ABSTRACT

INFLUENCES ON FACT-BASED AND SIMULATION-BASED COMPARISONS

by Ryan J. Walker

Research on counterfactual thinking and social comparisons typically examines one comparison on its own, without directly comparing it to other types of comparisons. The current work examines what affects these two types of comparisons by testing if these comparisons have different outputs or respond differently to inputs (e.g., motivation). Study 1 revealed that the outputs of these comparisons do not differ enough to influence the direction of a second comparison. Study 2 tested if these comparisons respond differently to motivational inputs. Although it was predicted that self-improvement motives would lead to counterfactual generation and self-enhancement motives would lead to social comparison generation, these predictions were only partially supported. Unexpectedly, vignette type influenced the type of comparison that participants generated. Future work is needed to further examine why these comparisons might respond differently to the same inputs, such as motivation.
INFLUENCES ON FACT-BASED AND SIMULATION-BASED COMPARISONS

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Ryan J. Walker
Miami University
Oxford, Ohio
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Advisor________________________
Amy Summerville, Ph.D.

Reader________________________
Allen R. McConnell, Ph.D.

Reader________________________
Kurt Hugenberg, Ph.D.
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Influences on Fact-Based and Simulation-Based Comparisons

People are continually in situations and contexts that facilitate different comparisons. In the same situation, an individual can imagine what might have been (counterfactuals) or they can compare themselves to someone else (social comparison). If Tim receives a bad grade on his psychology exam, he can imagine an alternative reality where he performed differently or he can compare himself to another student sitting next to him. In this example, it is clear that individuals are not limited to only one comparison (i.e., a counterfactual or a social comparison). There are countless other scenarios in which people both can think about “what might have been” and also can compare themselves to another person. This research builds upon past work by examining two types of comparisons together (counterfactuals and social comparisons), in order to address the broad question of: what affects these comparisons?

Types of comparison

In order to understand what affects counterfactual and social comparisons, it is necessary to first differentiate between these two types of comparison processes. The first comparison discussed above, imagining what might have been, is known as a counterfactual thought. Counterfactual thinking occurs when a person simulates an alternative world (Roese, 1994, 1997). Each counterfactual thought consists of an antecedent (an action or inaction) and a consequence (an outcome; Epstude & Roese, 2008). In Tim’s situation, he can think about what he could have done (e.g., “If only I had read the class handouts…” or “If I had partied with my friends last night…”) that would have led to a different outcome (e.g., “then I would have received a better grade” or “then I would have received a worse grade”). These thoughts are typically activated following a negative outcome when there is a discrepancy between an individual’s current situation and the ideal situation (Epstude & Roese, 2008; Gilovich, 1983; Roese & Hur, 1997). Moreover, these thoughts may be both functional and beneficial (Epstude & Roese, 2008; Roese, 1997). People can establish effective behavior that can lead to more desired outcomes (Johnson & Sherman, 1990; Markman, Gavanski, Sherman, & McMullen, 1993) or they can improve their affect in the moment (Markman et al., 1993; Roese & Olson, 1997; Sanna, 1996).

Counterfactual thinking thus has emotional, motivational, and behavioral repercussions (i.e., outputs). When an individual easily imagines a superior alternative outcome, this can lead to negative affect and regret (Epstude & Roese, 2008; Gilovich & Medvec, 1994).
Counterfactual thinking can also impact subsequent motivation (Markman et al., 1993), intention judgments (Smallman, 2013; Smallman & Roese, 2009), causal ascriptions (Wells & Gavanski, 1989), and self-inferences (Roese & Olson, 1993).

The second comparison discussed above, comparing one’s performance to another person’s, is an example of social comparison. In social comparisons, an individual uses another person as the comparison target to evaluate or reflect on his or her own situation, opinions, or abilities (Festinger, 1954; Wood, 1989). For example, if Tim received an average score on an exam (e.g., “C”), he can compare himself to a person in the class who did better than him or who did worse than him (Wood, 1989). Social comparisons share many of the functions and outputs of counterfactual comparisons (Olson, Buhrmann, & Roese, 2000). Social comparisons can help individuals make accurate self-evaluations (Trope, 1986), enhance affect and self-esteem in the moment (Taylor & Brown, 1988; Taylor & Lobel, 1989), promote self-improvement (Bandura, 1986; Berger, 1977), increase motivation (Taylor & Lobel, 1989), and even influence behavior (Frey & Meier, 2004).

Not surprisingly, both of these comparative processes are a frequent part of everyday life. In one study, 25.5% of comparative thoughts were counterfactuals and 24.2% of comparative thoughts were social comparisons (Summerville & Roese, 2008). The frequency of these comparisons in daily life means that it is crucial that research fully understand how both counterfactual and social comparison processes influence affect, motivation, and subsequent decisions. As noted above, research has addressed many of these points to a large degree. However, most work examines counterfactual and social comparisons separately (Olson et al., 2000). Thus, something that is left unaddressed in the literature is what affects the comparisons that people generate, while also taking into account more than one comparison type. In order to address this question, it is necessary to understand both the similarities and differences between these two types of comparisons.

**Common Themes**

**Direction and motivation.** One main similarity between counterfactual and social comparisons is the classification of comparison direction (i.e., upward or downward; McMullen, Markman, & Gavanski, 1995; Olson et al., 2000; Roese, 1994; Suls & Wheeler, 2000; Wheeler, 1966; Wills, 1981; Wood, 1989). Upward comparisons are characterized by individuals imagining an alternative world where things turned out better (counterfactual; Roese, 1994,
1997) or by individuals comparing themselves to a person who is *better* off (social comparison; Wheeler, 1966). Upward comparisons generally lead to negative affect, but they have positive motivational and informational effects (Markman et al., 1993; Roese, 1994; Taylor, Buunk, & Aspinwall, 1990; Wood, 1989). In contrast, in downward comparisons, an individual imagines an alternative world where things turned out *worse* (counterfactual; Roese, 1994; 1997) or compares him or herself to a person who is *worse* off (social comparison; Wills, 1981). These downward comparisons are useful for self-enhancement (Wood, 1989) and can lead to more positive affect (i.e., affect regulation; Brickman & Bulman, 1977; Roese, 1994; Taylor & Brown, 1988).¹

Not only do counterfactuals and social comparisons share comparison direction as a common factor, but both of these comparisons share similar *inputs*. For example, in counterfactuals and social comparisons, an individual’s motivation impacts the direction of a specific comparison. White and Lehman (2005) showed that people generated significantly more downward counterfactuals when they adopted a self-enhancement motive. When people adopted a self-improvement motive, they generated more upward counterfactuals compared to those with a self-enhancement motive. Likewise, when people adopt a strong self-improvement motivation, they generate relatively more upward social comparisons compared to people who are less motivated to self-improve (Wheeler, 1966). Conversely, downward social comparisons can be used for self-enhancement, such as ameliorating self-esteem (Taylor & Lobel, 1989; Wood, 1989; Wood, Taylor, Lichtman, 1985).

Motivation is thus a central similarity when examining what affects counterfactual and social comparisons for two reasons. First, motivation can impact the comparisons people make (Olson et al., 2000; Taylor & Lobel, 1989; White & Lehman, 2005; Willis, 1981). The goals an individual has prior to making a comparison affect the direction of that comparison. If Tim is motivated to self-improve after he receives his less than ideal test grade, then this should increase the likelihood that he makes an upward comparison. Conversely, if he is motivated to self-improve after he receives his less than ideal test grade, then this should increase the likelihood that he makes an upward comparison. Consequently, if he is motivated to self-

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¹ This affective reaction is known as affective contrast (e.g., upward comparison leading to worsened affect), and it can be contrasted with affective assimilation (e.g., upward comparison leading to improved affect). Although research has revealed that affect assimilation can result following a comparison (Buunk, Collins, Taylor, VanYperen, & Dakof, 1990; Markman, & McMullen, 2003), affective contrast has been a larger focus in the literature. Thus, the current work focuses on affective contrast, and it is important to note that future work should investigate affective contrast in this context.
enhance then this should increase the likelihood of him generating a downward comparison. These comparisons can therefore fulfill a motivation that an individual has prior to generating that comparison.

Secondly, the comparisons people make can influence what goals are active. Generating upward comparisons can prepare one for the future and activate self-improvement motives, whereas generating downward comparisons can provide comfort and activate self-enhancement motives (Epstude & Roese, 2008; Markman et al., 1993; Roese, 1997; Wood, 1989). If an individual compares his or her less desirable reality (e.g., receiving a D on an exam) to a better alternative reality (e.g., receiving a better grade on an exam), this can make the individual feel worse but it can also increase his or her motivation and persistence to work harder (Markman & McMullen, 2003). Markman, McMullen, and Elizaga (2008) directly demonstrated this effect and showed the counterfactual thoughts motivated individuals to try harder on subsequent tasks. Thus, changes in the focal point of the comparison can result in differences in the individual’s motives.

**The Reflection and Evaluation Model of comparisons.** Aside from direction and motivation, some researchers have posited that both types of comparisons operate via the same underlying process. Before there was a unifying model of comparisons, research often sought to understand the mechanisms that underlie a single comparative process (Festinger, 1954; Kahneman & Miller, 1986; McMullen, Markman, & Gavanski, 1995; Mussweiler, 2003; Roese, 1997; Taylor, & Lobel, 1989; Wood, 1989). Markman and McMullen (2003) recognized the similarities in different comparative processes (i.e., counterfactual comparison, social comparisons, and temporal comparisons) and integrated them into a single framework known as the Reflection and Evaluation Model (REM).

In short, the REM builds upon the notion that counterfactuals and social comparisons are similar. The model argues that the effect of comparisons on motivation is indirect and occurs via changes in affect. In other words, an individual’s affective response from a comparison determines his or her subsequent motivational state. Previous research has established that affect has an influential role on a person’s responses (Martin, Ward, Achee, & Wyer, 1993; Schwarz, 1990; Taylor, 1991), and the REM builds on this research by additionally arguing that a comparison leads to affective changes that in turn drive the individual’s response. For example, how Tim feels following a comparison should impact his motivation to act or not to act. If Tim
feels worse following a comparison, it should lead to greater persistence on achievement tasks and less persistence on enjoyment tasks. In other words, that affective reaction is activating self-improvement motives (Markman & McMullen, 2003; McMullen & Eppers, 2001).

The REM, direction, and motivation are some of the main similarities between counterfactuals and social comparisons, and it is important to understand these similarities when examining these comparisons together. The similarities discussed above reveal that counterfactual and social comparisons are at least somewhat similar in their inputs (e.g., motivation influencing the comparison one generates) and outputs (e.g., how a comparison influences motivation). However, these comparisons are not similar in all aspects.

**Critical Distinction: Fact versus Simulation**

The one aspect that fundamentally differs between counterfactuals and social comparisons is the type of comparison target. In counterfactual thinking, the comparison target is a mentally simulated alternative world. In other words, the person is imagining how things could have been different. A comparison that is based on imagination and simulation is known as a *simulation-based* comparison (Kahneman & Tversky, 1982; Summerville & Roese, 2008). In contrast, social comparisons can be classified as *fact-based* (Summerville & Roese, 2008) as the comparison target is typically focused on actual people.

This distinction affects the kinds of comparisons individuals will naturally generate. When the comparison target is simulation-based, there are few constraints limiting the comparison. There are countless possible ways an individual can make a comparison and it is not limited by reality. If Tim is generating a simulation-based comparison, he can imagine numerous things both real and not real that might have impacted his exam grade (e.g., reading class handouts, hanging out with friends the night before the exam, going to the professor’s office hours). This means simulation-based comparisons are less constrained by reality. In other words, this type of comparison is only constrained by the individual’s imagination. Conversely, when the comparison target is fact-based, many factors limit the comparisons that can be made. Fact-based comparisons are only generated from what was actually observed or what actually happened. This results in a comparison that is more constrained by reality (Summerville & Roese, 2008). If Tim is generating fact-based comparisons, then he can only compare himself to people or situations that are real (e.g., the student next to him, a friend in the class, the class average).
These differences in how a specific comparison is constrained means that a broader range of comparison targets is available for counterfactuals than social comparisons. Counterfactuals involve a contrast to a comparison target simulated from a similar experience stored in memory (Kahneman & Tversky, 1982). When individuals generate a counterfactual, they have a wide-assortment of comparison targets. Thus, which comparison target is selected is highly changeable. It is easy for the individual to choose an alternative cognitive target because a virtually limitless set of possible targets exists. For example, Tim normally takes the highway home from work, but today he takes the back road home and crashes his car. When Tim is imagining what might have been, he can compare his current bad outcome to a variety of comparison targets (e.g., making it safely home by taking his normal route, braking sooner, or leaving work earlier).

Likewise, some social comparison targets are more easily generated or more available than others. However, since social comparisons have a more limited assortment of comparison targets, which comparison target is selected is less changeable than in counterfactual thinking. It is more difficult for the individual to select another comparison target because the comparison target itself is constrained by reality. When Tim is comparing his current bad situation to someone else, there are fewer easily generated comparison targets. For instance, thinking of someone he knows who was severely injured in an accident on the way home from work will be constrained by whether or not such a person actually exists.

Due to this difference in ease of simulation, it is reasonable to predict that these comparisons might be affected differently by various inputs. That is, the effects of motives on a comparison should differ for a social versus counterfactual comparison. For instance, if self-improvement motives are activated, they should have less of an effect on a social than a counterfactual comparison. The comparison target in counterfactual thinking is more mutable and thus more apt to influence from a change in a specific input. Tim should have no trouble generate a specific type of counterfactual that fulfills the current motivation (i.e., upward counterfactual). In social comparisons, however, the comparison target is less mutable and less susceptible to be influenced by any change in current motivation. Tim may only be able to easily select one or two comparison targets for the current situation. Even if Tim wants to generate an upward social comparison he might be unable to generate it in the specific context. Therefore, the change in motivation should have a much smaller effect on social comparisons because there are fewer possible targets available.
What Affects Comparisons?

The shared and distinct properties discussed above demonstrate that counterfactual and social comparisons share various inputs (e.g., motives influence comparisons) and outputs (e.g., comparisons influence motives). However, the distinction between these comparisons (e.g., type of comparison target) also suggests that the inputs and outputs might somewhat differ. For example, the availability difference between counterfactual and social comparisons should influence how a specific comparison responds to motives. Thus, there are a number of plausible ways counterfactual and social comparisons may be affected by the factors discussed in the literature review.

First, it is plausible that social comparisons and counterfactuals differ in their ability to respond to specific inputs. In other words, social comparisons and counterfactuals have different numbers of relevant targets available for a given comparison (Kahneman & Tversky, 1982). Social comparisons have a limited number of available targets for a specific comparison, and even if there is a change in motives, mindset, or affect prior to a given comparison, a social comparison may not have the optimal comparison target available because there are relatively fewer targets available (i.e., actual other people). Conversely, counterfactuals have a nearly unlimited number of comparison targets. Any change in motivation or affect prior to a counterfactual should influence the comparison because alternative comparison targets are available. This suggests that comparisons might differ in how they can be influenced by internal states (e.g., motivation) and context.

It is also possible that social comparisons and counterfactuals may have different effects on motivation. Although both of these comparisons can lead to changes in motives, counterfactuals are arguably better at leading to self-improvement motives. Counterfactuals tend to be upward in direction (i.e., typically, over 80% of comparisons are upward; Roese & Hur, 1997; Summerville & Roese, 2008) whereas social comparisons are more evenly divided between upward and downward (Collins, 1996; Suls, Martin, & Wheeler, 2002), which suggests that counterfactual comparisons fulfill and activate self-improvement motives relatively more than social comparisons. Moreover, although social comparisons can also lead to self-improvement motives, social comparisons often require fairly specific conditions in order to provoke inspiration or self-improvement motives (Buunk et al., 1990; Cialdini, Borden, Walker, Freeman, & Sloan, 1976; Lockwood & Kunda, 1997; Snyder, Lassegard, & Ford, 1986). Thus,
social comparisons are often described in terms of self-enhancement (Wood, 1989), whereas counterfactuals are often described in terms of self-improvement (Roese, 1997). In sum, despite substantial similarities (e.g., Markman & McMullen, 2003), differences in the average direction of these comparisons do suggest that each comparison might have a different effect on affect or motivation.

**Predictions**

These differences between counterfactual and social comparisons lead to two specific predictions for the current work. First, due to the difference in the number of available targets, it is possible that social comparisons and counterfactuals will respond differently to specific inputs. The *input hypothesis* states that counterfactuals will be relatively more influenced by a specific input factor (e.g., motivation) than social comparisons. Therefore, if an individual is motivated to self-improve, counterfactuals will be mostly upward in direction whereas social comparisons will be evenly divided between upward and downward. Directly comparing how each of these comparisons responds to a specific input factor is one method of examining if these comparisons respond differently to the same input. For example, if an individual has self-improvement motives, that individual should be able to easily generate a counterfactual. Conversely, in the same situation, it might be difficult for the individual to generate a social comparison since there are a limited number of available targets. Thus, in this example, counterfactuals should be generated more frequently than social comparisons. In sum, this prediction suggests that because these comparisons differ in the number of available targets, how these comparisons respond to an input will also differ.

It is also possible that counterfactual and social comparisons may have different outputs. The *output hypothesis* states that counterfactuals will lead to greater self-improvement motives than social comparisons, which in turn means the downstream effects of a counterfactual on self-improvement motives should also be greater. If the outputs of these comparisons do indeed differ, then it is possible the capture this difference by testing how one comparison influences the direction of another. For instance, if two comparisons are generated in a row, a counterfactual might lead to greater self-improvement motives (compared to a social comparison), which means a subsequent comparison is more likely to be upward in direction. Conversely, even if a social comparison is upward in direction, it is possible that self-improvement motives are not as great
(compared to a counterfactual), which means a subsequent comparison is less likely to be upward in direction (i.e., more likely to be evenly divided between upward and downward).

**Overview of The Current Studies**

A series of two studies were conducted to explore if the outputs of counterfactual and social comparisons (Study 1) and the way these comparisons respond to an input (Study 2) differs. Specifically, Study 1 tested if the outputs of social comparisons and counterfactuals differed by investigating if an initial comparison influenced the direction of subsequent comparison. Results from Study 1 indicated that the outputs of these comparisons did not differ substantially enough to influence the subsequent comparison. Thus, in order to test if these comparisons respond differently to inputs, Study 2 examined how motives influence comparison type.

**Study 1**

Study 1 examined if the outputs of counterfactuals and social comparisons differ. Specifically, this study examined the output hypothesis by testing if the type of an initial comparison influences the direction of a second comparison. If it is the case that counterfactuals and social comparison differentially impact an individual’s motives or affect, then an initial comparison should predict direction of a subsequent comparison. However, if these comparisons do not lead to relatively different outputs, then initial comparisons should not influence the direction of a second comparison. This study also provides an avenue to test the input hypothesis. In other words, measuring how a subsequent comparison responds to an initial comparison provides some insight into how each comparison responds to an input. It is important to note that the input and output hypotheses are non-competing predictions, and it is entirely possible for both hypotheses to be supported or not supported in the current work.

**Method**

**Participants.** A sample of 175 (47 men and 127 women, 1 not specified) undergraduates was recruited from the Introductory Psychology participant pool at Miami University. Participants received credit towards their Introductory Psychology research requirement. The mean age was 18.61 ($SD = 1.10$).

**Materials.** *Negative event prompt.* Participants were given a short paragraph asking them to “Please describe a recent situation that had a negative outcome related to some specific
part of your life”. They were asked to write about an event and to “Include details about the
decision(s) you made that led to the negative outcome” (see Appendix A).

*Initial upward comparison elicitation.* Participants were given a paragraph adapted from
past research (Markman et al., 1993; Roese, 1994) describing counterfactual thoughts (“After a
negative experience, people often think how the past might have been different. You might have
done something different or said something else and things might have turned out differently, so
that things would have been better than they were”) or social comparisons (“After a negative
experience, people often think how their experience compares to that of other people. How is
your situation similar or different to that of others who wound up better off than you?”).
Participants were instructed to write about how things could have been better or to compare
himself or herself to someone who did better in their negative situation (see Appendix B). The
purpose of this was to examine how an initial comparison influences a second comparison.
Because of this, it was necessary to control the direction of the first comparison, which is why
the current studies only examined series of comparisons where the first comparison was upwards
in direction.

*Initial factual focus elicitation.* Control participants were given a paragraph asking them
to write about the facts related to their previously recalled negative experience. They were asked
to focus on things that they did or saw, so that they avoid comparisons (e.g., “People often think
about past events. Please list as many facts as you can about the negative experience you wrote
about. Focus on things that you did or saw during that experience”; see Appendix C).

*Open-direction elicitation.* Following the initial elicitation, participants were randomly
assigned to generate either a counterfactual or a social comparison. Participants were given a
paragraph adapted from past research that instructed them to generate one of these comparisons,
but a direction was not specified (Markman et al., 1993; Roese, 1994). The instructions also
included a few sentences further encouraging participants to incorporate a counterfactual or
social comparison into what they write (e.g., “When writing, it can help if you first write what
you could have done differently in your situation, then specify how the outcome would have
turned out differently”; “When writing, it can help if you first write about someone you saw,
observed, or know about that was in a similar situation to the one you described and then specify
how his or her outcome was different than your own outcome.”) The instructions were presented
for 30 seconds before the essay text box appeared in order to ensure that participants thoroughly read the instructions (see Appendix D).

**Affect measure.** Participants rated two items using a scale ranging from 1 (very bad) to 7 (very good) as a measure of affect: “Right now I feel…” and “Thinking about this experience, I feel…” These items were highly correlated with each other at each time point, $r > .63$, $p < .001$ so a composite measure of affect was calculated for each time point.

**Procedure.** Participants came to the lab for a study investigating how they make decisions, as well as how they think and feel about the decisions they make. After providing informed consent, participants were separated into individual experimental rooms and the door was shut to ensure privacy. Each suite contains a desk, chair, and Windows-based computer. The entirety of the study took place on the computer.

All participants were first instructed to write about a recent negative event that had resulted from a decision they made. Following this negative event recall, participants were randomly assigned to generate an initial thought (upward counterfactual, upward social comparison, or factual-focus) and then asked to answer two questions measuring affect (Time 1 affect). Following this brief affect measure, participants were asked to complete the open-direction elicitation followed by the second measure of affect (Time 2 affect). The direction of the second comparison was the dependent variable. This resulted in six between-subjects conditions: upward counterfactual followed by counterfactual, upward social comparison followed by counterfactual, factual-focus followed by counterfactual, upward counterfactual followed by social comparison, upward social comparison followed by social comparison, factual-focus followed by social comparison. Finally, participants were debriefed and informed of the purpose of the study.

**Results**

A group of trained coders (two per thought) blind to hypotheses coded the first comparison generated as either upward, downward, or none. Participants were only coded as “none” if they did not generate a comparison in their thought listing. The inter-rater reliability was good, $\kappa = .77$ ($p < .001$), and the first author resolved the few disagreements. The 46 participants (26%) who did not follow instructions and failed to generate a comparison were excluded from the analyses. Including these participants did not change any of the results and is therefore not discussed any further. Preliminary analyses revealed that there were no significant
differences in Time 1 affect, Time 2 affect, or affect change between the conditions, $F_{\text{s}} < 1.71, ps > .14$. Likewise, point-biserial correlations revealed that affect did not predict comparison direction, $rs < .09, ps > .23$.

A chi-square test was conducted to see if the direction of the second comparison was related to the initial comparison (see Table 1 for frequency data). The 3 (initial comparison type) X 2 (second comparison type) X 2 (comparison direction) chi-square test was not significant, $\chi^2 (2, N = 129) = .37, p = .83$, indicating that initial and second comparison type did not interact to predict comparison direction. I then conducted a 3 (initial comparison type) X 2 (comparison direction) chi-square, which was also nonsignificant, $\chi^2 (2, N = 129) = .62, p = .74$. This indicated that the initial comparison did not influence the direction of the second comparison.

I thus collapsed across the initial comparisons and ran a 2 (second comparison type) X 2 (comparison direction) chi-square test. This analysis revealed that there was a significant relationship between comparison type of the open-ended comparison and comparison direction, $\chi^2 (2, N = 129) = 25.60, p < .001$. All participants, except 1 person, in the condition in which the second comparison was a counterfactual generated upward comparisons. Conversely, participants in the condition in which the second comparison was a social comparison generated a similar number of upward and downward comparisons.

**Discussion**

This study examined if the outputs of counterfactuals and social comparisons differed by assessing if an initial comparison influenced the direction of a second comparison. The results clearly indicated that comparison direction only varied as a result of the second comparison. The factual focus (i.e., control) conditions did not significantly differ from the other two initial thought-type conditions. In other words, the factual focus followed by counterfactual condition did not differ from the social comparison followed by counterfactual or counterfactual followed by counterfactual condition. This indicated that the initial comparison did not influence the direction of the second comparison.

There are a few conclusions that can be drawn from these findings. First, the factual focus conditions indicate that the initial comparison is not influencing the second comparison in any way. This pattern goes against the output hypothesis because it suggests that the output from the initial comparison does not differ enough between upward counterfactuals and upward social comparisons to influence a subsequent comparison. If the output had differed between these
comparisons, then the initial comparison should have related to the direction of the second comparison. Second, the results revealed that comparison direction was related to comparison type, such that counterfactuals were mostly upwards and social comparisons were more evenly divided between upwards and downwards. This finding may suggest that these comparisons respond differently to the same inputs, which would support the input hypothesis. In other words, these findings suggest that counterfactuals may be more readily influenced by a specific input factor because they have more comparison targets available.

**Study 2**

The previous study established that an initial comparison does not influence a second comparison. Instead, in partial support of the input hypothesis, Study 1 revealed that almost all counterfactuals were upward, while social comparisons were evenly divided between upward and downward. Thus, Study 2 examines one possible explanation as to why these comparisons differed in direction: do individuals selectively choose a comparison based on their specific motivation? It is possible that individuals are more likely to seek self-improvement via counterfactuals and self-enhancement via social comparisons.

Although Study 1 provided some evidence in support of the input hypothesis, it is necessary to directly test how these comparisons respond to a specific input in order to provide more conclusive evidence for this hypothesis. One effective method to test this is to manipulate an input factor (e.g., motivation) and examine the type of comparison that is generated. In previous research, different comparison types have been discussed in relation to different motives: counterfactuals in terms of self-improvement and social comparisons in terms of self-enhancement (Roese, 1997; Wood, 1989). It is possible that individuals may choose to generate a specific comparison based on their current state. Specifically, because counterfactuals tend to result from self-improvement motives (Roese & Hur, 1997) and since Study 1 revealed that almost all counterfactuals were upwards, individuals might choose to generate counterfactuals when they are motivated to self-improve. Conversely, since social comparisons tend to result in self-enhancement motives (Wood, 1989) and Study 1 revealed that social comparisons were more evenly divided in direction, individuals might choose to generate social comparisons when they are motivated to self-enhance.

In order to test the prediction that comparisons respond differently to a specific input, the procedure from White and Lehman (2005) was adapted to the current research. The original
research manipulated participants’ motives by presenting them with a short paragraph describing self-improvement or self-enhancement motives and asking them to imagine responding to a vignette with these motives in mind. Following this, participants wrote their thoughts about a negative event, and counterfactual direction was measured. In my Study 2, participants’ motives were manipulated in a similar manner. However, instead of measuring comparison direction, comparison type was measured (i.e., counterfactual or social comparison). At the end of the study, participants’ perceived affordances of these comparisons were also assessed. In order to demonstrate that these comparisons respond differently to the same input factor, I predicted that participants who received self-improvement instructions would generate relatively more counterfactuals, whereas participants who received self-enhancement instructions would generate relatively more social comparisons. Likewise, I expected the affordance measures to reveal that participants believed counterfactuals were relatively more useful for self-improvement and social comparisons were relatively more useful for self-enhancement.

Method

Participants. A sample of 154 (60 men and 92 women, 2 not specified) undergraduates was recruited from the Introductory Psychology participant pool at Miami University. Participants received credit towards their Introductory Psychology research requirement. The mean age was 18.75 (SD = 1.01).

Materials. Negative event vignettes. Instead of recalling a negative event, participants read one vignette describing a negative event. Participants were randomly presented with a vignette that either described a scenario involving a car accident or the dissolution of a romantic relationship (taken from White & Lehman, 2005; see Appendix E).

Motive manipulation. Participants were randomly assigned to think about self-improvement or self-enhancement using instructions from White and Lehman (2005). Specifically, participants in the self-improvement [self-enhancement] condition read, “Sometimes we want to think about the situation in a way that makes us learn from the situation [feel particularly good about ourselves]. We select the information that we can learn from and that we can use to improve or to avoid a similar situation in the future [that makes us feel better and describes the situation in the most positive light]. The ability to sometimes think about the situation in this way may be important for adaptive functioning and good mental health.”
Comparison measure. Instead of measuring comparison direction, participants were asked to generate their choice of a counterfactual or social comparison. The elicitation in the self-improvement [self-enhancement] condition read, “On this page we would like you to write about the specific thoughts you would have about the situation if you wanted to improve yourself or learn from the situation [lift your spirits or see your situation in the most positive light]. Specifically, we would like you to write about one of the following thoughts, considering that you want to improve yourself or learn from the situation [lift your spirits or see your situation in the most positive light].” Participants were then asked the following question and the order of these statements was randomized: “Write about what you could have done so that things might have turned out differently or write about how your experience is different than someone else’s”.

Manipulation check. Participants answered a question taken from Rim and Summerville (2014) as a manipulation check. Specifically, participants were asked “When thinking about your negative situation, how interested are you in improving yourself and learning from the situation versus in lifting your spirits and feeling better about the situation?” Responses were measured on a 1 (only interested in feeling better about the situation) to 7 (only interested in learning from the situation) scale.

Affordance measures. Participants answered two questions that assessed their perceived affordances of both counterfactuals and social comparisons to meet their current motivation. Specifically, participants in the self-improvement [self-enhancement] condition were asked, “When you want to self-improve [self-enhance], how helpful is it to compare yourself to other people”, and "When you want to self-improve [self-enhance], how helpful is it to think about how things might have been different”. The order of these questions was randomized, and responses were measured on a 1 (not at all helpful) to 9 (very helpful) scale.

Procedure. Participants were first presented with a vignette and asked to practice generating both a counterfactual and a social comparison. The order that participants were asked to practice each comparison was randomized. Next participants were randomly presented with one of the negative event vignettes. Following this, half of the participants were presented with the self-improvement instructions and the other half were presented with the self-enhancement instructions. The pairing of the vignettes with the motivation manipulation was counterbalanced. Immediately following the motivation instructions, participants were asked to generate their
choice of a counterfactual or social comparison. Finally, participants were then asked to answer the motivation manipulation check questions and the two affordance questions.

**Results**

As expected, the manipulation check confirmed that the motivation manipulation was successful. Participants in the self-improvement condition reported being more interested in learning from the situation \((M = 4.73, SD = 1.62)\) compared to participants in the self-enhancement condition \((M = 4.20, SD = 1.45)\), \(t(151) = 2.13, p < .05\). Additionally, two trained coders blind to condition coded the first thought generated as a counterfactual, social comparison, or none. The inter-rater reliability was excellent, \(\kappa = .87 (p < .0001)\), and the first author resolved the few disagreements. Only 14.3% of participants \((n = 22)\) did not generate a comparison and were excluded from the comparison type analyses.

In order to test if self-improvement motives were related to counterfactual generation and if self-enhancement motives were related to social comparison generation, a chi-square test was conducted (see Table 2 for frequency data). The 2 (motivation) X 2 (vignette) X 2 (comparison type) chi-square test was significant, \(\chi^2 (1, N = 132) = 8.39, p < .01\). There was a relation between participants’ motivation and the type of comparison generated when the vignette was about the car accident, \(\chi^2 (1, N = 67) = 12.34, p < .001\). Specifically, as predicted, when participants had self-enhancement motives they generated a similar number of social comparisons and counterfactuals, whereas when participants had self-improvement motives they generated mostly counterfactuals. Against the hypothesis, there was no relation between participants’ motivation and the type of comparison generated when the vignette was about the dissolution of a romantic relationship, \(\chi^2 (1, N = 65) = .04, p = .59\). Specifically, for both types of motivation, participants generated mostly counterfactuals and relatively few social comparisons.

I then examined if the affordances of each comparison differed based on self-improvement and self-enhancement motives. I subjected the affordance measure to a 2 (comparison type) X 2 (motivation) X 2 (vignette) mixed-model ANOVA. There was no interaction with the vignettes \((ps > .18)\) so I collapsed across this factor. The subsequent 2 (comparison type) X 2 (motivation) ANOVA revealed a main effect of comparison type, \(F(1, 152) = 10.51, p < .001, \eta^2 = .07\). Participants tended to view counterfactuals as significantly more helpful than social comparisons at meeting both self-enhancement and self-improvement goals, \(t(153) = 3.01, p < .01, d = .33\). More importantly, this analysis revealed the predicted motivation
X comparison type interaction, $F(1, 152) = 25.80$, $p < .001$, $\eta^2 = .15$. When participants were motivated to self-improve, they believed a counterfactual was more helpful ($M = 7.10$, $SD = 1.78$) than a social comparison ($M = 5.22$, $SD = 2.01$), $t(176) = 6.39$, $p < .0001$, $d = .73$. Conversely, when participants were motivated to self-enhance, they did not differ in their ratings of social ($M = 5.57$, $SD = 2.13$) versus counterfactual ($M = 5.16$, $SD = 2.50$) comparisons, $t(176) = -1.21$, $p = .23$, $d = .14$ (see Figure 1).^2

**Discussion**

As a second test of the input hypothesis, Study 2 examined if self-improvement motives led to the generation of counterfactuals and if self-enhancement motives led to the generation of social comparisons. The predictions were only partially supported, however. As expected, participants with self-improvement motives generated mostly counterfactuals, whereas participants with self-enhancement motives generated a similar number of social comparisons and counterfactuals. However, this relationship only emerged when participants read and generated a comparison about the car accident vignette. When the vignette was about the dissolution of a romantic relationship, there was no relation between motivation and comparison type. Instead, participants generated mostly counterfactuals, regardless of their motivation. Recent work has revealed that romance is one of the top domains that people regret (Morrison & Roese, 2011; Roese & Summerville, 2005; Summerville & Buchanan, 2014). Thus, it is possible that people are particularly practiced at thinking about “what might have been” after a romantic-related negative outcome.

Similarly, the affordance ratings only partially followed the predictions. Specifically, when participants were motivated to self-improve, they believed counterfactuals were more helpful than social comparisons. However, when participants were motivated to self-enhance, they rated social comparisons and counterfactuals as equally helpful at that goal. Although these affordance findings must be interpreted with caution, as this measure was completed post-comparison, it does suggest that counterfactuals are viewed as more helpful, primarily when the individual is motivated to self-improve.

Although the proposed mechanism was not entirely supported, these findings do partially support the input hypothesis by demonstrating that individuals selectively choose comparisons

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^2 Excluding the 22 participants who did not generate a comparison did not change the affordance results.
based on their motives. Counterfactuals were the preferred comparison when individuals were motivated to self-improve. However, when individuals were motivated to self-enhance, participants selected counterfactuals and social comparisons equally. These findings suggest that counterfactual and social comparisons do respond at least somewhat differently to motivational inputs. Interestingly, the findings from Study 2 also suggest that specific contexts influence the type of comparison an individual generates. Overall, these findings support the input hypothesis, but there are a number of unanswered questions that must be addressed in future work.

General Discussion

This work explored the general question of what affects comparisons by testing two noncompeting hypotheses. Study 1 was the first study to examine if one comparison influences the direction of another, and it revealed that the initial comparison did not influence the direction of the second comparison. Importantly, in support of the input hypothesis, comparison direction was related to comparison type, such that counterfactuals were mostly upwards and social comparisons were divided between upwards and downwards. This suggested that counterfactuals and social comparisons respond differently to the same inputs. Study 2 built upon these findings by testing if individuals selectively choose comparisons based on their specific motivations, which provided additional partial support to the input hypothesis. As expected, when motivated to self-improve, participants generated relatively more counterfactuals than social comparisons. However, when motivated to self-enhance, participants generated an even number of social comparisons and counterfactuals. Unexpectedly, this finding depended upon the vignette type. When the vignette was about the dissolution of a romantic relationship, there was no relation between motivation and comparison type, and participants generated mostly counterfactuals. The affordance measure also partially supported predictions by revealing that participants perceived counterfactuals as more helpful than social comparisons when they were motivated to self-improve. However, participants perceived both counterfactuals and social comparisons as equally useful when they were motivated to self-enhance. In sum, Study 2 provided additional support to the input hypothesis by demonstrating that counterfactual and social comparisons do indeed respond differently to the input of motivation.

Implications of the Current Research

The current research demonstrates the utility of comparing two different types of comparisons. Prior to this work, almost all counterfactual and social comparison studies have
examined each comparison without considering the others (e.g., Lockwood & Kunda, 1997; Olson et al., 2000; White & Lehman, 2005). However, the current work revealed that there are important distinctions to be made between these comparisons. For instance, this is the first research to demonstrate that motivation may drive the type of comparison one generates. Additionally, because situations can differ in a variety of ways (e.g., domain, opportunity, controllability, predictability, mutability, severity, type of outcome, amount of information) exactly how motivation impacts comparison type may be dependent on various factors in a specific situation. For example, regret and counterfactuals may be more common in one domain (e.g., romance) compared to other domains (e.g., spirituality; Morrison & Roese, 2011). Therefore, the context and type of outcome may impact the relationship between motivation and comparison type because individuals may become highly practiced at generating a specific comparison in certain situations. Future work should further examine how these various factors influence counterfactual and social comparisons.

This work also emphasizes the function of counterfactuals in self-improvement. It is has been well established that counterfactuals help individuals improve in the future (Epstude & Jonas, 2015; Roese, 1994; Smallman, 2013; Smallman & Roese, 2009). However, this work suggests that compared to social comparisons, counterfactuals are perceived to be more useful for self-improvement. All but one participant generated upward counterfactuals in Study 1 when asked to generate a counterfactual, and Study 2 revealed that participants preferred to generate and also viewed counterfactuals as more helpful when motivated to self-improve. Additionally, findings from the current work suggest that the relationship between self-enhancement and social comparisons is not as strong as the relationship between self-improvement and counterfactuals. In fact, participants in Study 2 viewed social comparisons and counterfactuals as equally useful in self-enhancement situations. Thus, the current studies indicate that counterfactuals are perceived to be equally as useful for self-enhancement as social comparisons.

This finding is somewhat surprising because counterfactual and social comparisons are equally common in daily life (Summerville & Roese, 2008). Also, as previously mentioned, researchers often view both types of comparisons in similar ways (Markman & McMullen, 2003; Olson et al., 2000). For example, Olson and colleagues (2000) describe that both counterfactual and social comparisons serve a functional purpose and can impact downstream behavior. Nonetheless, these findings suggest that there are differences between motives and
counterfactual and social comparisons. It might be the case that people have lay theories that counterfactual thoughts are more beneficial than social comparisons. It might also be the case that in specific situations (e.g., self-improvement) generating a counterfactual thought actually provides more useful information for the future than generating a social comparison. Future research should directly examine if counterfactual and social comparisons impact behavioral intentions and downstream behavior differently (see Smallman, 2013). Research of this type is vital because it will allow current theories like the REM to be updated to reflect differences in the relation between motives and both counterfactual and social comparisons.

The findings from Study 1 also demonstrate that one comparison does not impact the direction of another comparison, as predicted by the output hypothesis. Although research has shown that comparisons influence motives and affect in similar ways (see Markman & McMullen, 2003), no work has tested if these changes following a comparison influence subsequent comparisons. Thus, the current work suggests that the downstream effects of these comparisons are not particularly powerful, at least when it comes to influencing the direction of a subsequent comparison. If the change to motives were substantial following an initial comparison, then it would be expected that an initial comparison would influence the direction of a subsequent comparison, as did the motive instructions in Study 2. However, no such changes were observed in Study 1.

Limitations and Future Directions

Although the current work provides some support to the input hypothesis, a primary limitation is that the current studies do not provide a conclusive mechanism that elucidates why these comparisons respond differently to inputs. Motivation only partially determined what comparison participants generated in Study 2. Furthermore, there are other factors that also determine how counterfactuals and social comparisons are influenced in a specific situation, such as the domain of the event. Individuals may have varying degrees of information about others in specific situations, which might determine what type of comparison they are able to generate. For example, one may not have particularly detailed information about the dissolution of another’s romantic relationship, which might lead to mostly counterfactuals. However, one may have relatively more information about another person’s car accident, which makes a social comparison a more feasible option. Future work should therefore investigate why the domain of the event influenced the type of comparison that was generated.
Relatedly, the two vignettes in Study 2 differ on a number of other factors, (e.g., severity, mutability, the type of outcome) even though they were taken from past work (White & Lehman, 2005). In order to fully understand the mechanism behind the current work, future research should investigate some of these factors and how they influence the type of comparison an individual generates. For example, the type of outcome between the vignettes differed, such that one was emotional (romantic relationship) and the other physical (car accident). It might be the case that simulating alternative realities (as opposed to comparing oneself to others) is the more common response when the outcome is emotional but not physical (Morrison & Roese, 2011), which might be why participants generated mostly counterfactuals in the romantic relationship scenario.

Additionally, the motivation manipulation in Study 2 may not have been as effective as intended. Although the manipulation check was significant, the difference between the means of the self-improvement and self-enhancement conditions was relatively small. Moreover, the mean of the self-enhancement condition was slightly above the midpoint of the scale ($M = 4.20$). This suggests that participants in the self-enhancement condition were not motivated to self-enhance and instead were motivated to self-improve (albeit, only slightly). This could explain why participants generated a similar number of counterfactuals and social comparisons when the vignette was about the car accident. In the dissolution of a romantic relationship scenario, participants may have been particularly practiced at generating counterfactuals (Morrison & Roese, 2011), which could be why participants generated mostly counterfactuals even though they were originally asked to think about self-enhancement.

Another limitation to the current work is that only upward comparisons were used for the initial comparisons in Study 1. It would have been possible to ask participants to generate a downward comparison before assessing the direction of a subsequent comparison, and the conclusions for Study 1 are limited in the sense that I only tested how upward comparisons influence subsequent comparisons. However, controlling the direction of the initial comparison made it possible to control for subsequent changes in motives or affect. I determined that using upward comparisons was an acceptable starting point because upward comparisons are both useful and easy for people to generate, and upward comparisons tend to be the most common direction of comparison (Epstude & Roese, 2008; Roese & Hur, 1997; Summerville & Roese,

**Conclusion**

Prior to these studies, most comparison research has focused on the antecedents and consequences of a single comparison type. The current work demonstrates the necessity of examining various comparison types together, as counterfactuals and social comparisons were influenced differently by the input of motivation. More importantly, very little work has given participants the choice of generating different types of comparisons (Olson et al., 2000) even though this is something that occurs every day in non-laboratory contexts (Summerville & Roese, 2008). Olson and colleagues (2000) stated, “Given the conceptual similarities between these two kinds of comparative judgments, we think that an integrative approach is both theoretically plausible and likely to increase our understanding of the two processes” (pp. 394-395). Thus, the findings from the current studies provide some of the first empirical evidence demonstrating the value of examining these comparisons together. Utilizing open-comparison elicitations in future work will not only will allow researchers to examine how different types of comparisons respond to input and output factors, but it will also allow researchers to examine comparisons in a more natural context.
References


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Figure 1. Mean comparison affordance ratings as a function of motivation demonstrates that participants who were motivated to self-improve believed counterfactuals were more helpful than social comparisons, whereas participants who were motivated to self-enhance did not differ in their affordance ratings. Error bars represent +/- 1 standard error.
Appendix A

Negative Event Prompt

Please describe a recent situation that had a negative outcome related to some specific part of your life. Please include enough detail so that someone else could understand the situation, but do not include any details such as names or exact locations that might allow someone to identify you or others.

Be sure to include details about the decision(s) you made that led to the negative outcome.
Appendix B
Initial Upward Comparison Elicitation

Counterfactual

After a negative experience, people often think how the past might have been different. You might have done something different or said something else and things might have turned out differently, so that things would have been better than they were. Do you have any of these thoughts? Something that you can't help but think about?

In the space below, please describe one of these thoughts (using the situation you described before this) about "what might have been", specifically about how your situation might have been better. Please include enough detail so that someone else could understand the situation and feel as you felt from reading the description, but leave out details like names or locations that might allow someone to identify you or others.

Social Comparison

After a negative experience, people often think how their experience compares to that of other people. How is your situation similar or different to that of others who wound up better off than you? Do you have any of these thoughts? Something that you can't help but think about?

In the space below, please describe one of these thoughts (using the situation you described before this) about how your situation compares to others, specifically about how someone else's situation was better. Please include enough detail so that someone else could understand the situation and feel as you felt from reading the description, but leave out details like names or locations that might allow someone to identify you or others.
Appendix C
Initial Factual-focus Elicitation

People often think about past events. Please list as many facts as you can about the negative experience you wrote about. Focus on things that you did or saw during that experience.

In the space below, please describe the facts from this experience. Imagine that you were describing these facts to a friend. Make sure you only list things that are factual, that is, that they actually happened. Please include enough detail so that someone else could understand the situation and feel as you felt from reading the description, but leave out details like names or locations that might allow someone to identify you or others.
Appendix D
Open-direction Elicitation

Counterfactual
After a negative experience, people often think how the past might have been different. You might have done something different or said something else and things might have turned out differently. Do you have any of these thoughts? Something that you can't help but think about? In the space below, please describe one of these thoughts (using the situation you described before this) about "what might have been". Please include enough detail so that someone else could understand the situation and feel as you felt from reading the description, but leave out details like names or locations that might allow someone to identify you or others. When writing, it can help if you first write, what you could have done differently in your situation and then specify how the outcome would have turned out differently. We know this may not be how you usually think about things (it is easier in certain situations than others), but it’s important that you think about this an incorporate a “what might have been” thought into what you write.

Social Comparison
After a negative experience, people often think how their experience compares to that of other people. How is your situation similar or different to that of others? Do you have any of these thoughts? Something that you can't help but think about? In the space below, please describe one of these thoughts (using the situation you described before this) about how your situation compares to others. Please include enough detail so that someone else could understand the situation and feel as you felt from reading the description, but leave out details like names or locations that might allow someone to identify you or others. When writing, it can help if you first write, about someone you saw, observed or know about that was in a similar situation to the one you described and then specify how his or her outcome was different than your own outcome. We know this may not be how you usually think about things (it is easier in certain situations than others), but it’s important that you think about this an incorporate a “comparison to someone else” into what you write.
Appendix E
Vignettes

Car Accident

Imagine that you are driving to work and that you are running late. You are a bit anxious, as this will be the third time in the last two weeks that you have been late. You pull up at a four way stop, stop briefly, and then begin to drive into the intersection. Suddenly, another driver sails through his stop sign at about 20 mph an hour without stopping. Even though the other car crashes into your right side, you manage to veer to the left to avoid a greater impact. You are not seriously hurt, but your back and neck are awfully sore. The other driver seems fine. There is damage to the right side of your car, it is caved in and looks like it will be fairly expensive to fix. The other driver’s front end is pushed in and his fender is dislocated.

Dissolution of a Romantic Relationship

Imagine that you and your significant other have been together for almost 10 months. Lately it seems like the two of you have been arguing a lot. Your significant other seems to not really be as attentive as he/she once was and has been spending less and less time with you. You feel like you have invested a lot into the relationship and want to work at staying together. You really do care about this person, but you also wonder if maybe you are too different to make it work. One evening your significant other shows up late. You are tired and exhausted from your day at school and slightly irritated because you have been waiting for an hour. You snap at your significant other about being late and it ends up escalating into a full blown argument. The argument ends up with the two of you breaking up.