of the fitness  
154 advantage their behavior may lead to<sup>60</sup>. In the following paragraphs, we detail how people  
155 manage their reputation and how it can be leveraged to promote effective climate mitigation<sup>61</sup>.

156

### 157 **Observability**

158 When behaviors can be easily identified as signals of cooperation, people are more likely to  
159 engage in them. This is the case in the so-called “prius effect”, by which individuals are more  
160 likely to buy a hybrid Toyota Prius rather than another electric car model as the unique design of  
161 the Prius makes it conspicuously green<sup>62,63</sup>. Researchers have identified that many pro-  
162 environmental behaviors have a signaling function<sup>62,64,65</sup>. However, many behaviors related to  
163 climate change are invisible such that reputational gains cannot take place<sup>66</sup>. This is true of all  
164 invisible efforts (e.g., adding a layer of insulation under one’s roof), private voting practices  
165 (e.g., going to the polling station to support green policies) and, by definition, of abstinent  
166 choices (e.g., not taking the plane or not eating beef). An obvious solution to this problem is to  
167 make pro-environmental behaviors more visible. For example, in the Spring of 2020, the British  
168 government adopted a new regulation allowing all electric vehicles to have a green flash on the  
169 left hand side of the license plate (see Figure 1). This not only makes it easier for local  
170 authorities to enforce policies such as reserved parking space for electric vehicles, it also allows  
171 people to display their green behavior. In addition, given that governments have limited financial  
172 resources to promote mitigation behaviors, they should focus their subsidies on hard-to-observe  
173 behaviors such as renovating one’s home insulation<sup>67</sup>.

174

### 175 **Competence**

176 People care a lot about enhancing their value to their social network as this will impact how they  
177 are perceived and thus whether they are chosen as a cooperation partner<sup>68</sup>. Appearing  
178 competent, wealthy, or well-connected are all potential ways to demonstrate a high value to  
179 others. However, appearing competent or wealthy can sometimes conflict with appearing pro-  
180 environmental. For example, residents in a neighborhood might continue watering their lawn  
181 despite calls to save water in order to maintain their image as wealthy neighbors who tend to  
182 their lawn. In addition, because environmental activists have on occasion been associated with  
183 negative stereotypes such as being eccentric or too militant, people may be reluctant to adopt the  
184 behaviors they promote<sup>69</sup>. Similarly, environmentally friendly products are associated with  
185 warmth, a trait that is not always desirable for consumers<sup>70</sup>. More research is warranted on the

186 impact of aligning mitigation behaviors with traits that people value, such as openness or  
187 innovation (e.g., adopting greener modes of transportation, eating lab-grown meat).

188

### 189 **Effort**

190 Beyond competence, humans also care about how much effort people invest when cooperating,  
191 because all else being equal, it is better to cooperate with someone who is willing to go the extra  
192 mile. People who exert more effort to achieve a goal will therefore enjoy a better reputation.<sup>71,72</sup>  
193 Certain actions such as recycling may require daily efforts, thereby conferring a positive  
194 reputation to the individual, even though the impact is quite limited. In contrast, actions that  
195 require less effort, such as taking the train instead of a plane for a short journey, may not be as  
196 socially rewarded even though the associated CO2 emissions reduction is much larger. As a  
197 result, people may privilege effortful behaviors instead of impactful ones. By aligning effort with  
198 impact, policy makers might be able to orient citizens towards more effective mitigation  
199 behaviors.

200

### 201 **Intentions and consequences**

202 Evidence shows that intentions matter a lot when people judge each other's character<sup>73</sup>.  
203 Achieving a good outcome based on bad intentions is often perceived as worse than achieving a  
204 bad outcome based on good intentions<sup>74</sup>. In addition, people tend to prefer individuals who act  
205 out of empathy or who follow deontological rules, rather than consequentialist individuals who  
206 weigh the costs and benefits of every action<sup>75</sup>. People who deliberate more about the  
207 consequences of their charity donations for example, are perceived as less moral and as less  
208 desirable social partners than individuals who rely more on empathy to make their donations  
209 choices<sup>76</sup>. In other words, although prioritizing actual impact is good from a societal standpoint,  
210 it may come at a reputational cost. This may explain why the effective altruism movement is still  
211 confined to a small group, despite the many rational arguments that support its value. For impact  
212 to matter as much as intentions, it must be easily measured and known to people. Making the  
213 link between people's action and their environmental consequences clearer will allow people to  
214 take impact into account more easily. Once causes are linked to consequences, it is much easier  
215 to make a case for choosing the most efficacious course of action<sup>77</sup>. Thankfully, there has been  
216 much progress in that direction in recent years. Impact assessments have become a common  
217 practice in many areas of public policy, and even researchers have called for impact-focused  
218 environmental psychology<sup>78</sup>. More research should be conducted on how to encourage  
219 individuals to adopt more impactful approaches to climate change mitigation.

220

### 221 **Fairness computation**

222 When engaging in cooperation, people not only decide who they should cooperate with, but also  
223 how the costs and benefits of cooperation should be shared. Research shows that our fairness  
224 computation mechanism evaluates the costs and benefits based on the outside options available  
225 to people, i.e. the payoff people would have enjoyed if they had decided not to cooperate with a

226 specific partner <sup>79</sup>. Individuals with more valuable outside options – typically people with large  
227 social networks including a lot of potential trustworthy partners – are usually given a larger share  
228 of the benefits, thus ensuring that a cooperative interaction is advantageous to all parties  
229 involved. To sustain cooperation, people constantly monitor the costs and benefits accrued to  
230 others, for example how much effort people from other countries are making to reduce CO2  
231 emissions <sup>80</sup>. This helps people identify the appropriate response, such as changing their lifestyle  
232 drastically or spending little effort on reducing emissions. This sort of computation is constantly  
233 happening in people’s minds, most often beyond their conscious awareness <sup>79</sup>. When people feel  
234 like the cost and benefits of cooperation are not fairly distributed, they will refrain from  
235 cooperating. The allocation of costs and benefits depends on specific principles, and is often  
236 deemed more important than the aggregate outcome of cooperation. A good illustration of that is  
237 the fact that citizens in low-income countries are less supportive of international agreements  
238 forcing their country to take climate change mitigation measures than citizens in wealthier  
239 nations are and tend to think that high-income countries should make more effort to protect the  
240 environment <sup>81</sup>. By understanding how fairness is computed, policy makers can design mitigation  
241 policies that may gather more support.

242

#### 243 **Fairness depends on perceived status quo**

244 The fair allocation of costs and benefits to individuals who are cooperating depends on the  
245 perceived status quo. Indeed, costs and benefits are calculated according to a given baseline,  
246 which includes the outside options of each individual <sup>82</sup>. People who have different perceptions  
247 of the status quo may have a hard time agreeing on what constitutes a fair outcome. Perhaps the  
248 most dramatic instance in which status quo perception matters is for a country's pledge to reduce  
249 CO2 emissions <sup>83</sup>. If people consider that the status quo is the current emissions level, then all  
250 countries should make commitments proportional to their current emissions and to their ability to  
251 mitigate them <sup>84</sup>. However, if people consider that the appropriate baseline is the status quo *ante*,  
252 which corresponds to the state of the world before the industrial revolution, then western  
253 countries such as the United States, Canada or members of the European Union, who have  
254 already contributed to more than 50% of the global cumulative CO2 emissions should  
255 compensate this disproportionate historical contribution to climate change <sup>85</sup>. Status quo  
256 considerations may also affect more local decisions, such as how to allocate public space  
257 between drivers, pedestrians and bicycles. If one considers that the baseline is that streets are  
258 mostly designed for cars, then any policy aiming at increasing bicycle paths will be seen as a loss  
259 for car drivers. However, if one considers that the relevant baseline situation is one where cities  
260 are built for all people and not just car drivers, then such policies will be construed as claiming  
261 back what rightfully belongs to pedestrians and cyclists. Changing our frame of reference can  
262 impact how we see the world <sup>86–88</sup>. More research is needed on the influence of the perceived  
263 status quo on support for environmental policies.

264

#### 265 **Fairness over effectiveness**

266 People often value fairness above and beyond the aggregate outcome of a given action. In other  
267 words, people’s sense of fairness does not follow consequentialist principles, which favor “the  
268 most good for the most people”. For example, a majority of people are unwilling to increase cure  
269 rates for a large group if it comes at the cost of reducing cure rates for a smaller group <sup>89</sup>.  
270 Additional examples include that most people will favor income distributions that are more equal  
271 rather than those with higher total income <sup>90</sup>; prefer retributive justice (in which the punishment  
272 is proportional to crime) to deterrence, even though basing punishments on deterrence leads to  
273 lower crimes than basing punishments on retribution <sup>91</sup>; and condemn pushing one person off of  
274 a footbridge to stop a trolley from killing five people further down the tracks <sup>92</sup>. When  
275 individuals must decide between different environmental policies, they will favor fairness as  
276 much as effectiveness <sup>93–95</sup>. Policies that are seen as unfair have very little chance of success, as  
277 the recent example of the “Yellow Vest” movement in France has shown <sup>96,97</sup>. The movement  
278 started after the government announced a new tax on carbon that would lead to increases in gas  
279 prices (which predominantly would affect poorer rural communities commuting by car to work),  
280 without impacting kerosene prices (which would affect richer individuals traveling by plane). If  
281 policy makers are to gain support for far reaching regulations such as a universal carbon tax, they  
282 will need to consider the perceived fairness by the general population <sup>98,99</sup>.

283

### 284 **Outstanding questions**

285 Our review highlights a critical need for further research on at least three fronts. First, more  
286 research should be done on the dynamic component of social norms. Experiments should be  
287 conducted to identify how new social norms can emerge rapidly in a group and how to use  
288 network analyses to target individuals who will accelerate the adoption of the norm. By  
289 understanding the dynamics of social norms, we can steer groups towards reaching a moral  
290 tipping point: a threshold beyond which it will become a moral obligation to adopt  
291 environmentally virtuous behaviors <sup>100,101</sup>. Second, more research should be done around the  
292 promotion of effectiveness as a moral standard. To mitigate global warming, people will not only  
293 need to change their behavior, they will have to systematically adopt those behaviors that are  
294 most effective at reducing their carbon footprint. Making people adopt an “effective  
295 environmentalist mindset” is a central issue for climate change mitigation. Finally, as many  
296 economists and climatologists have argued, large scale policies such as a carbon tax are essential  
297 tools for effective climate change mitigation design. As such, further research on the  
298 acceptability of these policies and the factors influencing perceived fairness is crucial. In  
299 addition, most studies cited in this review were conducted on Western subjects. Although  
300 Western countries produce the most per capita CO<sub>2</sub> <sup>102</sup>, more research should be done in other  
301 populations to determine whether results are generalizable.

302

### 303 **Accelerating sustainable transitions**

304 Cooperation is supported by dedicated cognitive mechanisms and can be seen as an adaptation to  
305 solve humans’ collective action problems. By detecting social norms, managing their reputation



306 and computing what is fair, people ensure that they benefit from cooperative endeavors. Climate  
307 change is a perfect example of a social dilemma in which people's social cognition plays a large  
308 role. The cognitive mechanisms supporting cooperation ensure that mitigation efforts are aligned  
309 with people's interests. If certain criteria are not met -- such as observability or fairness -- then  
310 the adaptive response will be to refrain from cooperating. A deeper understanding of people's  
311 social cognition can allow us to remove some barriers to effective climate change mitigation. For  
312 example, social cognition can be leveraged to reduce people's meat consumption and associated  
313 greenhouse gas emissions, as discussed in Box 2. Adding social motivation to the tools for  
314 promoting pro-environmental behaviors seems crucial given the urgency of the climate crisis. In  
315 addition, understanding people's social cognition can help make sense of seemingly unrelated  
316 behaviors. Indeed, biases in how people process information -- for example believing or not the  
317 scientific evidence for climate change -- may be a symptom of underlying social motivations  
318 <sup>7,41,103</sup>. Understanding people's attitude towards climate change mitigation is therefore  
319 inseparable from understanding people's social cognition.

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### **Box 1: Effective altruism**

Effectiveness is often defined as the size of the impact relative to the resources used to create such an impact. Under this definition, someone spending 100 euros to avoid 1 ton of greenhouse gas emissions is more effective than another individual spending 200 euros to avoid the same amount. This concept has gained some traction, moving from the field of engineering and economics to a diversity of domains such as organization management or even charity.

The movement “Effective Altruism” was created in the late 2000’s around individuals such as Toby Ord, William MacAskill, and Peter Singer. This movement advocates being impartial and prioritizing causes that are great in scale, highly solvable, and tractable<sup>104</sup>. This movement encourages its members to donate to charities that are effective, leading to the largest positive impact per amount spent. It also helps people define what career to choose to maximize their positive impact given their skill set<sup>105</sup>.

We define effective environmentalism as giving priority to mitigation efforts that have the most impact per amount of resources invested. For example, an individual deciding between spending 100 euros to buy organic groceries or spending 100 euros to finance a solar powered stove in a developing country should prioritize the latter as the environmental impact will be larger. Similarly, policy makers deciding between allocating resources to providing all citizens with a composting bin or improving public transportation should prioritize the latter.

So far, the effective altruism movement has been confined to an active but small community, located mainly in the United States and United Kingdom. In order for this movement to gain traction, it should take into account people’s social cognition. Many studies have shown that people’s intuitions often go against principles of effective altruism, such as the idea that geographic distance should not affect our willingness to help people. By taking people’s psychology into account, the effective altruism movement can become more popular.

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## Box 2: The case of meat eating

Reducing meat consumption represents a major opportunity to mitigate climate change<sup>106</sup> with 14.5% of all anthropogenic greenhouse gas emissions coming from the livestock sector<sup>107</sup>. In addition, there are few structural barriers to adopting a plant-based diet. Not only is such a diet often cheaper, it is nutritionally adequate and may provide health benefits for the prevention and treatment of certain diseases<sup>108</sup> and plant-based alternatives are easily accessible in most developed economies. Some informational barriers may still be an obstacle to adopting a plant-based diet, such as the belief that eating meat is important to stay healthy<sup>109</sup> or a lack of information regarding the environmental footprint of meat. Yet, many people frequently eat meat despite being well-aware of the negative impacts of these behaviors and having the means to make different choices<sup>16</sup>.

Taking into account people's social psychology is essential to encourage them to reduce their meat consumption<sup>110</sup>. Wyker & Davison have shown that **normative beliefs** regarding how much one's friends, family, and colleagues believe one should follow a plant-based diet are strong predictors of intentions to do so<sup>111</sup>. People may suffer from **pluralistic ignorance** on the issue of reducing meat consumption. Although many people may privately believe that reducing meat consumption is important to mitigate climate change, they may hold the false belief that a majority of people would disagree with them. In addition, eating meat is the current norm, offering little social pressure for people to change their behavior<sup>112</sup>. However, as Sparkman and colleagues have shown in multiple experiments, when given information about the **dynamic norm** - that is the increase in the number of people switching to vegetarian diets - people are more willing to select vegetarian options<sup>51,52</sup>. From a **reputation management** perspective, reducing meat consumption raises two issues. First, people's dietary choices are hard to observe, creating little incentives for people to reduce their meat consumption, for example when eating at home. Second, eating less meat may conflict with other aspects of one's reputation, such as appearing like a generous host<sup>113</sup>. As a result, people may gain little reputational benefits from adopting a vegetarian diet. By making dietary choices more conspicuous and by aligning people's values with plant-based diets, policy makers and companies can encourage people to reduce their meat consumption. Finally, **equity concerns** may also impact people's dietary choices. People may perceive the reduction in meat consumption as an unfair cost placed on meat producers. Policy makers should thus ensure that no segment of the population is unfairly affected by such dietary changes.

326 Figures and Tables:

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**Cognitive Mechanism Supporting  
Cooperation**

**Adapted Policy Intervention**

NORM DETECTION	
People tend to underestimate the proportion of cooperators	Make social norms more visible
People are sensitive to the credibility of social norms	Focus on actions rather than opinions, use local community leaders to promote social norms
People only respond to norms that are already prevalent	For behaviors that are not widespread, communicate about the dynamic norm
REPUTATION MANAGEMENT	
People prefer engaging in observable behaviors	Make sustainable behaviors more visible
People care about enhancing their value as cooperative partners	Align mitigation behaviors with positive traits
People are insensitive to impact when judging others' behavior	Make the impact more direct and understandable
People judge impact maximization negatively because it is seen as too calculating	Make the most impactful behavior the default option
FAIRNESS COMPUTATION	
People often prefer fairness over efficiency when deciding between policies	Include redistributive programs in policies and communicate about their impact
People base their fairness computation on their perceived "status quo"	Provide information to help people change their vision of the status quo

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**Table 1. People's social cognition can be leveraged to promote effective climate change mitigation.**

Cooperation between humans is supported by three cognitive mechanisms, (1) norm detection, (2) reputation management, (3) fairness computation. These cognitive mechanisms evolved to make cooperation beneficial at the individual level, which can often lead to ineffective outcomes at the collective scale. For example, people's fairness computation mechanism induces them to favor equity over effectiveness when supporting public policies. By taking into account the nature of human social cognition, policy makers can promote more effective behaviors. For example, by including redistributive programs in policies and communicating about their impact, policy makers can gather more support for environmental policies. Whether governments have the means and motivation to implement more redistributive policies is a question beyond the scope of this review.



345  
346 **Figure 1. Policy makers can leverage reputation management to promote pro-environmental**  
347 **behaviors by making them more observable.** In the fall of 2020, the UK government implemented a  
348 green number plate policy for electric vehicles. The government argues that “the plates will make it easier  
349 for cars to be identified as zero emission vehicles, helping local authorities design and put in place new  
350 policies to incentivise people to own and drive them.” This policy will also allow individuals to signal  
351 more easily their commitment to reduce their CO2 emissions and thus improve their reputation.  
352

### 353 **Competing interests**

354 The authors declare no competing interests.

355

### 356 **Author contributions**

357 M.B.F and C.C had the original idea for the review. M.B.F, A.G, N.B. and C.C. wrote the paper.

358

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361

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365 **Bibliography**

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