



OPINION ARTICLE

REVISED Social influence and external feedback control in humans [version 3; peer review: 2 approved]

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Abstract

This article aims to unravel the dynamics of social influence by examining the processes that occur when one person is the target of another's influence. We hypothesized that these processes are part of a feedback loop system in an individual. This loop involves the situation (input), a goal state (reference), a comparator, a selection mechanism, a feedback predictor, and an action (output). Each element can become the target of social influence, and different types of social influence can be classified and explained by how these elements are targeted. For instance, attempting to persuade another person with strong arguments targets the goal state of the affected individual, while obedience targets the selection mechanism, and violence targets the action. In summary, this article aims to categorize, order, and explain phenomena in social influence research using a feedback loop framework focusing on the influenced individual.

Keywords







feedback control, social influence, social interaction



This article is included in the [Social Psychology gateway](#).

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REVISED Amendments from Version 2

There are no significant differences to the previous version, as only two minor wording issues have been corrected.

Any further responses from the reviewers can be found at the end of the article

Introduction

Individuals often employ a variety of tactics in everyday life to exert influence over others (Aiello *et al.*, 2018; Higgins *et al.*, 2003). For example, people may offer incentives such as gifts to persuade colleagues to assist with a challenging task, use rewards to encourage children to behave appropriately or present compelling arguments to convince academic peers of the validity of their theories. These tactics have been thoroughly investigated, and social influence is one of social psychology's most extensively investigated research domains (Harkins *et al.*, 2017). The present article seeks to provide a fresh perspective on social influence by examining the potential goals of an *influencer* toward an influenced *target*. Specifically, social influence means producing a particular effect in another individual, whether it is a thought, emotion, decision, or behavior (Moussaïd *et al.*, 2013). Our perspective will focus more on the effects of social influence on an individual's behavioral control system rather than their perceptual system.

We build on cybernetic models of behavioral regulation, that is, models that are designed to understand or regulate dynamic processes in complex systems (Leonard *et al.*, 2021), focusing on the fundamental elements that comprise these models. Cybernetic models illustrate a closed system that regulates itself using a feedback loop. Social influence can target elements in cybernetic models, representing different forms of social influence.

We propose a framework that identifies beneficial and detrimental manipulation tactics in everyday life, contributing to a broader understanding of social influence. While previous research has identified different strategies of social influence (Bruins, 1999; Higgins *et al.*, 2003), our approach exceeds existing approaches by categorizing these strategies according to distinct entrance gates to the internal feedback loop. Thereby, the proposed framework helps to develop a precise description of where and how different kinds of social influence affect another person's internal feedback loop.

Our framework helps establishing a theoretical connection between cybernetic control models and other feedback regulation models, such as reinforcement learning (*i.e.*, learning the optimal behavior in an environment to obtain maximum reward through observations of how choices are influenced by past decisions and rewards; Sutton & Barto, 1998). By combining these models in the future, researchers might be able to identify interactions that enhance our understanding and prediction of social influence. For example, combining our proposed model with reinforcement learning can help determine which social influence mechanisms are advantageous and crucial in social interactions.

Feedback loops and feedback control

A feedback loop is a unit of cybernetic control consisting of four elements in a particular organization: input, reference, comparator, and output (Carver & Scheier, 2000b). Input is often described as the is-state, while reference can be framed as a goal or ought-state. The comparator is a core component that detects the distance to the desired outcome (is-ought discrepancy), and the output refers to the actual behavior. Two types of feedback loops can be differentiated: one that aims to reduce discrepancies between the status quo and a goal (approach) and another that aims to increase discrepancies toward a particular anti-goal (avoidance). Thus, any social influence on another individual will either act through an approach or avoidance feedback loop. The cybernetic feedback model has been associated with the self-regulation of behavior, attention, and affect (Carver, 2004; Carver & Scheier, 1981, 2000a). Different approaches have shown that social influence is related to emotional processes (Fischer *et al.*, 2003), visual attention (Frick *et al.*, 2018), and self-regulation (vanDellen & Hoyle, 2010), thereby providing a connection between social influence and feedback loop models.

We believe that the cybernetic model is applicable to social interactions and understanding the self-regulation of behavior, attention, and affect in an actor. Moreover, exploring these processes in a target being influenced by an influencer is beneficial to understand interpersonal communication, improve leadership effectiveness, or to develop effective behavior interventions. Our approach is a potential step towards establishing a stronger connection between research on cybernetic action control, general action control theories, and the social influence literature.

In social interactions, actions elicit responses from others, leading to the possibility of feedback control where the actions of two or more parties influence each other. Feedback control in social interactions refers to the repeated process by which a person's activities elicit reactions, generating a dynamic loop that determines subsequent behavior. This system requires

constant adjustments depending on feedback and determines the continuing dynamics of interpersonal interactions. Classical frameworks have already investigated the translation of cybernetic regulatory principles into social phenomena (von Bertalanffy, 1950; Wiener, 1949), providing insight into complex behavioral patterns, such as economic exchange and political negotiation (McClelland & Fararo, 2006; Robinson, 2007). Jäger *et al.* (2015) have illustrated how the cybernetic feedback model applies to negotiation situations, where self-regulation functions as a feedback loop for goal orientation and identifies central challenges in negotiation processes. To address these challenges, specific self-regulation strategies were developed based on the individual components of the cybernetic feedback model.

Similar control systems were involved in controlling the behavior of social interaction partners. Motor movements (*e.g.*, waving one's hand) can be equated with communicative signals to other people (Wolpert *et al.*, 2003). The principles governing social behavior, such as communication that influences our social world, also apply to motor behavior that impacts our physical environment. In each interaction, the actor generates motor commands based on predictions regarding the target's potential reaction to the commands (*e.g.*, raising one's hand to ask for the waiter). The perceived target behavior is then compared with the predicted reaction, closing the loop of social interaction. Additionally, an individual might respond to the same input with many different patterns. For example, raising a hand in a lecture might indicate a question or stretching owing to tiredness. The professor's response will depend on their interpretation of this social cue, either asking the student for their question or ignoring the signal altogether. Therefore, the interpretation of social signals may be ambiguous, and there is often a delay between the action and the intended reaction. This feedback loop demands a different approach than interactions with non-human physical objects, which are less likely to deviate from predictable behavior to the same degree.

Depending on the influencers' objective, they can adapt their social behavior to reduce the discrepancy between the current and desired states. Feedback control theories have previously been applied to explain influencers' behavior (Diel *et al.*, 2021; Mansell, 2020; Sadiq *et al.*, 2021). We aim to extend this approach by using feedback control theories to explain the target's (*i.e.*, affected person) behavior. Accordingly, we want to examine the effects of the change in the feedback loop processes from the target's perspective. Specifically, we seek to understand how and why certain aspects in the target's feedback loop, which might not be overt, can be effectively influenced to achieve a desired outcome.

Social influence

Social influence research has a long tradition, with the concept frequently discussed regarding social power (McDonald & Crandall, 2015; Raven, 1964; Turner, 1991). In its early stages, power was defined mathematically as the maximum possible force "Person A" could induce on "Person B," divided by B's maximum resistance (Lewin, 1941). Later, "influence" was defined as a force that an agent uses to alter the target's behavior, opinions, attitudes, goals, needs, and values (French & Raven, 1959). In their framework, French and Raven (1959) primarily differentiated between various types of exerting power, which will not be detailed here. Like influence, social power has often been defined as the ability to control or influence another's thoughts, behavior, or feelings in a meaningful way (Fiske, 1993; Thibaut & Kelley, 1959; Vescio *et al.*, 2003). In this line, more recent research on social power indicates that power might consist of two subcomponents, namely personal control and influence over others (*e.g.*, Lammers *et al.*, 2016; Van Dijke & Poppe, 2006). The terminologies of "power" and "influence" are sometimes used interchangeably. French and Raven (1959) attempted to resolve this by defining influence as "kinetic power, just as power is potential influence" (p. 152), thereby distinguishing between potential and actual demonstrations of power.

It is important to note that not all social influences involve power. This article focuses on influence, defined as "attempts to affect or change other people" (Levi & Askay, 2015, p. 128). Building on previous models, Raven (1992) shifted the focus from power subtypes to interpersonal influence, where agents are rational decision-makers who weigh the costs and benefits of their attempts to influence targets. This approach acknowledges that targets' internal processes may adapt to agents' attempts to influence them.

Combining feedback loops and social influence

From a feedback loop perspective, extending the potential locus of influence may allow for a fresh perspective on human social interaction. Hence, we aimed to differentiate between different forms of social influence using the feedback loop perspective of the target of influence. Within this framework, there are various ways in which an external social agent can target elements of the feedback loop system of the target to achieve a desired outcome.

In adapting the cybernetic feedback model to social influence, we have slightly modified these terms coined by Carver and Scheier (2000b) to better suit our purposes. We refer to the reference value as a **goal state** as it represents the desired outcome of a sequence of actions. In our case, the input is described as the present social **situation**. During social influence situations, individuals learn from feedback received from the situation and make predictions about their own success, which we refer to as **feedback prediction**. This process affects the **comparator/reference**, just like the goal state

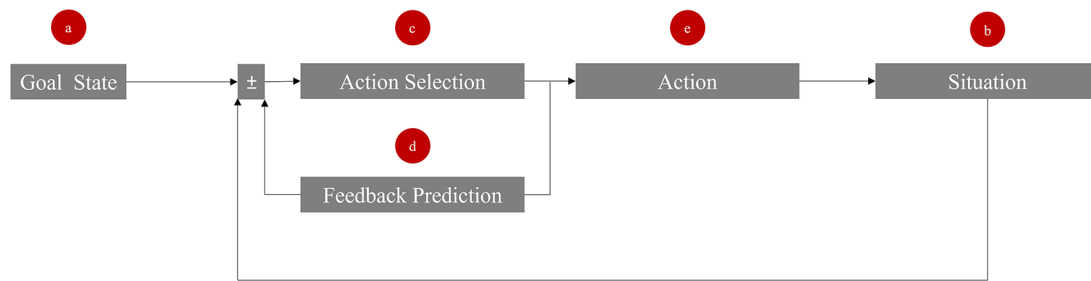


Figure 1. Five entrance gates (a-e) to manipulate the feedback loop in social interactions. The \pm sign reflects the “comparator” and indicates that a possible discrepancy can be either positive or negative.

and situation. In between these stages, we have included **action selection** and **execution**, which operationalize the output function and achieve the desired goal, thereby modifying the classical feedback model for social influence. Our adaptation of the cybernetic feedback model for social influence is supported by previous research in social psychology, which has highlighted the importance of social norms, expectations, and feedback in shaping behavior (Cialdini & Goldstein, 2004; McDonald & Crandall, 2015; Wood, 2000), thereby providing a basis for understanding the processes involved in social influence. Importantly, some examples of influence aim to target an approach feedback loop in the target, while others address an avoidance loop (Carver & Scheier, 2000b). These two types of loops are conceptually linked to promotion and prevention focused on the target (Higgins, 1998, 1999).

We propose a model comprising five key elements to access the internal feedback loop of a target, as illustrated in Figure 1. These elements are explained through the example of two roommates negotiating over the division of a shared television. The influencer uses the elements to manipulate the target’s internal goal state, situation, action selection, feedback prediction, and behavior.

Imagine two people—an *influencer* and a *target*—arguing about the division of a currently shared television. Let us consider a situation where the *influencer* wants to buy a brand-new television for him- or herself. The *influencer* may try to increase the value of the currently shared object and negotiate a deal to “sell” the shared television to the *target* to receive some money, by manipulating the *target*’s **goal state** (a), that is ‘owning the shared TV’ in this example. In this situation, the *influencer* persuades the *target* to understand that the *goal* (i.e., the shared television) is a worthwhile undertaking with advantages over other goal-like items. Alternatively, the *influencer* may want to keep the shared television and try to devalue it (the goal) to get the *target* to buy a new one. In this situation, the *influencer* might persuade the *target* that the *goal* is not worthwhile. Both strategies directly manipulate the *target*’s internal goal state or reference; in these examples, the *influencer* tries to amplify or attenuate the attractiveness of the *goal* for the *target* by either increasing or decreasing the value attributed to the *goal* and thus changing the desirability of the goal state. Hence, the amplification, attenuation, implementation, and elimination of a goal state may be relevant principal target strategies.

To manipulate the **situation** (b), the *influencer* can encourage the *target* to withdraw or to act. For example, the *influencer* could give the *target* a cheap TV as a gift to eliminate the discrepancy between not having a TV and wanting one, or remove the TV from the *target*’s access to increase the *target*’s desire for it. When the situation is manipulated, the comparator (which reflects the difference between the goal state, the current situation, and feedback prediction) can guide the *target*’s action selection.

When there is a misalignment between the *target*’s goal and their current situation, **action selection** (c) becomes important. The *influencer* can advise the *target* to encourage or discourage certain actions. For example, if *influencers* want to support the *target*’s goal pursuit, they can emphasize how difficult it would be to find a new one instead. On the other hand, if *influencers* want to discourage the *target* from achieving their goal, *influencers* can also suggest alternative actions to be selected, for example that the *target* buys a new TV. Depending on their interests, the *influencers* may suggest actions that increase or decrease the likelihood of the *target* achieving a goal about which they compete, including suggesting dubious alternatives.

Influencing the *target*’s **feedback prediction** (d) mechanism might motivate or discourage them by enhancing or lessening their expectations of achieving the goal. For example, the *influencer* could say, “I will make it very difficult for you to get this TV!” or “Why bother buying a new TV when you can have this one easily?”. Hence, the action might be encouraged or hindered by manipulating expectations; in particular, lowering the *target*’s expectations of success might result in frustration and disappointment, leading them to discontinue potential further efforts. Accordingly, feedback prediction mainly refers to the likelihood of reaching the desired goal state when selecting a certain action.

Lastly, during the **action** phase (e), the *influencer* can directly change the *target's* behavior by making it easier or harder to perform certain actions. For instance, *influencers* might see the *target* packing up the TV and then remove it themselves from the house before the target can complete the action. In some cases, violent or deceptive methods may be used, such as physically stopping someone from running away, not paying a previously negotiated price because no contract was signed, or “accidentally” breaking the TV.

To illustrate our theoretical views and contribution to the literature, we provide specific examples of negotiation, social norms and sanctions, compliance, advertisement, and nudging in the following subsections. Thereby, we show how our feedback framework can be used to distinguish and understand the different forms of social influence. Prior to an in-depth exploration of each component within our proposed framework in detail, we want to clarify that our discussion emphasizes the predominant influence on individual components. This focus does not mean that influencing one component has no effect on other components. For instance, influencing the *target's* action selection could also affect the goal state or situation. This interplay among components underscores the complexity of social influence, suggesting that interventions on one component may cascade into multifaceted consequences. However, our primary goal is to delve into the fundamental elements of influencing another person's internal feedback loop. Developing an understanding of how to influence only one particular aspect while excluding the influence of another aspect can be crucial for a more detailed perspective on social influence.

Social influence towards the goal state

To clarify how influence works, we outline the conceptual differences between persuasion and manipulation (see, *e.g.*, Gass & Seiter, 2022); then, we explore how changes in the *target* can be achieved through persuasion and how this relates to the *target's* goal state. A differentiation between persuasion and manipulation is necessary since persuaders usually have transparent intentions and are open about their goals, whereas manipulators may hide their true intentions, using tactics that intentionally mislead or deceive others. Yet, both kinds of influence may be directed towards the target's goal state.

Influence through persuasion can affect the goal state of the *target* even before the target takes any action. For influence directed toward achieving a particular goal, especially through communication and reasoning, the term “persuasion” is the most fitting descriptor. We do not aim at conceptualizing persuasion as a sub-facet of influence; rather, we use persuasion as a specific type of influence with a focus on communication and achieving a defined goal state. Falk and Scholz (2018) defined persuasion as changes in the preferences or behavior of recipients of information that conform to the active attempts of a communicator to promote such changes. According to the elaboration likelihood model (ELM; Petty & Cacioppo, 1986), a dualistic process accounts for attitude changes, which is relevant to changing goal states. The central route comprises a deliberate argumentation that requires a high degree of message elaboration to elicit a change in one's attitudes and beliefs. Message elaboration refers to the extent to which individuals actively process information contained in a message. Thus, it involves the cognitive effort and depth of thinking invested in understanding and evaluating a message. In contrast, when a person lacks the ability or motivation to process a message in-depth, they may rely on the peripheral route, which means that peripheral cues or superficial aspects of the message rather than engaging in elaborate cognitive processing. These peripheral cues could be the influencer's attractiveness or level of knowledge, which could lead to increased credibility. Taken together, we argue that persuasion as conceptualized here changes attitudes which in consequence will affect the choice of goal states of a target.

In addition to the influenced target route, the self-regulatory focus of the target is critical to determining the most effective manner of persuasion (Aaker & Lee, 2001). Individuals with an independent self-view (*i.e.*, a self-regulatory focus on promotion) prefer a persuasion focusing on approach motivation (Aaker & Lee, 2001). In contrast, those with an interdependent self-view (*i.e.*, a self-regulatory focus on prevention) prefer a persuasion that focuses on avoidance (Aaker & Lee, 2001). Matching the persuasion/benefit of the interaction partner with the self-regulatory focus of the target leads to more effective persuasion (Pentina & Taylor, 2013).

Aaker and Lee (2001) demonstrated these propositions through experiments, calling this mechanism a “central processing route to persuasion.” Although the authors did not apply a cybernetic view to their study, this perspective might be quite close to persuasion research. Their persuasive approach is characterized by its impact on the goal state or reference value, which constitutes the central mechanism in a cybernetic feedback model. Therefore, the persuasive approach aligns with the mechanism proposed by the cybernetic feedback model. Approach and avoidance motivation implicate the concepts of approach and avoidance goals (*e.g.*, Carver and Scheier, 2000b), which have conceptual overlap with promotion and prevention focus, respectively. The necessity to match these to personal preferences of the target are well in line with the idea that this kind of persuasion is directed towards target's goal states.

Related empirical evidence indicates that negative framing of information in a prevention-focused context is more effective in persuading individuals than positive framing, and *vice versa* for promotion-focused contexts (Holler *et al.*, 2008; Spiegel *et al.*, 2004). For instance, Holler and colleagues provided a negative framing of insufficient tax provision, stating that “the health care system could not be maintained, and in case of illness outdated methods would be used” (Holler *et al.*, 2008 p. 7). They found that individuals with a prevention focus were more tax compliant when presented with information emphasizing potential danger, and *vice versa*. Our framework aligns with the idea that persuasion is most effective when it matches the goal category, hence promotion or prevention domains.

Our proposed model suggests that persuasion can be most effective when transforming goals into action plans. This occurs when the goal is roughly defined, and the person considers the steps needed to achieve it. Manipulating goals can involve implementing a new goal or modifying an existing one, such as amplifying, attenuating, or eliminating it. To illustrate these differences, we additionally give the following examples.

Asch (1940) argued that the primary process in influence is not to change the attitude toward but the meaning of the object. Thus, changing the object’s meaning can lead to changes in implicit valuation, cognitive goal structures, attitudes, and behavior. Persuading individuals to frame desired goals can be an effective strategy for influencing subsequent action selection. However, framing requires the individual to have relevant knowledge about the object (Nelson *et al.*, 1997). Framing can amplify or attenuate existing goals and their evaluation toward a specific direction using existing knowledge structures and potentially related long-term goals. Examples of this include emphasizing the emotional value of an object (*e.g.*, highlighting the potential for promoting social gatherings like watching sports events with friends or romantic movies with a partner) or related long-term goals (*e.g.*, emphasizing the potential of saving money if the target keeps the TV compared with buying a new one).

Haddock *et al.* (2008) discovered that matching persuasive messages’ cognitive or affective content with an individual’s initial attitude has a greater impact on goal persuasion than mismatched messages. Cognitive-oriented individuals are more susceptible to cognitive appeals, while affect-oriented individuals are more likely to be persuaded by affective appeals (Petty *et al.*, 2009). For promotion-focused individuals, gain-framed messages are more persuasive, while loss-framed messages are more effective for prevention-focused individuals (Cesario & Higgins, 2008; Lee & Aaker, 2004). Matching the message frame with regulatory focus results in greater fluency and influence (Cesario & Higgins, 2008; Lee & Aaker, 2004).

Evidence from consumer research suggests that the way goals are framed affects persuasion significantly (Min *et al.*, 2013; Poels & Dewitte, 2008). For example, framing goals as pursuing intrinsic rather than extrinsic objectives can lead to more desirable outcomes and higher engagement (Vansteenkiste *et al.*, 2004). Therefore, framing intrinsic motivation, promotion focus, or matching initial attitudes can provide an effective surface for persuasion. This can be applied to the *influencer* in our example who tries to convince the *target* that watching TV does not align with their internal life goals (*e.g.*, watching TV is a waste of time).

In persuasion, the fit between self-regulatory orientations (prevention and promotion) and comparative valence is crucial as persuasion is most effective when promotion-focused individuals are influenced by a positive comparative valence; the opposite is true of prevention-focused individuals (Chang & Chou, 2008). This means that if the *influencer* aims to convince the *target* that the goal is unattractive, it will work best if the *target* is prevention-focused. Conversely, if the *influencer* wants to persuade the *target* to believe the goal is worth pursuing, this would work best if the *target* was promotion-focused. The influencer can attempt to amplify or attenuate a goal state within the target by downplaying or exaggerating its value, respectively.

A manipulator can influence goals to trigger conformity (*e.g.*, the social goal to give group-conform responses), as shown by an experiment in which people estimated the movement of a dot of light (Sherif, 1936). The individual assessments differed when people were alone versus in a group, suggesting that external factors can influence internal regulation. Social context can implement or amplify social goals in the manipulated person, such as maintaining social relationships or gaining recognition. Social influence is based on normative and informational influence (Deutsch & Gerard, 1955; Legros & Cislighi, 2020); normative influence aims to conform to expectations, while informational influence aims to reduce uncertainty. Influencers can address both types of conformity and even influence internal goals. Conformity can regulate persuasive processes and affect other levels of the feedback loop, such as restricting or postponing the selection of actions.

Social influence on the subjective situation

To impact a situation, individuals need to be aware of the situation and how to influence it. In our shared television example, the *influencer*’s belief in their ability to win the argument can affect the outcome. For example, if the *influencer*

is the property owner, they could change the situation by declaring the TV as part of the apartment inventory, altering the legality of the negotiation. This action could make the *target* rethink their financial situation and potentially withdraw from the negotiation, reducing the risk of a physical conflict (von Hippel & Trivers, 2011).

Another example of how influence affects the situation is that people are likelier to litter in a polluted environment than in a clean one (Cialdini *et al.*, 1990). However, confederate littering in both environments had contrasting effects: it led to an increase in littering in the polluted environment but a decrease in the clean one. This indicates that situational cues can influence behavior. In the roommate example, as suggested above the influencer could give the *target* a cheap TV as a gift, or remove the TV from the *target*'s access and thus changing the situational context. Alternatively, the *influencer* could manipulate the negotiation situation by choosing a location that gives them an advantage. Let us say the *influencer* is good at gambling at which the *target* is not good and makes the *goal* part of a stake, compromising the *target*, who might feel uncomfortable in the desired scenario. Such an influence changes the current and subjective situation of the target, resulting in subsequent consequences in the feedback loop. The discrepancy between the goal state and the situation (*i.e.*, the *goal* is not yet in the target's possession) becomes amplified. The reason for this amplification is not the absolute difference between the goal and situation, as the *goal* remains unchanged and is still not in the *target*'s possession; instead, the *target* may be less capable of demonstrating behavior that could successfully lead to the goal. This ultimately means that the feedback prediction or success probability is lowered. Consequently, a larger discrepancy is created in the comparator.

Social comparison is an adjacent concept that alters the perception of a situation instead of the facts. Social comparison involves comparing oneself to others, which can influence how individuals perceive their own circumstances. Hence, the influencer's actions may stimulate the target making either upward or downward social comparisons. Upward comparisons aim to increase achievement, while downward comparisons aim to increase subjective well-being (Diel *et al.*, 2021; Wheeler, 1966; Wills, 1981). Accordingly, the *target* may perceive the situation differently when making either of these two kinds of comparisons. In influencing the television negotiation, the *influencer* might point to newer and better TV models if the intention is to keep the shared TV; if the intention is to sell it, the reference may be to older TV models or the benefits of the shared TV.

The specific reason for influencing a situation is often aimed at subsequently affecting the different mechanisms of the cybernetic feedback model. According to the mechanism of upward and downward comparison, an influence on the perceived state may provoke a discrepancy in the comparator of the feedback loop or obscure an existing one. Furthermore, it is possible to influence the situation to increase the basic physical distance between the goal and the target. Another reason for influencing might be to decrease action opportunities and, thus, influence action selection. In both cases, the performance of a successful action by the *target* becomes increasingly difficult, indicating that influence decreases the probability of success, affecting feedback prediction.

Social influence on action selection

Persuasion can alter the internal feedback loop of others during action selection. While the concept of persuasion is widely studied in social psychology, we will only discuss a relevant aspect of persuasion in our article—our interpretation of persuasion based on the feedback framework and its impact on the feedback loop. It is difficult to isolate persuasion solely aimed at action selection versus goal structures, such as an individual's basic preferences. However, differentiating between the two types of persuasion could aid in understanding the persuasion mechanism. We aim to provide a systematic persuasion approach based on the feedback loop's affected aspects. In terms of the direct influence on action selection influencers may promote and prevent certain actions of the target by advising and coaching the target and by directly suggesting to select a specific action as compared to another one.

When doing this, matching the argument in the *influencer*'s statement to the function underlying the *target*'s attitudes is an important aspect of persuasion (Lavine & Snyder, 1996). People have different attitude functions for various issues, and not all are equally receptive to persuasion. Knowing the *target*'s attitude functions helps the *influencer* evaluate the effectiveness of their persuasive attempts, and using convincing arguments instead of weak ones is crucial for successful persuasion (Petty & Wegener, 1998) when suggesting the target to favor one action option as compared to others. Persuasive messages targeting important attitude functions are processed carefully and are less influential (Marsh *et al.*, 1997). Several factors contribute to the success or failure of persuasive attempts aimed at action selection and influencing the internal feedback loop of the *target*.

Chambon and Haggard (2012) proposed a model on the prospect aspect of agency, suggesting that early signals reflecting action selection contribute to a sense of control. A positive sense of agency helps individuals adjust to a dynamic environment and direct their behavior toward a goal (Elsner & Hommel, 2001; Hommel & Elsner, 2009; Ren *et al.*, 2023).

Thus, it is useful to reinforce prioritized actions that lead to control over the environment (Redgrave *et al.*, 2008; Redgrave & Gurney, 2006). It is challenging to influence directly at this stage. However, an external source might be able to manipulate the internal feedback loop; arguments previously expressed by others before action selection may come to mind at this stage. Accordingly, arguments in favor of an action option should promote the prospect of agency and an expected high sense of control.

In contrast, to make some action options less likely, the opposite would be promising, namely a reduction in the expected agency and sense of control. In the context of the shared TV example, imagine that the *influencer* wants to donate the TV to charity, but the *target's* goal state would be to keep it. If the *influencer* posts about giving it to charity on social media, knowing the *target* will see it, it could lead to the *target* withdrawing their own action plan to get the TV since they might feel unable to oppose such a socially desirable action option. In this case, the *influencer* would have promoted an alternative course of action by raising doubts in the *target* about their own potential action. The *action selection* in the *target* may thus result in withdrawing from keeping the TV and the decision to let it go. This influence strategy is based on the *target's* re-evaluation processes and could be successful for the *influencer*.

Another way to influence action selection is through obedience (Caspar *et al.*, 2021). Milgram's (1963) experiments demonstrated how people comply with commands despite potentially harming others. In these experiments, a fictional authority-subordinate relationship was established to create a goal state that required a predetermined action (*i.e.*, administering electrical shocks to an unseen receiver). Later research replicated these findings, showing the importance of predetermined action selection as a potential influence strategy (Slater *et al.*, 2006). The use of electric shocks as a means of social influence highlights the complexity of social influence and the need for a nuanced understanding of the underlying processes. For instance, the experiment could also influence the goal state, as using electric shocks for education may differ depending on one's moral objections.

According to Stayton *et al.* (1971), humans are receptive to social influence through external signals rather than internalized control. This suggests that humans are prepared to obey verbal instructions. The foot-in-the-door technique (Freedman & Fraser, 1966) is an example of compliance without the involvement of an authority figure. This technique initially makes a small request, followed by a larger related request. The strategy is successful where the compliance rate is higher for those who received the original request than those who did not (Freedman & Fraser, 1966).

The influence of an *influencer* on the *target's* action selection can be affected by various factors, such as the *influencer's* perceived reputation and trustworthiness. If the *target* perceives the *influencer* as highly reputable and trustworthy (Haslam *et al.*, 2014; Hollander & Turowetz, 2017), they may be more likely to obey or comply with the *influencer's* advice. This is true, even if the advice does not necessarily align with the *target's* intuitive approach to achieving their goals.

In our shared TV example, the *influencer* might suggest a specific action that is purposeful but may not align with the *target's* initial preferences. However, this tactic is more likely to be effective if the *influencer* is perceived as highly reputable and trustworthy, which may lead the *target* to comply. Depending on the *influencer's* goal, they may suggest actions that increase or decrease the probability of the *target* achieving their goals. For instance, an *influencer* may suggest dubious action alternatives to compromise the *target's* success rate or portray an authority that the *target* should obey, especially if the *influencer* appears to have more experience or technical knowledge.

Other social manipulation tactics, such as coercion, hardball, or silent treatment (see Buss, 1992), also fall under this category. These tactics use strong aversive motivational tools to push a particular action selection in the *target*. However, this article does not address these tactics in more detail. Another potential approach to influence action selection is nudging, which uses positive reinforcement and indirect suggestions to encourage a particular behavior or decision without restricting the individual's freedom of choice (Sunstein, 2014).

In summary, the effectiveness of an *influencer's* strategy in influencing the *target's* action selection depends on various factors, including the *influencer's* perceived reputation and trustworthiness, their interests, and the type of approach they use.

Social influence on behavior while acting

The influence on actual behaviors is particularly challenging to isolate in the proposed cybernetic feedback model. In this article, we tried to address attentional, perceptual, or cognitive manipulations in the stages preceding entering a feedback loop. Hence, we refer to physically-induced manipulation when discussing behavior in this subsection. This subsection comprises influences closely linked to behavioral change, such as violent or deceptive action redirections (*e.g.*, pretending to be a courier for someone before delivering completely different information).

However, most social influence research concerns social norms and subtle psychological processes (Cialdini & Goldstein, 2004). Thereby, descriptive norms refer to the behavior of relevant others (*e.g.*, peers, family, society) and provide a socially determined standard for effective behavior (*i.e.*, what individuals typically do), while injunctive norms refer to appeals about what other members of society approve or disapprove of. Descriptive norms, for instance, can be sufficient to alter an individual's behavior through exposure to peer groups (Cullum *et al.*, 2010; Goldstein *et al.*, 2008). The social influence induced by social norms can alter the internal feedback loop regarding action selection but also action itself. Specifically, exposure to peer groups' behavior can prime and make a selected action more salient (Do *et al.*, 2022) or the mere adaption of an action more likely (Albert *et al.*, 2013). In contrast, the ability to deduce intentions from peers' behavior can lead to the formation of goals (for a review on peer influence in energy consumption behavior, see Wolske *et al.*, 2020). Another interesting aspect in this context, which is not discussed in detail here, is the identity-based group influence as discussed in a recent review (Spears, 2021).

In addition, actively promoting and enforcing social norms can alter the future behavior of others. For example, people may ostracize norm-deviant behavior to strengthen their position in a group (Willer *et al.*, 2009). This directly affects the punished person and indirectly influences others through previously mentioned mechanisms. The punishment may implement an avoidance goal, influence action selection by favoring active avoidance choices and alter feedback prediction by reducing the expected success of behavior opposing the influencer.

The distinction between physically-induced manipulations and social influence research is important in understanding the various mechanisms of social influence. While physically-induced manipulations are the focus of this opinion piece in the current section, social norms and influence processes are important to altering related feedback loop behavior. By understanding these mechanisms, we can gain insight into how behavior can be altered in feedback loops, both directly and indirectly.

Social influence on feedback prediction

In reinforcement learning theories, feedback prediction is the predicted reward value of performing an action. Our brains utilize these values to adapt behavior by biasing action selection towards instrumental actions with the highest predicted reward value (Redgrave *et al.*, 1999; Sosa & Giocomo, 2021). In the broader sense of value based on expectancy models, feedback prediction optimizes goal pursuit and combines reward value and the probability of success. Those behavioral actions that are instrumental to achieving goals with higher predicted outcome values are chosen more often (Samejima *et al.*, 2005) and more rapidly (Brown & Bowman, 1995) than those with lower values. Furthermore, the reward system is also known to prefer actions and goals that implicate actual (Bednark & Franz, 2014; Behne *et al.*, 2008) versus potential (Leotti & Delgado, 2011; Tricomi *et al.*, 2004) control over the environment.

In our proposed model, the *target's* internal feedback loop can be altered by manipulating their subjective probability of success; it can be increased to stimulate or motivate action or reduced to discourage it. As mentioned (see "social influence on the subjective situation"), manipulating the situation may often be a valid pathway to influence feedback prediction.

In some cases, the *influencer* may use deception to instill a false belief in the *target's* mind to reach their goal. We use deception as a functional strategy to achieve goals in a social interaction by influencing others in their feedback prediction process. The central aim is to alter the *target's* success predictions, either by exaggerating them to promote success or abridging them to discourage it. We will not delve into the consequences of falsehoods or affective aspects that may arise when deception is detected, as we focus on the framework for entering a feedback loop.

Framing is key in achieving this type of influence, as it emphasizes the distinct attributes of an issue over other potential consequences (Nelson *et al.*, 1997; Nelson & Kinder, 1996; Price & Tewksbury, 1997); its effectiveness seems to depend on familiarity with the issue. The reason might be that persons familiar with a certain topic have a deeper knowledge structure than individuals unfamiliar with it. In the context of our shared TV example, a devaluation framing could be a phrase like "I will make it very difficult for you to get this TV!" or the opposite might be a phrase like "Why bother buying a new TV when you can have this one easily?". Many studies have explored this persuasive strategy (Druckman, 2001; Gächter *et al.*, 2009; Tversky & Kahneman, 1981) though framing may sometimes also address the valuation of the goal state and would then be related to the respective section above.

Examples of model applications

In the following subsections, we describe studies dealing with different aspects of social influence and persuasion. We outline how our model differs characteristically and alters the internal feedback loop of participants at different stages. In Higgins' (1997) regulatory focus theory, the authors posit two distinct self-regulatory orientations—prevention and

promotion focus—relevant to our model as they directly influence the cybernetic feedback loop. Following that model, we posit that a prevention or promotion feedback loop will occur in a target person. There may be overlapping aspects between—but also within—the studies regarding the different entrance gates to manipulate the *target's* feedback loop, which we will present in the following subsections. Moreover, not all aspects of our model will be addressed and easily implemented in every experiment. However, by altering the experiments, we propose simple and creative solutions to describe manipulation options according to our model. While the mechanisms of our cybernetic feedback model could most effectively be investigated through laboratory experiments, we have decided to include both field and laboratory experiments.

Before starting with the research examples, we will briefly describe the systematic approach used to analyze studies in this domain. First, we identified the relevant goals in the experiment (*e.g.*, social goals, personal goals) and whether their value was manipulated or an additional goal was included. For instance, introducing a social comparison may add social goals to an otherwise private context. Second, we analyzed the influenced situational characteristics. Third, we examined whether action selection was manipulated—whether a specific behavioral choice was promoted. Fourth, we examined action opportunities or direct effects on action execution. Fifth, we examined the effects of social influence on feedback prediction and ‘goal state versus situation’ discrepancy, for example, by manipulating a *target's* subjective goal attainment probability.

In the following subsections, we explain the findings, apply our model, and derive additional experimental manipulations based on our framework.

Descriptive and injunctive social norms

Melnyk *et al.* (2013) argue that descriptive norms motivate engagement in specific behavior depending on their social rewards, while injunctive norms motivate engagement through the threat of punishment. They investigated the effect of regulatory focus on the influence of descriptive and injunctive social norms in the context of sustainable food choices. We use their study as an example of a potential influence on the goal state and (indirectly) action selection.

In the first three experiments by Melnyk *et al.* (2013), state regulatory focus was induced as a between-variable to participants. For norm induction, participants were shown a fictitious website covering information on fair-trade coffee using a text framed with either descriptive or injunctive norms. Participants were then asked to answer questions regarding attitudes toward fair-trade coffee and their planned buying intentions. While controlling for past buying behavior, an induced promotion focus increased the efficiency of descriptive norms, resulting in more favorable attitudes and intentions toward sustainable choices. In contrast, injunctive norms were not influenced by the regulatory focus state.

While the second experiment by Melnyk *et al.* (2013) only targeted the perceived fluency of the different normative messages, the third experiment replicated the first, using organic milk instead of fair-trade coffee. Here, regulatory focus induction was included in the text message and not conducted separately, as in the first experiment. However, the results were comparable to those of the first experiment. When taken together, the results showed that promotion focus increased buying intentions in the descriptive norm condition, while no differences were found in the injunctive norm condition. This may be due to a ceiling effect since intentions were as high in the injunctive conditions as in the promotion-focused descriptive conditions. The former aligns with descriptive norms' influence on a promotion-feedback loop.

As participants in the studies conducted by Melnyk *et al.* (2013) were invited to evaluate the design of a website, their goal orientation was distracted from the actual research goal. However, social comparisons regarding relevant others (*i.e.*, other students), which were used in the descriptive norm induction (“A great number of [...] students purchase Fair Trade coffee regularly”), might have activated an explicit awareness of social norms regarding pro-environmental behavior. Importantly, environmental goals were not different between conditions, so only the presence of different social goals was relevant.

Particularly, the presence of an injunctive norm generally increased intentions, so it was sufficient to influence behavior. According to our model, we argue that this was due to the inclusion and presence of a social goal. In the descriptive norm condition, we suggest that the presence of a promotion focus was sufficient to activate a goal in participants. Moreover, participants in the studies of Melnyk *et al.* (2013) conducted the experiment together in one room, facilitating implicit social comparisons with peers. Consequently, the situation was influenced by the data collection (*i.e.*, in groups), indicating that the state-induced regulatory focus might have become fragile, particularly for individuals sensitive to social pressure.

In the studies conducted by Melnyk *et al.* (2013), action selection was manipulated by the different normative framings present in the website content. However, as participants were instructed to focus on design features, the target manipulation tool of the study was implicit. The distraction from the study goal might have enabled participants to answer the dependent variable questions for reasons other than experimental manipulation (*e.g.*, general pro-environmental attitudes). Nonetheless, the experiments did not directly influence action selection because they were based on text reading and questionnaires. However, the success of feedback prediction depends on interindividual differences. Individuals with pro-environmental attitudes and a low budget might have perceived the situation as a trigger for a discrepancy between the personal goal state and the is state (*i.e.*, they would like to buy fair-trade coffee but cannot afford it). Regarding the apparent study goal—evaluating a website design—a discrepancy between the goal state and the situation might only have been present if the website design was overly flawless. Such a scenario would have caused participants to be unable to offer suggestions and fail to achieve the goal.

Future research based on the cited study might add several conditions and prerequisites to investigate the interaction between regulatory focus, descriptive norms, and the first and injunctive norms. We propose two additional conditions with the explicit goal of focusing on the text by asking participants whether the content could lead to more purchases of fair-trade products (versus a control group). Therefore, differences in the goal state and the influence on action selection could be examined using our framework. Furthermore, we recommend that future studies focus more on goal-framing than on peers' behavior; for instance, buying fair-trade coffee could be presented to students as promotional material for local and sustainable food production or preventing the exploitation of local resources.

In two field experiments, Goldstein *et al.* (2008) investigated the influence of three different towel reuse signs in hotel rooms on pro-environmental behavior. The hotel guests were not informed about their participation in the experiment and were randomly assigned to one of three towel-reuse conditions. This example serves to highlight the influence on action selection beyond the goal state more clearly.

In the first experiment, the first condition corresponded to an industry standard that emphasized towel reuse for environmental reasons without referring to any descriptive and normative information. The second condition corresponded to a global standard describing the towel reuse behavior of all hotel guests. The third condition was a provincial norm describing the towel reuse behavior of other guests who had booked the same room. The results showed that the third condition (specific hotel room) significantly impacted behavior; the provincial norm led to more towel reuse than the global and industry standards. In the second experiment, the authors replicated the findings of the first experiment, showing that hotel guests conformed more to the provincial norm compared with the norms of other hotel guests (*e.g.*, gender identity).¹ Unfortunately, there was no control condition for this experiment.

The major difference between the three main conditions was the presence of a social comparison in the second and third conditions. This may introduce additional social goals and social motivation for the target. Considering these additions, participants were prompted to compare their behavior with the proposed social comparison group. This may have motivated behavior through goals such as social attachment. As the hotel guests were ostensibly unaware of their study participation, they were also unaware of the manipulation of the goal state and the study aim. This study design has an advantage over laboratory experiments, although the latter might induce an artificial focus on social norms. However, environmental characteristics, such as the hotel type (in this case, a “midpriced chain hotel”), might have subconsciously implemented a general behavioral goal; for instance, an eco-hotel might increase pro-environmental behavior. Replicating these experiments using a controlled setting would allow for investigating general pro-environmental behavior without any norms (*e.g.*, avoid energy-wasting behavior), which might more accurately represent an internal goal state than the signage would.

An alternative experimental manipulation of the situation could be to measure the number of towels reused per day compared with relative numbers; the situation, in this case, depends on the number of booked nights. With this approach, researchers may assess behavioral changes for guests with different bookings, identifying potential differences between staying only one night and staying one week, for example. In another hypothetical scenario, the signs might focus on different standards rather than specific reuse goals. For example, if the goal is to reuse 10 towels per week, participants' behavior might differ if eight have already been reused when they enter the room compared with a situation where only two have been reused.

¹Schultz *et al.* (2008) could not replicate differences between the two types of normative messages. Hence, further research is needed to investigate conditions under which different types of messages increase pro-environmental behavior in this context.

The selected study aimed to manipulate action selection using different signs. However, the most effective method for manipulating action selection was to address the current situation of participants (*i.e.*, the towel reuse behavior of other guests who had booked the same room). This example illustrates that, during the physical absence of social agents, action selection needs to and can be manipulated *via* a preceding operation (*i.e.*, manipulating the goal state or the situation). In this scenario, one possibility to influence action directly, in an ethical manner, would have been to implement a condition where cleaning staff would put the towels back, thereby forcing participants to reuse them. Participants would then have to invest more energy into not reusing the towels; for example, hotel guests may need to specifically request that staff clean the towels.

An additional reward or token system for towel reuse behavior could be applied to directly address the action and feedback prediction simultaneously. In a cybernetic feedback model, when there is a significant difference between an individual's internal reference value (such as their preference for reusing towels) and external information (such as a feedback sign in a hotel bathroom evaluating their behavior), this can lead to a larger disparity in the comparator. As a result, the individual may make more significant adjustments in their action selection and execution to decrease this discrepancy, for instance, increasing towel reuse if their initial preference for reusing towels was low. By extending and altering the study setup with these examples, future studies could investigate which pathway for addressing social norms might best foster pro-environmental behavior within a feedback loop framework.

Compliance

To illustrate the merit of our model for compliance, we can apply our framework—especially the influence on the goal state—to research related to health promotion and disease prevention in healthcare (Spiegel *et al.*, 2004) in a study on the nutritional habits of college students. Participants received a daily nutrition log booklet to record their daily consumption of fruits and vegetables; they were instructed to return a week later with a completed booklet. Participants received a questionnaire on food habits and health messages along with the booklet. Using a between-subjects design, participants received four different messages framing the regulatory focus (addressing the imagined benefits of compliance) and the outcome (addressing the imagined costs of non-compliance). The dependent variable was the effectiveness of health messages in changing behavior: eating more fruits and vegetables after one week. Results revealed that messages that focused on the potential benefits of successful dietary change were more effective in promoting behavior change when the goal was presented as health promotion-focused, compared to messages that focused on the potential costs of dietary change failure. The opposite was true when the goal of eating more fruits and vegetables was presented as a health prevention-focused issue, and no main effects of regulatory focus or outcome framing were identified.

Experiment two was notable, where participants were requested to read either a promotion or a prevention-framed health message urging them to eat more fruits and vegetables; a goal was explicitly set. In line with regulatory focus theory and our model, we argue that social influence works best when targeting either a promotion (approach) or a prevention (avoidance) feedback loop in the target. Researchers could also directly address action selection by giving participants specific action planning options in addition to the goal state (imagination of benefits). Accordingly, a fit between influencing action selection (*e.g.*, identifying a good time) and influencing the goal (*i.e.*, outcome benefits) may provide the best results in influencing action selection. Future research might manipulate feedback prediction by adding comparative information about the degree and likelihood of success toward dietary change.

Advertisement

Zhao and Pechmann (2007) examined the impact of regulatory focus and different framing strategies on the persuasiveness of antismoking advertisements for high school students. This study illustrates how behavior can be influenced during action selection, but also the goal state and the feedback prediction according to our framework. The authors created four antismoking advertisements that differed in their regulatory focus (promotion versus prevention) and outcome framing (favorable versus unfavorable). In the first experiment, the authors used a three-factor between-design categorization, classifying participants based on their dominant regulatory focus (assessed via a validated scale), the advertisement's regulatory focus, and the outcome framing. A control group with a non-smoking-related advertisement was included. The criterion was the intention not to smoke cigarettes. The study found that anti-smoking advertisements were most effective when the viewers' regulatory focus, the advertisement's regulatory focus, and the message framing worked together. Specifically, promotion-focused individuals responded best to promotion-focused advertisements with a positive outcome framing, while prevention-focused individuals responded best to prevention-focused advertisements with a negative outcome framing. A second experiment with a similar design, but with an active manipulation of participants' regulatory focus, replicated the results of the first experiment.

The participants in this study were randomly assigned to groups and watched an episode of a TV show where the advertisements were shown between several other filler advertisements. The goal to be implemented or strengthened in

targets was non-smoking, which might be pursued by addressing health issues. However, advertisements also specifically added social goals to the context of smoking, particularly social acknowledgment and attachment. Thus, the goal level was directly addressed with these advertisements; the social environment provided positive and negative feedback toward the depicted smoker.

Per our framework, the target of the presented experiments in [Zhao and Pechmann \(2007\)](#) was to manipulate behavior (*i.e.*, the post-experimental questionnaire assessing the intention to smoke) *via* the presentation of these advertisements. The inclusion of the advice, “Don’t smoke!” in the advertisement had a direct influence on action selection but did not seem to change behavior compared to the control group. Feedback prediction was influenced by showing participants the potential social consequences of smoking and non-smoking through the behavior present in the advertisement’s social context. The study clearly showed that a match among individual regulatory focus, outcome type, and the regulatory or motivational state leads to the greatest changes in behavior. In the feedback loop framework, we argue that manipulation works on a specific feedback loop in a target. Ideally, all manipulation aspects should converge on the same feedback loop—either a promotion/approach loop or a prevention/avoidance loop.

Several options can be employed to extend the experimental design and add manipulation possibilities using our framework. Although [Zhao and Pechmann \(2007\)](#) included a control condition for the task, all participants were classified by a regulatory focus or induction. An additional, unbiased control group without regulatory focus induction should be included in future research. Furthermore, the intention to smoke may vary in contexts outside the school classroom. Therefore, future studies could examine the influence of situational factors, such as watching a TV show in the classroom and on a smartphone in the corner of the schoolyard. Situational influences on intentions might then be examined by measuring baseline intentions to smoke and previous smoking behavior; these state variables might interact with the implementation of the social goals using the advertisements. In smokers or people with stronger smoking intentions, social goal implementation likely leads to a stronger is-ought discrepancy, which may increase adjustments or reactance; for example, if the discrepancy is too large for an individual to deal with. Future research should assess the level of is-ought behavior discrepancy.

Nudging

According to [Thaler and Sunstein \(2008\)](#), nudging refers to interventions implemented by persons with responsibilities over a group to help those individuals make responsible decisions. We used a study investigating the effects of nudging on when and why users opt for online ID verification in the context of digital platforms to explore the application of our model in an example ([Schneider *et al.*, 2017](#)). This study is a good case of targeting action selection rather than goal structures. The researchers combined assurance statements as claims (which were framed as promotion and prevention focus) on a fictional car-sharing platform. The supporting data covered the convenience, security, and privacy aspects of online verification (present versus absent). The dependent variable was the choice for online verification (*i.e.*, a webcam session with a verification agent) compared with offline verification (*e.g.*, physically visiting a post office). A control group without claims and data was included in addition to the four experimental groups (two claims, each with present or absent data). The results showed that participants in the promotion focus group were more likely to choose online verification when no data was available than those in the prevention focus group. However, this effect was reversed in the presence of data, as participants chose online verification more often in the prevention focus group than in the promotion focus group.

Concerning the goal state of achieving verification, two paths of action were available. Regarding action selection, participants faced a binary choice: online versus offline verification. They were asked to put themselves in the position of a prospective car-sharing user, and the goal of completing the registration process was implemented. In this case, the goal value was not manipulated, but the means to achieve it was (*i.e.*, online versus offline verification). Depending on the car-sharing platform’s relevance for participants, their personal goals might have amplified the goal state. For example, participants who used car-sharing platforms more often were motivated to participate. A general bias towards a digital context might have implicitly influenced the situation because the study was conducted online, and participants were asked to take the perspective of a car-sharing user. The manipulation of action selection was targeted by increasing the credibility of online verification by including security-related data on the platform and the regulatory focus framing of the claims.

By conducting the experiment in a laboratory, researchers could manipulate situational factors—such as conducting offline verification in a controlled manner and in a separate room—which reduced the influence of the distance between participants’ homes and a post office. To manipulate action, a queue condition could be implemented in the offline verification process, highlighting the time-related advantages of the online process. To influence feedback prediction, the researchers could use a sequential design to present regulatory focus framing and supportive security data, evaluate

the choice option multiple times, and provide participants with more information about the likelihood of success and the difficulties in attaining the goal.

We further selected a series of studies on dietary decisions to apply our model (Prinsen *et al.*, 2013). The rationale of Prinsen *et al.* (2013) was that individuals conform to the eating behavior of others and, therefore, should be affected by the corresponding environmental cues that signal what others have done. The authors conducted field and laboratory experiments using a between-group design with a bowl of hand-wrapped chocolates. The amount of chocolate taken was the outcome variable. The researchers placed a second bowl next to the bowl of hand-wrapped chocolates; this second bowl had twenty used wrappers for one group of participants and was empty for the second group. Participants were more likely to take chocolates in the presence of an environmental cue (*i.e.*, empty wrappers indicating that previous participants also took chocolate). In another experiment, the authors manipulated the healthiness of the snack (healthy snack compared with unhealthy snack) and the goal prime (a magazine on healthy eating versus a magazine on hedonic eating) to measure snack choice. The results indicated that participants conformed to environmental cues about the food type others had eaten in addition to the eating behavior of others in general. The participants in all experiments were given a false story that they were waiting for the experiment to start; the authors evaluated the experiments during this waiting period.

In the first two experiments, no food-related goal state was implemented or directly manipulated for participants. However, since participants had to answer several questions (*e.g.*, the time difference to their last meal), we cannot completely rule out that at least some of the participants focused on the food. Participants in the laboratory settings were told that the study assessed their reaction time (Experiment two) or their completion of a cognitive task (Experiment three). The empty wrappers may have worked to manipulate the situation in several ways: they may disinhibit eating behavior because other participants had already eaten the chocolate, which could activate social motivation to act similarly (activating a social goal state). Second, they may have directly influenced action selection by promoting simple behavioral imitation.

To manipulate the goal state, a possible experimental condition would be to label the fake “target” tasks as food-related or not. In the published study, the authors focused on manipulating the situation with the filled and empty bowls, which indicated past participants’ behavior and demonstrated that such behavior impacted decision-making. Moreover, the magazines on healthy versus hedonic eating might be considered manipulation tactics influencing the goal state or action selection. These magazines should only affect behavior if the decision to take food has already been made. In this task, manipulating the action could pose ethical issues involving forcing someone to eat. However, this may be accomplished by experiments relating to tasting and judging food, which makes people eat. Implementing a prediction error in the feedback loop of the participants would suffice to manipulate feedback prediction. For example, if the instruction had been that “eating is voluntary, but healthy versus unhealthy food (or *vice versa*) that does not get eaten will be thrown away,” they might have experienced a conflict between the behavior of previous participants, the goal prime induced by the magazine they read, and the type of food that would be discarded. In addition, the subjective situation may be manipulated by letting participants enter the experiment in a hungry or a full state.

To ensure the optimal nudging practice, we suggest that it may be critical to reducing the discrepancy between the optimal outcome (choosing more healthy food) and the initial goal state. To disentangle the indirect influences on goal and direct influences on action, one option could be to use videos that depict or do not depict eating behavior. Additionally, the videos could include a verbal message promoting or preventing a certain kind of eating behavior, such as unhealthy food. While the direct influence on action may be the imitation of the seen/condemned behavior, the impact on the goal state should depend on the verbal content of the material promoting health. Additionally, all levels of manipulation might address either a promotion or a prevention feedback loop.

Boundary conditions

We deal with apparent boundary conditions to complete the theoretical discourse of the social influence on a target’s feedback loop system. Our proposed model, and probably influence in general, depends on the reactance of the *target*. Some people may be more susceptible to influence strategies than others, and these differences may hinder or even exclude the success of social influence. Furthermore, the ability of the *target* to mentalize the *influencer*’s intentions may interfere with the *influencer*’s successful exertion of influence. Therefore, highly reactant individuals and people good at mentalizing their social interaction partners might not be good *targets* for applying this framework. However, it may be interesting to examine whether the discrepancy between the reference or goal state and the current state or situation can predict reactance. Potentially, a discrepancy that seems too large for the individual may promote reactance. Alternatively, there may be a threshold at which the magnitude of the discrepancy between the goal state and the current state renders the pursuit of the goal obsolete, thus resulting in a decline in reactance.

Conclusions

We proposed a social influence model that targets different parts of an interaction partner's internal feedback loop. To illustrate the need for this model, we explained the influence on the goal state, action selection, action, and feedback prediction in detail. Lastly, we analyzed classical experiments on social influence, conformity, and advertisements and applied our model. As many examples have shown, there are different ways to enter another person's feedback loop by exerting external social influence. Depending on the *influencer's* intentions, one specific influence tactic might affect different stages or even more than one stage of the cybernetic loop system at the same time.

With our proposed model, we aimed to present a new perspective on classic experiments and paradigms that have investigated different kinds of social influence and to classify them according to our model. Future studies should selectively examine the single stages of social influence and combine this model with others, such as reinforcement learning. In addition, future research should carefully consider whether there are interindividual differences in the influenced person, such as gender or personality, that might promote or hinder the effectiveness of different influence strategies according to our model. In our view, understanding how to influence only one particular aspect while excluding the influence of another aspect may be crucial for a more detailed perspective on social influence.

Data availability

No data are associated with this article.

References

- Aaker JL, Lee AY: **"I" seek pleasures and "we" avoid pains: The role of self-regulatory goals in information processing and persuasion.** *J. Consum. Res.* 2001; **28**(1): 33–49.
[Publisher Full Text](#)
- Aiello A, Tesi A, Pratto F, et al.: **Social dominance and interpersonal power: Asymmetrical relationships within hierarchy-enhancing and hierarchy-attenuating work environments.** *J. Appl. Soc. Psychol.* 2018; **48**(1): 35–45.
[Publisher Full Text](#)
- Albert D, Chein J, Steinberg L: **The teenage brain: Peer influences on adolescent decision making.** *Curr. Dir. Psychol. Sci.* 2013; **22**(2): 114–120.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Asch SE: **Studies in the principles of judgments and attitudes: II. Determination of judgments by group and by ego standards.** *J. Soc. Psychol.* 1940; **12**(2): 433–465.
[Publisher Full Text](#)
- Bednark JG, Franz EA: **Agency attribution: Event-related potentials and outcome monitoring.** *Exp. Brain Res.* 2014; **232**(4): 1117–1126.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Behne N, Scheich H, Brechmann A: **The left dorsal striatum is involved in the processing of neutral feedback.** *NeuroReport.* 2008; **19**(15): 1497–1500.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Brown VJ, Bowman EM: **Discriminative cues indicating reward magnitude continue to determine reaction time of rats following lesions of the nucleus accumbens.** *Eur. J. Neurosci.* 1995; **7**(12): 2479–2485.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Bruins J: **Social power and influence tactics: A theoretical introduction.** *J. Soc. Issues.* 1999; **55**(1): 7–14.
[Publisher Full Text](#)
- Buss DM: **Manipulation in close relationships: Five personality factors in interactional context.** *J. Pers.* 1992; **60**(2): 477–499.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Carver CS: **Self-regulation of action and affect.** Vohs KD, Baumeister RF, editors. *Handbook of self-regulation: Research, theory, and applications.* The Guilford Press; 2004; pp. 13–39.
- Carver CS, Scheier MF: *Attention and self-regulation: A control-theory approach to human behavior.* New York: Springer-Verlag; 1981.
[Publisher Full Text](#)
- Carver CS, Scheier MF: **Scaling back goals and recalibration of the affect system are processes in normal adaptive self-regulation: Understanding "response shift" phenomena.** *Soc. Sci. Med.* 2000a; **50**(12): 1715–1722.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Carver CS, Scheier MF: **On the structure of behavioral self-regulation.** Boekaerts M, Pintrich PR, Zeidner M, editors. *Handbook of self-regulation.* Academic Press; 2000b; pp. 41–84.
[Publisher Full Text](#)
- Caspar EA, Beyer F, Cleeremans A, et al.: **The obedient mind and the volitional brain: A neural basis for preserved sense of agency and sense of responsibility under coercion.** *PLoS One.* 2021; **16**(10): e0258884.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Cesario J, Higgins ET: **Making message recipients "feel right": How nonverbal cues can increase persuasion.** *Psychol. Sci.* 2008; **19**(5): 415–420.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Chambon V, Haggard P: **Sense of control depends on fluency of action selection, not motor performance.** *Cognition.* 2012; **125**(3): 441–451.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Chang CC, Chou YJ: **Goal orientation and comparative valence in persuasion.** *J. Advert.* 2008; **37**(1): 73–87.
[Publisher Full Text](#)
- Cialdini RB, Goldstein NJ: **Social influence: Compliance and conformity.** *Annu. Rev. Psychol.* 2004; **55**: 591–621.
[Publisher Full Text](#)
- Cialdini RB, Reno RR, Kallgren CA: **A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places.** *J. Pers. Soc. Psychol.* 1990; **58**(6): 1015–1026.
[Publisher Full Text](#)
- Cullum J, Armeli S, Tennen H: **Drinking norm-behavior association over time using retrospective and daily measures.** *J. Stud. Alcohol Drugs.* 2010; **71**(5): 769–777.
[Publisher Full Text](#)
- Deutsch M, Gerard HB: **A study of normative and informational social influences upon individual judgment.** *J. Abnorm. Soc. Psychol.* 1955; **51**(3): 629–636.
[Publisher Full Text](#)
- Diel K, Grelle S, Hofmann W: **A motivational framework of social comparison.** *J. Pers. Soc. Psychol.* 2021; **120**: 1415–1430.
[Publisher Full Text](#)
- Do KT, Prinstein MJ, Telzer EH: **Neurobiological susceptibility to peer influence in adolescence.** Cohen Kadosh K, editors. *The Oxford Handbook of Developmental Cognitive Neuroscience.* Oxford University Press; 2022.
[Publisher Full Text](#)
- Druckman JN: **Using credible advice to overcome framing effects.** *J. Law Econ. Org.* 2001; **17**(1): 62–82.
[Publisher Full Text](#)
- Elsner B, Hommel B: **Effect anticipation and action control.** *J. Exp. Psychol. Hum. Percept. Perform.* 2001; **27**(1): 229–240.
[Publisher Full Text](#)
- Falk E, Scholz C: **Persuasion, influence, and value: Perspectives from communication and social neuroscience.** *Annu. Rev. Psychol.* 2018; **69**:

- 329–356.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Fischer AH, Manstead ASR, Zaalberg R: **Social influences on the emotion process.** *Eur. Rev. Soc. Psychol.* 2003; **14**(1): 171–201.
[Publisher Full Text](#)
- Fiske ST: **Controlling other people: The impact of power on stereotyping.** *Am. Psychol.* 1993; **48**(6): 621–628.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Freedman JL, Fraser SC: **Compliance without pressure: The foot-in-the-door technique.** *J. Pers. Soc. Psychol.* 1966; **4**(2): 195–202.
[Publisher Full Text](#)
- French JRP, Raven B: **The bases of social power.** Cartwright D, editor. *Studies in social power.* University of Michigan; 1959; pp. 150–167.
- Frick TW, Li T, Pavlou P: **Social influence and visual attention in the personalization privacy paradox for social advertising: An eye tracking study.** *WISP 2018 Proceedings.* 2018; **8**.
- Gass RH, Seiter JS: *Persuasion: Social influence and compliance gaining.* Routledge; 2022.
[Publisher Full Text](#)
- Gächter S, Orzen H, Renner E, et al.: **Are experimental economists prone to framing effects? A natural field experiment.** *J. Econ. Behav. Organ.* 2009; **70**(3): 443–446.
[Publisher Full Text](#)
- Goldstein NJ, Cialdini RB, Griskevicius V: **A room with a viewpoint: Using social norms to motivate environmental conservation in hotels.** *J. Consum. Res.* 2008; **35**(3): 472–482.
[Publisher Full Text](#)
- Haddock G, Maio GR, Arnold K, et al.: **Should persuasion be affective or cognitive? The moderating effects of need for affect and need for cognition.** *Personal. Soc. Psychol. Bull.* 2008; **34**(6): 769–778.
[Publisher Full Text](#)
- Harkins SG, Williams KD, Burger JM: *The Oxford handbook of social influence.* Oxford University Press; 2017.
[Publisher Full Text](#)
- Haslam SA, Reicher SD, Birney ME: **Nothing by mere authority: Evidence that in an experimental analogue of the Milgram paradigm participants are motivated not by orders but by appeals to science.** *J. Soc. Issues.* 2014; **70**(3): 473–488.
[Publisher Full Text](#)
- Higgins CA, Judge TA, Ferris GR: **Influence tactics and work outcomes: A meta-analysis.** *J. Organ. Behav.* 2003; **24**(1): 89–106.
[Publisher Full Text](#)
- Higgins ET: **Beyond pleasure and pain.** *Am. Psychol.* 1997; **52**(12): 1280–1300.
[Publisher Full Text](#)
- Higgins ET: **Promotion and Prevention: Regulatory Focus as a Motivational Principle.** *Adv. Exp. Soc. Psychol.* 1998; **30**: 1–46.
[Publisher Full Text](#)
- Higgins ET: **Promotion and prevention as a motivational duality: Implications for evaluative processes.** Chaiken S, Trope Y, editors. *Dual-process theories in social psychology.* The Guilford Press; 1999; pp. 503–525.
[Reference Source](#)
- Hollander MM, Turowetz J: **Normalizing trust: Participants' immediately post-hoc explanations of behaviour in Milgram's 'obedience' experiments.** *Br. J. Soc. Psychol.* 2017; **56**(4): 655–674.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Holler M, Hoelzl E, Kirchler E, et al.: **Framing of information on the use of public finances, regulatory fit of recipients and tax compliance.** *J. Econ. Psychol.* 2008; **29**(4): 597–611.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Hommel B, Elsner B: **Acquisition, representation, and control of action.** Morsella E, Bargh JA, Gollwitzer PM, editors. *Social cognition and social neuroscience.* Oxford handbook of human action. Oxford University Press; 2009; pp. 371–398.
- Jäger A, Loschelder DD, Friese M: **How self-regulation helps to master negotiation challenges: An overview, integration, and outlook.** *Eur. Rev. Soc. Psychol.* 2015; **26**(1): 203–246.
[Publisher Full Text](#)
- Lammers J, Stoker JL, Rink F, et al.: **To have control over or to be free from others? The desire for power reflects a need for autonomy.** *Pers. Soc. Psychol. Bull.* 2016; **42**(4): 498–512.
[Publisher Full Text](#)
- Lavine H, Snyder M: **Cognitive processing and the functional matching effect in persuasion: The mediating role of subjective perceptions of message quality.** *J. Exp. Soc. Psychol.* 1996; **32**(6): 580–604.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Lee AY, Aaker JL: **Bringing the frame into focus: The influence of regulatory fit on processing fluency and persuasion.** *J. Pers. Soc. Psychol.* 2004; **86**(2): 205–218.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Legros S, Cislighi B: **Mapping the social-norms literature: An overview of reviews.** *Perspect. Psychol. Sci.* 2020; **15**(1): 62–80.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Leonard A, Scholte T, Shepherd K, et al.: **Cybernetics Approaches and Models.** Metcalf GS, Kijima K, Deguchi H, editors. *Handbook of Systems Sciences.* Springer; 2021; pp. 67–86.
[Publisher Full Text](#)
- Leotti LA, Delgado MR: **The inherent reward of choice.** *Psychol. Sci.* 2011; **22**(10): 1310–1318.
[Publisher Full Text](#)
- Levi D, Askay DA: *Group dynamics for teams.* SAGE Publications; 2015.
- Lewin K: **Analysis of the concepts whole, differentiation, and unity.** *University of Iowa Studies in Child Welfare.* 1941; **18**(1): 226–261.
- Mansell W: **Changing Behavior Using Control Theory.** Hamilton K, Cameron LD, Hagger MS, et al., editors. *The Handbook of Behavior Change.* Cambridge University Press; 2020; pp. 120–135.
[Publisher Full Text](#)
- Marsh KL, Hart-O'Rourke DM, Julka DL: **The Persuasive Effects of Verbal and Nonverbal Information in a Context of Value Relevance.** *Personal. Soc. Psychol. Bull.* 1997; **23**(6): 563–579.
[Publisher Full Text](#)
- McClelland KA, Fararo TJ: *Purpose, meaning, and action: Control systems theories in sociology.* Palgrave-MacMillan; 2006.
- McDonald RI, Crandall CS: **Social norms and social influence.** *Curr. Opin. Behav. Sci.* 2015; **3**: 147–151.
[Publisher Full Text](#)
- Melnik V, van Herpen E, Fischer ARH, et al.: **Regulatory fit effects for injunctive versus descriptive social norms: Evidence from the promotion of sustainable products.** *Mark. Lett.* 2013; **24**(2): 191–203.
[Publisher Full Text](#)
- Milgram S: **Behavioral study of obedience.** *J. Abnorm. Soc. Psychol.* 1963; **67**(4): 371–378.
[Publisher Full Text](#)
- Min KS, Martin D, Jung JM: **Designing advertising campaigns for destinations with mixed images: Using visitor campaign goal messages to motivate visitors.** *J. Bus. Res.* 2013; **66**(6): 759–764.
[Publisher Full Text](#)
- Moussaïd M, Kämmer JE, Analytis PP, et al.: **Social Influence and the Collective Dynamics of Opinion Formation.** *PLoS One.* 2013; **8**(11): e78433.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Nelson TE, Kinder DR: **Issue frames and group-centrism in American public opinion.** *J. Polit.* 1996; **58**(4): 1055–1078.
[Publisher Full Text](#)
- Nelson TE, Oxley ZM, Clawson RA: **Toward a psychology of framing effects.** *Polit. Behav.* 1997; **19**(3): 221–246.
[Publisher Full Text](#)
- Pentina I, Taylor DG: **Regulatory Focus and Daily-Deal Message Framing: Are We Saving or Gaining With Groupon?** *J. Interact. Advert.* 2013; **13**(2): 67–75.
[Publisher Full Text](#)
- Petty RE, Brinol P, Loersch C, et al.: **The need for cognition.** Leary R, Hoyle RH, editors. *Handbook of individual differences in social behavior.* The Guilford Press; 2009; pp. 318–329.
[Reference Source](#)
- Petty RE, Cacioppo JT: *Communication and persuasion: Central and peripheral routes to attitude change.* Springer; 1986.
[Publisher Full Text](#)
- Petty RE, Wegener DT: **Matching Versus Mismatching Attitude Functions: Implications for Scrutiny of Persuasive Messages.** *Personal. Soc. Psychol. Bull.* 1998; **24**(3): 227–240.
[Publisher Full Text](#)
- Poels K, Dewitte S: **Hope and self-regulatory goals applied to an advertising context. Promoting prevention stimulates goal-directed behavior.** *J. Bus. Res.* 2008; **61**(10): 1030–1040.
[Publisher Full Text](#)
- Price V, Tewksbury D: **News values and public opinion: A theoretical account of media priming and framing.** Barett GA, Boster FJ, editors. *Progress in the communication sciences.* Vol. 13. Ablex; 1997; pp. 173–212.
- Prinsen S, de Ridder DTD, de Vet E: **Eating by example. Effects of environmental cues on dietary decisions.** *Appetite.* 2013; **70**: 1–5.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Raven BH: *Social Influence and Power.* California Univ; 1964.
- Raven BH: **A power/interaction model of interpersonal influence: French and Raven thirty years later.** *J. Soc. Behav. Pers.* 1992; **7**(2): 217–244.
- Redgrave P, Gurney K: **The short-latency dopamine signal: A role in discovering novel actions?** *Nat. Rev. Neurosci.* 2006; **7**(12): 967–975.
[Publisher Full Text](#)

- Redgrave P, Gurney K, Reynolds J: **What is reinforced by phasic dopamine signals?** *Brain Res. Rev.* 2008; **58**(2): 322–339.
[Publisher Full Text](#)
- Redgrave P, Prescott TJ, Gurney K: **The basal ganglia: A vertebrate solution to the selection problem?** *Neuroscience.* 1999; **89**(4): 1009–1023.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Ren Q, Gentsch A, Kaiser J, et al.: **Ready to go: higher sense of agency enhances action readiness and reduces response inhibition.** *Cognition.* 2023; **237**: 105456.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Robinson DT: **Control theories in sociology.** *Annu. Rev. Sociol.* 2007; **33**: 157–174.
[Publisher Full Text](#)
- Sadiq M, Adil M, Paul J: **Does social influence turn pessimistic consumers green?** *Bus. Strateg. Environ.* 2021; **30**(7): 2937–2950.
[Publisher Full Text](#)
- Samejima K, Ueda Y, Doya K, et al.: **Representation of action-specific reward values in the striatum.** *Science.* 2005; **310**(5752): 1337–1340.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Schneider D, Lins S, Grupp T, et al.: **Nudging users into online verification: The case of carsharing platforms.** *ICIS 2017: Transforming Society with Digital Innovation.* 2017.
- Schultz WP, Khazian AM, Zaleski AC: **Using normative social influence to promote conservation among hotel guests.** *Soc. Influ.* 2008; **3**(1): 4–23.
[Publisher Full Text](#)
- Sherif M: *The psychology of social norms.* Harper & Brothers; 1936.
- Slater M, Antley A, Davison A, et al.: **A virtual reprise of the Stanley Milgram obedience experiments.** *PLoS One.* 2006; **1**(1): e39.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Sosa M, Giocomo LM: **Navigating for reward.** *Nat. Rev. Neurosci.* 2021; **22**(8): 472–487.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Spears R: **Social influence and group identity.** *Annu. Rev. Psychol.* 2021; **72**: 367–390.
[Publisher Full Text](#)
- Spiegel S, Grant-Pillow H, Tory Higgins E: **How regulatory fit enhances motivational strength during goal pursuit.** *Eur. J. Soc. Psychol.* 2004; **34**(1): 39–54.
[Publisher Full Text](#)
- Stayton DJ, Hogan R, Ainsworth MD: **Infant obedience and maternal behavior: The origins of socialization reconsidered.** *Child Dev.* 1971; **42**(4): 1057–1069.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Sunstein CR: **Nudging: A Very Short Guide.** *J. Consum. Policy.* 2014; **37**(4): 583–588.
[Publisher Full Text](#)
- Sutton RS, Barto AG: **Reinforcement Learning: An Introduction.** *IEEE Transactions on Neural Networks.* Vol. 9. MIT Press; 1998.
[Publisher Full Text](#)
- Thaler RH, Sunstein CR: *Nudge: Improving decisions about health, wealth, and happiness.* Yale University Press; 2008.
- Thibaut JW, Kelley HH: *The social psychology of groups.* John Wiley & Sons, Inc.; 1959.
- Tricomi EM, Delgado MR, Fiez JA: **Modulation of caudate activity by action contingency.** *Neuron.* 2004; **41**(2): 281–292.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Turner JC: *Social influence.* Thomson Brooks/Cole Publishing Co; 1991; xvi, 206.
- Tversky A, Kahneman D: **The framing of decisions and the psychology of choice.** *Science.* 1981; **211**(4481): 453–458.
[Publisher Full Text](#)
- vanDellen MR, Hoyle RH: **Regulatory accessibility and social influences on state self-control.** *Personal. Soc. Psychol. Bull.* 2010; **36**(2): 251–263.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Van Dijke M, Poppe M: **Striving for personal power as a basis for social power dynamics.** *Eur. J. Soc. Psychol.* 2006; **36**(4): 537–556.
[Publisher Full Text](#)
- Vansteenkiste M, Simons J, Lens W, et al.: **Motivating learning, performance, and persistence: The synergistic effects of intrinsic goal contents and autonomy-supportive contexts.** *J. Pers. Soc. Psychol.* 2004; **87**(2): 246–260.
[Publisher Full Text](#)
- Vescio TK, Butz DA, Snyder M: **Power in stereotypically masculine domains: A Social Influence Strategy × Stereotype Match Model.** *J. Pers. Soc. Psychol.* 2003; **85**(6): 1062–1078.
[PubMed Abstract](#) | [Publisher Full Text](#)
- von Bertalanffy L: **An outline of general system theory.** *Br. J. Philos. Sci.* 1950; **1**(2): 134–165.
[Publisher Full Text](#)
- von Hippel W, Trivers R: **Reflections on self-deception.** *Behav. Brain Sci.* 2011; **34**(1): 41–56.
[Publisher Full Text](#)
- Wheeler L: **Motivation as a determinant of upward comparison.** *J. Exp. Soc. Psychol.* 1966; **1**(Suppl. 1): 27–31.
[Publisher Full Text](#)
- Wiener N: **Cybernetics: Control and communication in the animal and the machine.** *Econ. J.* 1949; **59**(236): 573–575.
[Publisher Full Text](#)
- Willer R, Kuwabara K, Macy MW: **The false enforcement of unpopular norms.** *Am. J. Sociol.* 2009; **115**(2): 451–490.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Wills TA: **Downward comparison principles in social psychology.** *Psychol. Bull.* 1981; **90**(2): 245–271.
[Publisher Full Text](#)
- Wolpert DM, Doya K, Kawato M: **A unifying computational framework for motor control and social interaction.** *Philos. Trans. R. Soc. B: Biol. Sci.* 2003; **358**(1431): 593–602.
[Publisher Full Text](#)
- Wolske KS, Gillingham KT, Schultz PW: **Peer influence on household energy behaviours.** *Nat. Energy.* 2020; **5**(3): 202–212.
[Publisher Full Text](#)
- Wood W: **Attitude change: Persuasion and social influence.** *Annu. Rev. Psychol.* 2000; **51**(1): 539–570.
[Publisher Full Text](#)
- Zhao G, Pechmann C: **The impact of regulatory focus on adolescents' response to antismoking advertising campaigns.** *J. Mark. Res.* 2007; **44**(4): 671–687.
[Publisher Full Text](#)

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On page 6, there is a syntax error:

"We do not aim at conceptualizing persuasion is a sub-facet of influence"

On page 8/9, the authors write "Persuasive messages targeting important attitude functions are processed carefully and are less influential". Could it be that the authors mean "...more influential"?

On page 11 the authors write "According to our model, we argued that this was due to the inclusion and presence of a social goal". I suggest to use present tense ("we argue") for consistency.

Apart from the minor points above, I have no further comments to make.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Social psychology, motivation, affect, approach-/avoidance-motivation, anger, powerlessness, threats

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 08 Feb 2024

Martin Weiß

Dear Dr. Willardt,

Thank you very much for your comments. We have implemented the two minor changes (typo + tense). Regarding your second point, our wording ("less influential") was correct in relation to the cited paper.

Competing Interests: No competing interests were disclosed.

Reviewer Report 23 January 2024

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I thank the authors' work, I have no further comments.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Social psychology, social behavior, and social emotions

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 21 November 2023

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Thank you for the opportunity to review the opinion article "Social influence and external feedback control in humans".

In the article, the authors use a feedback loop model to categorize and describe the different ways in which an influencing person can exert social influence on a targeted person. Most of my comments are concerned with the clarity of the article. In the following, I will outline my feedback in detail following the structure of the paper. Afterwards, I emphasize two points in particular that should be addressed: The justification for introducing the suggested feedback loop model and the nomenclature used to derive at the model.

The sentence "Different approaches have shown that social influence is related to emotional processes, visual attention, and self regulation" (page 3) feels like the justification for connecting a feedback loop model with social influence. If that is indeed the case, this should be stated more explicitly.

The term feedback control on page 3 ("In social interactions, actions elicit responses from others, leading to the possibility of feedback control...") should be explained in greater detail.

On page 4 under the heading "Social influence", a sentence is started with the word 'nonetheless', even though the preceding sentence does not entail a contradiction to the subsequent one.

It might be interesting for the discussion of social influence on page 4 that there is some power research indicating that power actually consists of two subcomponents, namely personal control and influence over others (e.g., Lammers et al, 2016; Van Dijke & Poppe, 2006).

When describing the individual components of the feedback loop model, it would add clarity to specifically state whose goals are meant with the term "goal state". Those of the target of those of the influencer? The same goes for the feedback prediction component.

Is the comparator/reference component the plus/minus sign in the graphical depiction of the model? Please clarify.

On page 4 the authors introduce the struggle for a TV to illustrate the model. The goal in this case is described as "the division of a shared television". But this seems to represent a communal goal rather than the individual goals of the two roommates. Maybe it would be better to avoid the term "goal" in this situation and only use it to refer to the target's goals in the examples that follows.

In the subsequent sentence, the goal state is described as the target buying the television. The use of goal and goal state and the lack of a clear attribution of these terms to either one of the two roommates is very confusing.

See also the sentence "In this situation, the influencer might persuade the target that the goal is not worthwhile" where it is unclear what goal the authors refer to.

On page 5, the heading reads "Social influence towards the goal state". This is somewhat irritating since social influence towards the goal state was already touched upon in the example of the two roommates (the same applies to the subsequent headings).

Here, the authors should also explain why a differentiation between persuasion and manipulation is necessary.

The sentence "Influence through persuasion can affect the goal state even before the target takes any action. Persuasion is the most appropriate term for what we consider influence toward the goal state" is hard to comprehend: At this point it is yet unclear what the difference between influence and persuasion is. Is persuasion a sub-facet of influence, namely influence towards the goal state? Please explain.

The terms 'message elaboration' and 'peripheral route' should also be outlined in greater detail

The authors refer to Sherif's experiment (p. 7). Outlining the mentioned goal the manipulator is thought to influence (I assume it is the social goal to give group-conform responses) would help to better imbed this research.

Under the heading "Social influence on the subjective situation" on page 7, the authors refer to social comparison. The connection of this concept to the example given and to social influence on the situation remains somewhat unclear.

On page 8, the authors write "In the context of the shared TV example, imagine that the influencer wants to donate the TV to charity, but the target wants to keep it." In that case the goal state of the target would be to keep the TV. I suggest to emphasize the connection between the used examples (such as this one) and the components of the proposed model more (in this case: target's goal → keep TV).

Also on page 8, the authors write "If the target perceives the influencer as highly reputable and trustworthy, they may be more likely to obey or comply with the influencer's advice. This is true, even if the advice does not necessarily align with the target's intuitive approach to achieving their goals." This empirical claim should be backed up by a reference.

Under the heading "Social influence on behavior while acting", the authors write "The social influence induced by social norms can alter the internal feedback loop regarding action selection." This implies that the authors refer to the subcomponent action selection rather than the subcomponent action here (see also the subsequent sentence). It would help the clarity of the paper to precisely state which subcomponents the authors target.

Under the heading "Social influence on feedback prediction", the authors outline the term feedback prediction in greater detail for the first time in their article. I suggest to do so much earlier in the paper in order to facilitate the readers' ability to understand this important subcomponent of the model. The authors then state that "As mentioned (see "social influence on the subjective situation"), manipulating the situation may often be a valid pathway to influence feedback prediction." This suggests that social influence on one component of the model might simultaneously affect another one. Can the authors elaborate on this more? When outlining social influence on the individual components of the model earlier in the article, the examples given often appear to be applicable to more than one subcomponent (e.g., influencing the target's action selection also affects the situation).

The authors outline the studies by Melnyk et al. (2013) to show the influence of social norms onto action selection. Are they not also affecting action itself as well as participants' goal states?

The subsequently described studies could be better connected to the feedback loop model. The

studies are also analysed regarding their limitations. At times, it is hard to see why these limitations are mentioned in the context of the authors' model. The description of the study by Zhao and Pechmann (2007) is a good example for how to better connect the presented research with the theoretical model (especially the top paragraph of page 13).

The authors state on page 13 that "This study is a good case of targeting action selection rather than goal structures". A sentence like this at the beginning of each outlined study would help to understand why the authors are referring to these particular studies in light of their model. A possible way to better structure the description of the studies is to first outline what components of the model the studies target. After that, limitations can be described.

On page 14, the authors state that "... it may be interesting to examine whether the discrepancy between the reference or goal state and the current state or situation can predict reactance. Potentially, a discrepancy that seems too large for the individual may promote reactance". Assuming that the goal is the target's goal, wouldn't an enlarged discrepancy rather reduce reactance since the target would not see a point in pursuing the goal anyway? Also on page 14, the authors write "However, the affected stage largely depends on the intentions of the influencer, as the same influence tactic might be interpreted differently within another stage of the feedback loop". I have troubles understanding this sentence. Please clarify

As their very last sentence, the authors state that "understanding how to influence only one particular aspect while excluding the influence of another aspect may be crucial for a more detailed perspective on social influence." I think this point represents a big argument for the model that should be emphasized more (also in the description of the described studies since it justifies and explains the authors' effort to point out limitations and weaknesses of the mentioned studies).

This brings me to the justification for introducing a feedback loop model in order to investigate social influence. In the introduction of the article, the authors describe past research on social influence. It appears that social influence has already been well studied and the question emerges what the proposed feedback loop model adds to this. The authors occasionally touch upon this question as on page 5 where they state that "While previous research has identified different strategies of social influence, our approach exceeds existing approaches by categorizing these strategies according to the five entrance gates to the internal feedback loop. Thereby, we show how our feedback framework can be used to distinguish and understand the different forms of social influence". This justification should be mentioned earlier. In general, I would encourage the authors to make clearer why the feedback loop model is necessary and what advantages it entails (e.g., precise description of where and how different kinds of social influence affect a target).

Lastly, I suggest some minor alterations and modifications for the nomenclature used in the article:

- The authors refer to different feedback loop concepts throughout the article. Among them is the feedback loop system (page 1), the cybernetic feedback model (page 3), and the cybernetic feedback loop (page 10). An example for how this can lead to ambiguity can be found on page 4: "Feedback loops consist of several stages or elements, including the reference value, comparator, input, and output. In adapting the cybernetic feedback model to social influence...". Here, it is hard to comprehend whether the authors refer to different concepts or whether they use the different terms interchangeably.

- On page 3, the authors write: “We aim to establish a theoretical connection between cybernetic control models and other feedback regulation models, such as reinforcement learning”. Reading this, I felt overwhelmed by the many terms and concepts introduced at ones. It might help to outline the term ‘cybernetic’ in greater detail. Furthermore, without having been introduced to the model, a reader can struggle to understanding where and how reinforcement learning comes into play here.
- I suggest to refrain from using the term ‘study’ (page 7 under “Social influence on action selection”) when referring to the theoretical model outlined in the present article. It suggests that data will be presented.

References

1. Lammers J, Stoker J, Rink F, Galinsky A: To Have Control Over or to Be Free From Others? The Desire for Power Reflects a Need for Autonomy. *Personality and Social Psychology Bulletin*. 2016; **42** (4): 498-512 [Publisher Full Text](#)
2. van Dijke M, Poppe M: Striving for personal power as a basis for social power dynamics. *European Journal of Social Psychology*. 2006; **36** (4): 537-556 [Publisher Full Text](#)

Is the topic of the opinion article discussed accurately in the context of the current literature?

Yes

Are all factual statements correct and adequately supported by citations?

Partly

Are arguments sufficiently supported by evidence from the published literature?

Yes

Are the conclusions drawn balanced and justified on the basis of the presented arguments?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Social psychology, motivation, affect, approach-/avoidance-motivation, anger, powerlessness, threats

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 21 Dec 2023

Martin Weiß

Dear Dr. Willardt,
thank you for this thoughtful review. We have revised the paper based on the suggestions.

See below, for our point-by-point response. As our manuscript is already quite long, we have tried to keep the revisions based on your comments as concise and precise as possible.

The sentence “Different approaches have shown that social influence is related to emotional processes, visual attention, and self regulation” (page 3) feels like the justification for connecting a feedback loop model with social influence. If that is indeed the case, this should be stated more explicitly.

Response: We agree and extended the sentence accordingly.

“Different approaches have shown that social influence is related to emotional processes (Fischer *et al.*, 2003), visual attention (Frick *et al.*, 2018), and self-regulation (vanDellen & Hoyle, 2010), thereby providing a connection between social influence and feedback loop models.”

The term feedback control on page 3 (“In social interactions, actions elicit responses from others, leading to the possibility of feedback control...”) should be explained in greater detail.

Response: We added the following explanation.

“Feedback control in social interactions refers to the repeated process by which a person’s activities elicit reactions, generating a dynamic loop that determines subsequent behavior. This system requires constant adjustments depending on feedback and determines the continuing dynamics of interpersonal interactions.”

On page 4 under the heading “Social influence”, a sentence is started with the word ‘nonetheless’, even though the preceding sentence does not entail a contradiction to the subsequent one.

Response: We deleted “Nonetheless” from this sentence.

It might be interesting for the discussion of social influence on page 4 that there is some power research indicating that power actually consists of two subcomponents, namely personal control and influence over others (e.g., Lammers *et al.*, 2016; Van Dijke & Poppe, 2006).

Response: We have refrained from a detailed discussion as we have already shortened the power paragraph to avoid distracting the reader from the main topic of this opinion piece. Nevertheless, we have added the aspect mentioned by the reviewer.

“Like influence, social power has often been defined as the ability to control or influence

another's thoughts, behavior, or feelings in a meaningful way (Fiske, 1993; Thibaut & Kelley, 1959; Vescio *et al.*, 2003). In this line, more recent research on social power indicates that power might consist of two subcomponents, namely personal control and influence over others (e.g., Lammers *et al.*, 2016; Van Dijke & Poppe, 2006)."

When describing the individual components of the feedback loop model, it would add clarity to specifically state whose goals are meant with the term "goal state". Those of the target of those of the influencer? The same goes for the feedback prediction component.

Response: Thank you. Since we are elaborating on how an influencer can intervene in the feedback loop of the target, it is always about the target. We have specified this in the respective sections.

Is the comparator/reference component the plus/minus sign in the graphical depiction of the model? Please clarify.

Response: Exactly, we have displayed the comparator with plus/minus signs, as it can lead to two results. Either there is a discrepancy exists or not. Discrepancies can be either positive or negative. We have clarified this in the figure caption:

"The \pm sign reflects the "comparator" and indicates that a possible discrepancy can be either positive or negative."

On page 4 the authors introduce the struggle for a TV to illustrate the model. The goal in this case is described as "the division of a shared television". But this seems to represent a communal goal rather than the individual goals of the two roommates. Maybe it would be better to avoid the term "goal" in this situation and only use it to refer to the target's goals in the examples that follows. In the subsequent sentence, the goal state is described as the target buying the television. The use of goal and goal state and the lack of a clear attribution of these terms to either one of the two roommates is very confusing.

Response: We have grouped both of the reviewer's points together as they relate to the same paragraph. In this passage, we admit that the distinction between goal and goal state was confusing, as we sometimes referred to the TV as the goal and sometimes to a desire of the target (e.g., keeping the TV). We now always use goal for the TV and goal state for the target's internal state. Thus, we changed the paragraph in the revised version as follows:

"Imagine two people—an *influencer* and a *target*—arguing about the division of a currently shared television. Let us consider a situation where the *influencer* wants to buy a brand-new television for him- or herself. The *influencer* may try to increase the value of the currently shared object and negotiate a deal to "sell" the shared television to the *target* to receive some money, by manipulating the *target's goal state* (a), that is 'owning the shared TV' in

this example. In this situation, the *influencer* persuades the *target* to understand that the *goal* (i.e., the shared television) is a worthwhile undertaking with advantages over other goal-like items. Alternatively, the *influencer* may want to keep the shared television and try to devalue it (the goal) to get the *target* to buy a new one. In this situation, the *influencer* might persuade the *target* that the *goal* is not worthwhile. Both strategies directly manipulate the *target's* internal goal state or reference; in these examples, the *influencer* tries to amplify or attenuate the attractiveness of the *goal* for the *target* by either increasing or decreasing the value attributed to the *goal* and thus changing the desirability of the goal state. Hence, the amplification, attenuation, implementation, and elimination of a goal state may be relevant principal target strategies."

See also the sentence "In this situation, the influencer might persuade the target that the goal is not worthwhile" where it is unclear what goal the authors refer to.

Response: In our example, the goal is always the television. To make our example easier to understand, we have included the specific terms in brackets in the first paragraph in which we introduce the example.

On page 5, the heading reads "Social influence towards the goal state". This is somewhat irritating since social influence towards the goal state was already touched upon in the example of the two roommates (the same applies to the subsequent headings).

Response: We have used the paragraph about the example with the two roommates and the TV to give a naturalistic overall impression of the proposed framework. The following headings serve to discuss the entrance gates in more detail with empirical findings. In our view, this is made clear by the last paragraph preceding the sections on the individual aspects:

"To illustrate our theoretical views and contribution to the literature, we provide specific examples of negotiation, social norms and sanctions, compliance, advertisement, and nudging in the following subsections. While previous research has identified different strategies of social influence (Bruins, 1999; Higgins *et al.*, 2003), our approach exceeds existing approaches by categorizing these strategies according to the five entrance gates to the internal feedback loop. Thereby, we show how our feedback framework can be used to distinguish and understand the different forms of social influence."

Here, the authors should also explain why a differentiation between persuasion and manipulation is necessary.

Response: We provided the following explanation.

"A differentiation between persuasion and manipulation is necessary since persuaders usually have transparent intentions and are open about their goals, whereas manipulators may hide their true intentions, using tactics that intentionally mislead or deceive others."

The sentence “Influence through persuasion can affect the goal state even before the target takes any action. Persuasion is the most appropriate term for what we consider influence toward the goal state” is hard to comprehend: At this point it is yet unclear what the difference between influence and persuasion is. Is persuasion a sub-facet of influence, namely influence towards the goal state? Please explain.

Response: When we talk about influence directed toward achieving a particular goal or outcome, especially through communication and reasoning, the term "persuasion" is the most fitting descriptor. It's not that persuasion is a sub-facet of influence; rather, it's a specific type of influence with a focus on communication and achieving a defined goal state. However, we understand that our initial formulation needs to be improved.

“For influence directed toward achieving a particular goal, especially through communication and reasoning, the term "persuasion" is the most fitting descriptor. We do not aim at conceptualizing persuasion as a sub-facet of influence; rather, we use persuasion as a specific type of influence with a focus on communication and achieving a defined goal state.”

The terms ‘message elaboration’ and ‘peripheral route’ should also be outlined in greater detail

Response: We added explanations for both aspects.

“Message elaboration refers to the extent to which individuals actively process information contained in a message. Thus, it involves the cognitive effort and depth of thinking invested in understanding and evaluating a message. In contrast, when a person lacks the ability or motivation to process a message in-depth, they may rely on the peripheral route, which means that peripheral cues or superficial aspects of the message rather than engaging in elaborate cognitive processing. These peripheral cues could be the influencer’s attractiveness or level of knowledge, which could lead to increased credibility.”

The authors refer to Sherif’s experiment (p. 7). Outlining the mentioned goal the manipulator is thought to influence (I assume it is the social goal to give group-conform responses) would help to better imbed this research.

Response: We have gratefully integrated the useful addition provided by the reviewer.

“A manipulator can influence goals to trigger conformity (e.g., the social goal to give group-conform responses), as shown by an experiment in which people estimated the movement of a dot of light ([Sherif, 1936](#)).”

Under the heading “Social influence on the subjective situation” on page 7, the

authors refer to social comparison. The connection of this concept to the example given and to social influence on the situation remains somewhat unclear.

Response: In line with the reviewer's comment, we emphasized the connection between social comparison and influence on the situation.

"Social comparison is an adjacent concept that alters the perception of a situation instead of the facts. Social comparison involves comparing oneself to others, which can influence how individuals perceive their own circumstances. Hence, the influencer's actions may lead the target making upward and downward social comparisons. Upward comparisons aim to increase achievement, while downward comparisons aim to increase subjective well-being (Diel et al., 2021; Wheeler, 1966; Wills, 1981). Accordingly, the target may perceive the situation differently when making either of these two kinds of comparisons."

On page 8, the authors write "In the context of the shared TV example, imagine that the influencer wants to donate the TV to charity, but the target wants to keep it." In that case the goal state of the target would be to keep the TV. I suggest to emphasize the connection between the used examples (such as this one) and the components of the proposed model more (in this case: target's goal à keep TV).

Response: Thank you for pointing this out. We rewrote the section to clarify this in the mentioned paragraph.

"In contrast, to make some action options less likely, the opposite would be promising, namely a reduction in the expected agency and sense of control. In the context of the shared TV example, imagine that the *influencer* wants to donate the TV to charity, but the *target's* goal state would be to keep it. If the *influencer* posts about giving it to charity on social media, knowing the *target* will see it, it could lead to the *target* withdrawing their own action plan to get the TV since they might feel unable to oppose such a socially desirable action option. In this case, the *influencer* would have promoted an alternative course of action by raising doubts in the target about their own potential action. The *action selection* in the *target* may thus result in withdrawing from keeping the TV and the decision to let it go. This influence strategy is based on the *target's* re-evaluation processes and could be successful for the *influencer*."

Also on page 8, the authors write "If the target perceives the influencer as highly reputable and trustworthy, they may be more likely to obey or comply with the influencer's advice. This is true, even if the advice does not necessarily align with the target's intuitive approach to achieving their goals." This empirical claim should be backed up by a reference.

Response: Agreed. We added the following references.

Haslam, S. A., Reicher, S. D., & Birney, M. E. (2014). Nothing by mere authority: Evidence that in an experimental analogue of the Milgram paradigm participants are motivated not by

orders but by appeals to science. *Journal of Social Issues*, 70(3), 473-488.

Hollander, M. M., & Turowetz, J. (2017). Normalizing trust: Participants' immediately post-hoc explanations of behaviour in Milgram's 'obedience' experiments. *British Journal of Social Psychology*, 56(4), 655-674.

Under the heading "Social influence on behavior while acting", the authors write "The social influence induced by social norms can alter the internal feedback loop regarding action selection." This implies that the authors refer to the subcomponent action selection rather than the subcomponent action here (see also the subsequent sentence). It would help the clarity of the paper to precisely state which subcomponents the authors target.

Response: We specified the potential influence on the action itself more clearly in this paragraph.

"The social influence induced by social norms can alter the internal feedback loop regarding action selection but also action itself. Specifically, exposure to peer groups' behavior can prime and make a selected action more salient (Do et al., 2022) or the mere adaption of an action more likely (Albert et al., 2013)."

Under the heading "Social influence on feedback prediction", the authors outline the term feedback prediction in greater detail for the first time in their article. I suggest to do so much earlier in the paper in order to facilitate the readers' ability to understand this important subcomponent of the model. The authors then state that "As mentioned (see "social influence on the subjective situation"), manipulating the situation may often be a valid pathway to influence feedback prediction." This suggests that social influence on one component of the model might simultaneously affect another one. Can the authors elaborate on this more? When outlining social influence on the individual components of the model earlier in the article, the examples given often appear to be applicable to more than one subcomponent (e.g., influencing the target's action selection also affects the situation).

Response: We agree with the reviewer that the influence on one component may not only affect this component, but also other components. We have included a brief explanation on this topic before presenting all the individual components in detail.

"Prior to an in-depth exploration of each component within our proposed framework in detail, we want to clarify that our discussion emphasizes the predominant influence on individual components. This focus does not mean that influencing one component has no effect on other components. For instance, influencing the *target's* action selection could also affect the goal state or situation. This interplay among components underscores the complexity of social influence, suggesting that interventions on one component may cascade into multifaceted consequences. However, our primary goal is to delve into the fundamental elements of influencing another person's internal feedback loop. Developing an understanding of how to influence only one particular aspect while excluding the influence

of another aspect can be crucial for a more detailed perspective on social influence.”

We also extended the section on feedback prediction in the introduction:

“Influencing the target’s feedback prediction (d) mechanism might motivate or discourage them by enhancing or lessening their expectations of achieving the goal. For example, the influencer could say, “I will make it very difficult for you to get this TV!” or “Why bother buying a new TV when you can have this one easily?”. Hence, the action might be encouraged or hindered by manipulating expectations; in particular, lowering the target’s expectations of success might result in frustration and disappointment, leading them to discontinue potential further efforts. Accordingly, feedback prediction mainly refers to the likelihood of reaching the desired goal state when selecting a certain action.”

The authors outline the studies by Melnyk et al. (2013) to show the influence of social norms onto action selection. Are they not also affecting action itself as well as participants’ goal states?

Response: Since previous studies do not build on our framework, it is not trivial to select exemplary research to illustrate the application of the model. We agree that some of the studies concern not only the part for which we selected them, but also other parts of the model. In the previous version of the manuscript, we already informed the reader about these overlaps, but have now added an extension.

“There may be overlapping aspects between – but also within – the studies regarding the different entrance gates to manipulate the *target’s* feedback loop, which we will present in the following subsections.”

The subsequently described studies could be better connected to the feedback loop model. The studies are also analysed regarding their limitations. At times, it is hard to see why these limitations are mentioned in the context of the authors’ model. The description of the study by Zhao and Pechmann (2007) is a good example for how to better connect the presented research with the theoretical model (especially the top paragraph of page 13).

The authors state on page 13 that “This study is a good case of targeting action selection rather than goal structures”. A sentence like this at the beginning of each outlined study would help to understand why the authors are referring to these particular studies in light of their model.

A possible way to better structure the description of the studies is to first outline what components of the model the studies target. After that, limitations can be described.

Response: Thank you. In the manuscript, we already explained our systematic approach in more detail before discussing the concrete examples: “Before starting with the research examples, we will briefly describe the systematic approach used to analyze studies in this domain. First, we identified the relevant goals in the experiment (*e.g.*, social goals, personal goals) and whether their value was manipulated or an additional goal was included. For

instance, introducing a social comparison may add social goals to an otherwise private context. Second, we analyzed the influenced situational characteristics. Third, we examined whether action selection was manipulated—whether a specific behavioral choice was promoted. Fourth, we examined action opportunities or direct effects on action execution. Fifth, we examined the effects of social influence on feedback prediction and goal state versus situation discrepancy, for example, by manipulating a *target's* subjective goal attainment probability.

In the following subsections, we explain the findings, apply our model, and derive additional experimental manipulations based on our framework.”

To address the reviewer’s point without losing our systematic structure, we have added/revise the introductory sentences of each example to make it clearer which component(s) of our model are covered in more detail.

On page 14, the authors state that “... it may be interesting to examine whether the discrepancy between the reference or goal state and the current state or situation can predict reactance. Potentially, a discrepancy that seems too large for the individual may promote reactance”. Assuming that the goal is the target's goal, wouldn't an enlarged discrepancy rather reduce reactance since the target would not see a point in pursuing the goal anyway?

Response: This is an interesting thought experiment. We admit that there could be a sweet spot where the discrepancy could become large enough that the goal pursuit could become obsolete, which would mean that the reactance would be reduced. We have extended the sentence to this point.

“Alternatively, there may be a threshold at which the magnitude of the discrepancy between the goal state and the current state renders the pursuit of the goal obsolete, thus resulting in a decline in reactance.”

Also on page 14, the authors write “However, the affected stage largely depends on the intentions of the influencer, as the same influence tactic might be interpreted differently within another stage of the feedback loop”. I have troubles understanding this sentence. Please clarify

Response: We revised this sentence as follows:

“Depending on the *influencer's* intentions, one specific influence tactic might affect different stages or even more than one stage at the same time.”

As their very last sentence, the authors state that “understanding how to influence only one particular aspect while excluding the influence of another aspect may be crucial for a more detailed perspective on social influence.” I think this point represents a big argument for the model that should be emphasized more (also in the

description of the described studies since it justifies and explains the authors' effort to point out limitations and weaknesses of the mentioned studies).

Response: This is a valid and very helpful suggestion. We incorporated this aspect in the section we inserted before the in-depth discussion of the components of our framework.

"Prior to an in-depth exploration of each component within our proposed framework in detail, we want to clarify that our discussion emphasizes the predominant influence on individual components. This focus does not mean that influencing one component has no effect on other components. For instance, influencing the *target's* action selection could also affect the goal state or situation. This interplay among components underscores the complexity of social influence, suggesting that interventions on one component may cascade into multifaceted consequences. However, our primary goal is to delve into the fundamental elements of influencing another person's internal feedback loop. Developing an understanding of how to influence only one particular aspect while excluding the influence of another aspect can be crucial for a more detailed perspective on social influence."

This brings me to the justification for introducing a feedback loop model in order to investigate social influence. In the introduction of the article, the authors describe past research on social influence. It appears that social influence has already been well studied and the question emerges what the proposed feedback loop model adds to this. The authors occasionally touch upon this question as on page 5 where they state that "While previous research has identified different strategies of social influence, our approach exceeds existing approaches by categorizing these strategies according to the five entrance gates to the internal feedback loop. Thereby, we show how our feedback framework can be used to distinguish and understand the different forms of social influence". This justification should be mentioned earlier. In general, I would encourage the authors to make clearer why the feedback loop model is necessary and what advantages it entails (e.g., precise description of where and how different kinds of social influence affect a target).

Response: In line with the reviewer's suggestion, we shifted the motivation for our model to an earlier point in the manuscript (section "Introduction") and refined the necessity of such a model.

"We propose a framework that identifies beneficial and detrimental manipulation tactics in everyday life, contributing to a broader understanding of social influence. While previous research has identified different strategies of social influence (Bruins, 1999; Higgins et al., 2003), our approach exceeds existing approaches by categorizing these strategies according to distinct entrance gates to the internal feedback loop. Thereby, the proposed framework helps to develop a precise description of where and how different kinds of social influence affect another person's internal feedback loop."

Lastly, I suggest some minor alterations and modifications for the nomenclature used in the article:

- **The authors refer to different feedback loop concepts throughout the article. Among them is the feedback loop system (page 1), the cybernetic feedback model (page3), and the cybernetic feedback loop (page 10). An example for how this can lead to ambiguity can be found on page 4: "Feedback loops consist of several stages or elements, including the reference value, comparator, input, and output. In adapting the cybernetic feedback model to social influence...". Here, it is hard to comprehend whether the authors refer to different concepts or whether they use the different terms interchangeably.**

Response: We understand the confusion and deleted the sentence on page 4 as it was also redundant (see first sentence in the section "Feedback loops and feedback control"). To avoid misunderstandings, we used the term cybernetic feedback model consistently.

On page 3, the authors write: "We aim to establish a theoretical connection between cybernetic control models and other feedback regulation models, such as reinforcement learning". Reading this, I felt overwhelmed by the many terms and concepts introduced at ones. It might help to outline the term 'cybernetic' in greater detail. Furthermore, without having been introduced to the model, a reader can struggle to understanding where and how reinforcement learning comes into play here.

Response: We improved the order of our arguments as the reinforcement learning part was more like a future use case of a theoretical connection to our model. The revised paragraphs are as follows:

"We build on cybernetic models of behavioral regulation, that is, models that are designed to understand or regulate dynamic processes in complex systems (Leonard et al., 2021), focusing on the fundamental elements that comprise these models. Cybernetic models illustrate a closed system that regulates itself using a feedback loop. Social influence can target elements in cybernetic models, representing different forms of social influence. We propose a framework that identifies beneficial and detrimental manipulation tactics in everyday life, contributing to a broader understanding of social influence. While previous research has identified different strategies of social influence (Bruins, 1999; Higgins et al., 2003), our approach exceeds existing approaches by categorizing these strategies according to distinct entrance gates to the internal feedback loop. Thereby, the proposed framework helps to develop a precise description of where and how different kinds of social influence affect another person's internal feedback loop.

Our framework helps establishing a theoretical connection between cybernetic control models and other feedback regulation models, such as reinforcement learning (i.e., learning the optimal behavior in an environment to obtain maximum reward through observations of how choices are influenced by past decisions and rewards; Sutton & Barto, 1998). By combining these models in the future, researchers might be able to identify interactions that enhance our understanding and prediction of social influence. For example, combining our proposed model with reinforcement learning can help determine which social influence mechanisms are advantageous and crucial in social interactions."

I suggest to refrain from using the term ‘study’ (page 7 under “Social influence on action selection”) when referring to the theoretical model outlined in the present article. It suggests that data will be presented.

Response: Agreed. We replaced the term “study” by “article” or “opinion piece”.

Competing Interests: No competing interests were disclosed.

Reviewer Report 07 August 2023

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Yanyan Qi

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In this article, Weiß et al. proposed a social influence model under a cybernetic control system. They hypothesized that social influence can occur by influencing the target’s situation, goal state, comparator, action selection, feedback predictor, or action. Then as model applications, they discussed some commonly-seen social influence tactics, e.g., social norms, and advertisement, under this framework. This paper is interesting and in general easy to follow. While before indexing, I still have some suggestions.

Abstract

1. In the first sentence the authors said “This article aims to describe social influence by elucidating the cognitive, affective, and motivational processes that occur when an individual experiences an attempt at being influenced.” But when reading the full context, I am still confused about the meaning of “the cognitive, affective, and motivational processes”.
2. I suggest the authors write the abstract according to the manuscript, e.g., the author mentioned ‘ coercion targets the selection mechanism, and violence targets the action’, which had not been discussed in the full text.

The full context

1. Since the paper is quite long, I suggest the authors give different heading levels, which will make it easier to understand the article structure.
2. In “social influence on behaviour while acting” section, the authors first mentioned “descriptive norms” without the definition, while in “Examples of model applications” section, the authors mentioned it again and gave a definition. Please re-organize this part.

3. Some newly published literature could be added to the manuscript.
4. Just a suggestion, since the author frequently mentioned “framing”, and “self-regulatory focus”, I am thinking maybe you can add an “influencing factors” section, which can contain not only the “framing” and “self-regulatory focus” from the target’s side, but also the characteristics of the influencer, e.g., as you mentioned, reputation and trustworthiness.

Is the topic of the opinion article discussed accurately in the context of the current literature?

Yes

Are all factual statements correct and adequately supported by citations?

Yes

Are arguments sufficiently supported by evidence from the published literature?

Yes

Are the conclusions drawn balanced and justified on the basis of the presented arguments?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Social psychology, social behavior, and social emotions

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 21 Dec 2023

Martin Weiß

Dear Dr. Qi,
we appreciate the thoughtful review and have addressed the feedback. These changes are noted below in a point-by-point response.

Abstract

In the first sentence the authors said “This article aims to describe social influence by elucidating the cognitive, affective, and motivational processes that occur when an individual experiences an attempt at being influenced.” But when reading the full context, I am still confused about the meaning of “the cognitive, affective, and motivational processes”.

Response: We agree that this sentence is too vague and not well explained in the abstract.

Therefore, we have reworded the beginning of the abstract as follows:
"This article aims to unravel the dynamics of social influence by examining the processes that occur when one person is the target of another's influence."

I suggest the authors write the abstract according to the manuscript, e.g., the author mentioned ' coercion targets the selection mechanism, and violence targets the action', which had not been discussed in the full text.

Response: We changed "coercion" to "obedience" as an example for the selection mechanism as we discussed obedience in more detail in the corresponding section. For action, however, we stuck to "violence", as this was one of our examples ("violent or deceptive action redirections").

The full context

Since the paper is quite long, I suggest the authors give different heading levels, which will make it easier to understand the article structure.

Response: The heading levels were set to one level by the journal during the editing process - we unfortunately cannot change anything in this regard.

In "social influence on behaviour while acting" section, the authors first mentioned "descriptive norms" without the definition, while in "Examples of model applications" section, the authors mentioned it again and gave a definition. Please re-organize this part.

Response: Thank you. Agreed. We moved the definition to the first mentioned section "Social influence on behavior while acting". The first sentence of the second paragraph in this section now reads:

"However, most social influence research concerns social norms and subtle psychological processes ([Cialdini & Goldstein, 2004](#)). Thereby, descriptive norms refer to the behavior of relevant others (*e.g.*, peers, family, society) and provide a socially determined standard for effective behavior (*i.e.*, what individuals typically do), while injunctive norms refer to appeals about what other members of society approve or disapprove of."

Some newly published literature could be added to the manuscript.

Response: We have included the following (more recent) papers at appropriate positions in the manuscript.

Caspar, E. A., Beyer, F., Cleeremans, A., & Haggard, P. (2021). The obedient mind and the volitional brain: A neural basis for preserved sense of agency and sense of responsibility under coercion. *PLoS one*, 16(10), e0258884.

- Diel, K., Grelle, S., & Hofmann, W. (2021). A motivational framework of social comparison. *Journal of Personality and Social Psychology*, 120(6), 1415–1430.
- Gass, R. H., & Seiter, J. S. (2022). *Persuasion: Social influence and compliance gaining*. Routledge.
- Haslam, S. A., Reicher, S. D., & Birney, M. E. (2014). Nothing by mere authority: Evidence that in an experimental analogue of the Milgram paradigm participants are motivated not by orders but by appeals to science. *Journal of Social Issues*, 70(3), 473-488.
- Hollander, M. M., & Turowetz, J. (2017). Normalizing trust: Participants' immediately post-hoc explanations of behaviour in Milgram's 'obedience' experiments. *British Journal of Social Psychology*, 56(4), 655-674.
- Legros, S., & Cislighi, B. (2020). Mapping the social-norms literature: An overview of reviews. *Perspectives on Psychological Science*, 15(1), 62-80.
- Ren, Q., Gentsch, A., Kaiser, J., & Schütz-Bosbach, S. (2023). Ready to go: higher sense of agency enhances action readiness and reduces response inhibition. *Cognition*, 237, 105456.
- Sosa, M., & Giocomo, L. M. (2021). Navigating for reward. *Nature Reviews Neuroscience*, 22(8), 472-487.
- Spears, R. (2021). Social influence and group identity. *Annual Review of Psychology*, 72, 367-390.
- Wolske, K. S., Gillingham, K. T., & Schultz, P. W. (2020). Peer influence on household energy behaviours. *Nature Energy*, 5(3), 202-212.

Just a suggestion, since the author frequently mentioned “framing”, and “self-regulatory focus”, I am thinking maybe you can add an “influencing factors” section, which can contain not only the “framing” and “self-regulatory focus” from the target’s side, but also the characteristics of the influencer, e.g., as you mentioned, reputation and trustworthiness.

Response: We appreciate the suggestion by the reviewer. Since this opinion piece is focused on how and where the influencer can enter the internal feedback loop system of the target, we have deliberately decided not to address individual differences of the influencer, because we believe that the focus of the paper would otherwise remain less clear and it would be too much for the manuscript in terms of its scope. We have therefore refrained from further elaborating on “influencing factors” in relation to the influencer him/herself although this is a highly interesting topic.

Competing Interests: No competing interests were disclosed.

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