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From Imagined Threats to Imagined Rewards: A Comparative Case Study of Mental Simulation in Environmental and Digital Media Contexts

Siyuan Liu

University of Birmingham, Birmingham, UK
siyuan_liuu@163.com

Abstract. As contemporary communication increasingly shapes how individuals imagine possible futures, mental simulation may influence emotional and behavioural responses across both environmental and digital media contexts. This study employs a comparative case study approach, analysing IPCC climate change communication as a case of threat-oriented mental simulation and TikTok's algorithmic recommendation environment as a case of reward-oriented mental simulation through a Future-oriented Mental Simulation Framework. The study aims to examine how different forms of imagined future outcomes influence emotional responses and behavioural tendencies. The findings suggest that threat-oriented simulation tends to activate concern, anxiety, and protective motivation but may also lead to avoidance, while reward-oriented simulation tends to generate anticipation and approach motivation that can promote continued engagement and potentially repetitive use. The study demonstrates that the valence of imagined futures plays an important role in shaping behavioural direction and provides a cross-contextual psychological perspective for understanding risk-oriented and reward-seeking behaviour.

Keywords: mental simulation, climate change communication, algorithmic recommendation, short-form video, future-oriented cognition

1. Introduction

Mental simulation is the construction of mental models for future events, the anticipation of possible outcomes, and the corresponding adjustment of emotions and behaviour [1]. Instead of processing existing information, one can use their imagination to experience future situations in their minds and thus change their perception of risk, motivation, decision-making and behaviour, etc. Based on previous psychological studies, the future-oriented mental simulation will affect behaviour in the presence of a potential hazard or anticipation of a reward.

Many kinds of mental simulations can take place in different social settings. Climate change is a typical future-oriented problem in environmental psychology that is uncertain and has delayed effects. As people cannot experience the environment in the future directly, they are only aware of the potential risks through scientific knowledge and media reports. For example, the Intergovernmental Panel on Climate Change (IPCC) climate change reports present future scenarios

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of the world's temperature rise, extreme weather events and ecological damage, etc., providing people with a mental image of possible environmental risks [2]. Thus, the threat simulation may alter people's perception of climate risk and anxiety about climate change.

Digital media environments generally offer positive future expectations and expected rewards to motivate people to behave in a certain way. TikTok and other short-video platforms use algorithms to recommend content that users are likely to like based on their previous behaviour, and then continuously show new content. The For You Page (FYP) will show users many personalised and unexpected videos, and they hope that the next one will be entertaining, informative or socially positive [3]. This way is a reward-oriented mental simulation that will increase user participation but may also lead to repeated use and addictive short-video behaviour.

Although previous studies have separately investigated climate risk perception in environmental psychology and user engagement or problematic use in digital media, these two areas have rarely been examined using the same psychological mechanism. Although both cases involve people imagining the future, the kind of this imagined future is different: environmental communication focuses on what people may lose in the future, while digital media shows what people can gain. To learn to distinguish between threat-oriented and reward-oriented mental simulations is to learn how imagination in the future will make people feel and behave.

Therefore, this paper will conduct a comparative case study of mental simulation in the environment and on the Internet. By analyzing the IPCC's climate change communication as a case of imagined threats and TikTok's recommendation system as a case of imagined rewards, this paper studies how different forms of future-oriented mental simulation affect emotions and behaviour. This study will extend the application range of mental simulation theory and provide a comparative psychological perspective on risk-taking behaviour and reward-seeking in digital media.

2. Literature review

2.1. Mental simulation and future-oriented cognition

Mental simulation is the creation of mental pictures for events, situations or outcomes that may occur in the future by people. Instead of thinking abstractly about a possible event, mental simulation can help people experience some parts of a future situation in their minds beforehand. Based on previous psychological studies, mental simulation can change a person's emotions, motives, desires for something, choices and behaviour [4]. Mental simulation is closely related to future-oriented thinking, and people often make decisions according to their current circumstances and their expectations of what will happen in the future. By creating a future picture in their minds, people can consider what will happen and change their behaviour accordingly [5]. For example, imagining the negative consequences of an unhealthy behaviour may increase avoidance motivation, and imagining the positive outcomes of achieving a goal can motivate one to pursue that goal.

Mental simulation does not need to have a particular emotion or behaviour either. The content and valence of the imagined future will affect people's responses. When people mentally construct an undesirable or threatening future, this process can be viewed as threat-oriented mental simulation. The above simulations may increase perceived risk, fear, anxiety or protective motivation [6]. In contrast, when individuals imagine desirable or rewarding future outcomes, it can be understood as reward-oriented mental simulation, which may increase anticipation, motivation, curiosity, and approach behaviour.

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2.2. Threat-oriented mental simulation in the climate change context

Climate change provides an ideal environment for studying future-oriented cognition because many of its severe consequences will not be directly experienced by people in the present. Climate change is a long-term alteration of the environment and its future development is unpredictable. As a result, people often use scientific communication, media portrayals and future predictions to build their own mental images of the environment.

The Intergovernmental Panel on Climate Change (IPCC) will show the future climate risks in this report. Its assessment reports present scientific forecasts of the world's temperature rise, extreme weather phenomena, sea-level rise, changes in ecosystems and other possible impacts of climate change [2]. These representations provide people with the information needed to build mental pictures of the future environment. Climate change communication can thus serve as an external cognitive cue for the purpose of mental simulation. When people are informed about the future risks of climate change, they may imagine a world that is too hot and wet, too dry, and biodiversity has been lost, etc. The imagined future may thus change people's perception of the severity and urgency of climate change.

Earlier studies on climate communication have found that emotions affect people's perceptions and behaviours of climate change. Threat-oriented representations may increase fear, worry, anxiety, and the feeling of vulnerability, thus motivating individuals to engage in pro-environmental behaviour. For instance, if the people can feel the negative impact of the future environmental damage, they will be motivated to reduce energy consumption, support environmental policies and live more sustainably.

However, there is no direct connection between the threat simulation and behaviour. Too much emphasis on a terrible future can make people feel helpless, detached from life, or avoidant [7]. When people feel that the danger is serious but believe they are unable to do anything about it, fear and anxiety may not motivate them to act. Therefore, the people may ignore the problem mentally.

2.3. Reward-oriented mental simulation in short-video use

Digital media environments often create expectations of a good life and do not discuss the climate. TikTok and other short-video platforms use algorithms to recommend a large number of personalised videos to users continuously. The For You Page (FYP) shows videos that match a user's past behaviour and interests, and new, interesting content is added all the time [3]. Although the users are initially responding to the video currently on the screen, their sustained interest may also be due to anticipation of what will be shown next. A user hopes that the next video will be enjoyable, educational, socially conscious or otherwise interesting to them. This uncertainty produces a sense of the future and makes people wish to keep scrolling.

Therefore, in terms of mental simulation, algorithms can provide external cues to help promote reward-oriented future thinking. The user does not know what the next video will be about, but can imagine or expect a good time. The above are related to psychological phenomena, such as the anticipation of rewards, curiosity, variable reinforcement and habit formation. The first is that it is not certain. If all the following pieces of content were completely predictable, the motivation to continue consuming them might also decline. Instead, one expects that the next video will be more interesting than the current one and thus is motivated. Therefore, the user will continue to exhibit this behaviour in an attempt to obtain the expected reward.

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2.4. Research gap

Earlier research has examined people's perceptions of climate risk, climate anxiety and pro-environmental behaviour, as well as the functions of algorithms and reward mechanisms in digital media. The two areas have not been studied together to explore the common psychological reasons for changes in behaviour in the future. Both contexts are about future-oriented mental simulations, but they differ in the valence of the imagined future. Climate communication often shows a picture of possible loss and danger, whereas the use of digital media anticipates the prospect of pleasure, knowledge or social recognition. Therefore, this study addresses a deficiency in the application of mental simulation as a cross-contextual psychological system. Compare threat-oriented and reward-oriented mental simulations to determine whether the valence of imagined futures affects emotions and behaviour differently in different environments and digital media.

3. Theoretical foundation

Based on the literature reviewed above, this paper proposes a future-oriented mental simulation framework to investigate how imagined future outcomes may affect one's current emotions and behaviour. The four links of the framework are shown in Figure 1.

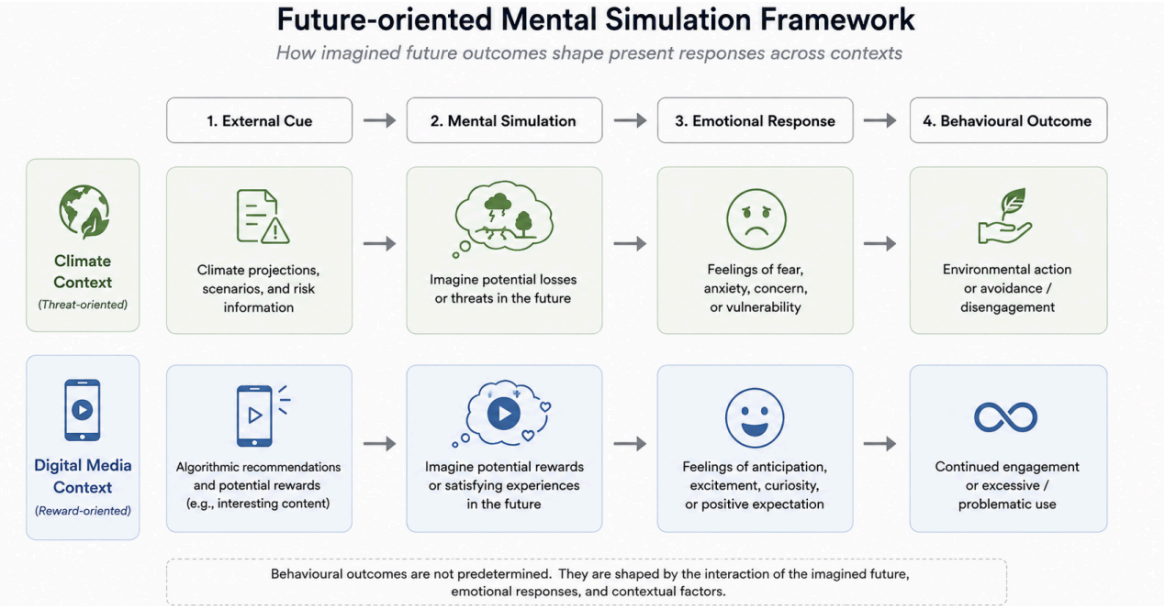

Figure 1. Future-oriented mental simulation framework

First, an external stimulus gives people information about what will happen in the future. Such cues in climate communication may include climate projections, environmental scenarios and risk information. They may be algorithms that recommend or signal potentially rewarding content in digital media. These cues can trigger mental simulation, and people create a possible future experience in their minds. The two situations are different only in the emotional tone of the imagined future. Climate-related simulation generally refers to threats and includes possible environmental damage, loss or risk. Digital media simulation is mainly reward-oriented and aims to provide people with pleasure through entertainment, information, etc.

Mental simulation will then cause an emotional response. Threat-oriented simulations may cause fear, anxiety, worry or vulnerability; reward-oriented simulations can make people feel anticipation,

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excitement, curiosity, etc. Therefore, there will be some changes in behaviour. Given the climate, they may be outdoors doing some environmental activities or choose not to participate. In the context of digital media, they may promote continuous participation and multiple uses of the work. The system cannot predict that the mental simulation will lead to behaviour. Behavioural outcomes are thus viewed as resulting from the interaction of the imagined future, emotional response and contextual conditions. Thus, the framework can address various behavioural results that stem from the same future-oriented psychological process.

4. Comparative analysis

4.1. Case selection and overview

To explore how future-oriented mental simulation is expressed in different environments, this paper takes two contrasting cases: IPCC climate change communication and TikTok's algorithmic recommendation system. The two cases were selected because they represent different forms of imagined futures but share a common future-oriented psychological process.

The first is IPCC climate change communication, which is threat-oriented mental simulation [2]. Climate reports and other communications provide scientific forecasts of the possible changes in the future, such as rising temperatures, severe weather, sea-level rise and ecological damage. Although these consequences have not occurred yet, the above information can help people imagine what the future environment will be like and what may be lost or damaged.

The second case, TikTok's recommendation environment, represents reward-oriented mental simulation [3]. Through the For You Page, users are continuously presented with personalised and novel content. Users do not know what the next video will be about, but they may expect that it will be enjoyable, educational, interesting or socially responsible. The prospect of a good experience is thus expected to occur in the near future.

Therefore, the two cases are of different kinds. The climate case is based on an undesirable future and expected loss, while the digital media case is centred on a desirable future and anticipated reward. The two are used to study how the valence of the imagined future affects emotions and behaviour.

4.2. External cues and mental simulation

The first type of comparison is the external cues that trigger future-oriented mental simulation. Climate is also changing, and some models have been built by scientists to forecast the future changes in the climate. People use these representations to imagine the consequences that have not yet happened [8]. TikTok's algorithm will recommend some content for users based on their interests. Each recommended video suggests the possibility of another enjoyable experience and makes users look forward to what will be shown next. Climate communication presents a relatively distant future; TikTok, on the other hand, continuously unfolds a future within users' immediate media experience [9]. Therefore, both cases start with external information that draws attention to a possible future result, but the type of cue is different. Climate communication provides concrete references for future environmental risks and algorithms recommend related media.

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4.3. Emotional and behavioural responses

All forms of future-oriented mental simulation are associated with different emotions and behaviours. Given the climate, people will likely feel fearful, anxious, worried and vulnerable about future changes in the environment. The above emotions can increase the psychological impact of climate change and motivate people to alter their behaviour towards the environment. If people believe that climate change is too serious or out of their control, they may be unwilling to face this risk and will therefore avoid or withdraw. Previous studies have shown that emotions are closely related to people's perceptions of climate risk and their responses to it, and mental imagery can also affect these emotions [8, 9].

Reward-oriented simulations can create a sense of curiosity and anticipation in people on TikTok. Users will continue to view because the next video may be more interesting, informative or personally relevant. Research on personalised TikTok recommendations shows that algorithmically selected content is linked to reward-oriented processing, and recent studies of short-form video platforms have indicated that recommendation systems and anticipated rewards can result in repetitive scrolling [9]. Reward-based motives have also been linked to more intensive use and problematic social media behaviour.

5. Conclusion

By comparing the IPCC's climate change communication as a case of threat-oriented mental simulation with TikTok's algorithmic recommendation environment as a case of reward-oriented mental simulation, the study found a common process in which external cues shape imagined future experiences, emotional responses and subsequent behavioural tendencies. As shown in the comparison, the valence of the imagined future is relatively high; threat-oriented simulations may motivate protective behaviour but can also lead to avoidance, while reward-oriented simulations promote approach behaviour and prolonged use of digital devices. Based on the above results, the application of mental simulation theory has been extended from individual psychology to a comparative study of risk-taking and reward-seeking behaviour.

This study has some deficiencies. First, as a conceptual comparative case study, it does not directly observe people's mental images, emotions or behaviour. Therefore, the proposed relationships cannot be regarded as causal effects. Secondly, only two general cases have been examined, and the actual differences in people's perception of climate risk and responses to algorithmic recommendations have not been fully investigated. Third, the division between threat-oriented and reward-oriented simulation is mainly conceptual; other types of mental imagery, such as imagery of past experiences or imagined emotional states, have not been studied.

In the future, based on the above system, empirical research can be conducted to study people's mental images when watching short-form videos. Future research can explore whether users' expectations or mental images of the future viewing experience lead to a craving for and problematic use of short-form videos. Questionnaires on mental imagery and metacognitive beliefs can be combined with experimental tasks that alter exposure to rewarding short-form videos to conduct such research. Thus, these studies can further investigate whether mental imagery mediates the relationship between metacognitive beliefs and problematic short-form video use, and if craving serves as a follow-up driving force.

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