

mere possibilities. Nothing turns on whether the imagining in question involves imagistic representations.) This is a claim that Byrne and Johnson-Laird have been defending for some time (and one which, as she notes, has a long philosophical lineage). Here the main alternative is a version of the inference rule theory – the theory that our inferences are guided by more or less complex sets of rules that tell us how to proceed from premises to conclusions; that our reasoning consists in applying such rules rather than actively considering a range of possibilities. There are several points in Byrne’s book where she argues against this alternative (e.g., pp. 51–52 and pp. 115–16), but these passages are fairly brief and inconclusive. This book does not (primarily) address that dispute.

Note how the above two premises combine in the case of deductive reasoning, according to Byrne:

Deductive reasoning is rational because people have the underlying competence to think of all the relevant possibilities so that they could search for counterexamples. Why then do people make mistakes? Their performance is sometimes not rational because of the limits to the possibilities they can consider. (p. 29)

From what I have described so far, one might expect Byrne’s project to be a detailed account of just how limits on our imagination constrain our reasoning performance – how our imaginations select from the totality of logical possibilities in order to produce our (often flawed) reasoning performance. And this is precisely what I think she actually does. Chapter by chapter, she describes particular ways in which we limit the logical possibilities that we imagine when reasoning about what actions or conditions would or would not have made a difference, what ought to have happened, what we regret, and what we deem inevitable. These are interesting, useful, and nicely documented observations, deserving of close attention and continued discussion.

Byrne’s stated position, however, is something different, for the conclusion of each version of her three-step argument (and what she repeatedly calls the central idea of the book) is this:

Conclusion: *Counterfactual imagining is rational*

Given the severe restrictions on the sets of possibilities that we are said to imagine when contemplating what would have made a difference, or what we should have done, and so on, and given Byrne’s equating of deductive competence with an ability to imagine all relevant possibilities (and thus all possible counterexamples), this is a surprising conclusion.

3. Counterfactual imagining is guided by the same principles as those that guide human reason and imagining possibilities. Byrne’s crucial third premise, which is stated in a number of different ways (compare versions on pp. 38, 199, 208, and 215), claims that the principles that guide human counterfactual imagining – which is a subset of imagining possibilities more generally – are the *same* principles as those that guide human reasoning. Since premise 1 affirms the rationality of these principles, it is now an easy step to the conclusion that counterfactual imagining is rational.

As we have already noted, though, the most that this would establish would be our *competence* for rational counterfactual imagining; it would not ensure the rationality of our actual counterfactual imagining. And given Byrne’s careful detailing of the many possibilities that most of us do not (usually) consider in counterfactual imagining (possibilities that are less controllable, possibilities that are forbidden, possibilities that are in the more distant past, etc.), it is clear that our actual performance falls far short of our underlying competence. If the third premise is understood as referring to the principles that characterize our rational competence, it would seem more appropriate to conclude that counterfactual imagining is *irrational* – not in principle, but in fact.

On the other hand, if the principles that guide counterfactual imagining are captured in the list of principles that Byrne articulates, chapter by chapter (see Table 7.2, p. 161, for the complete

list), then there is little reason to think that these principles (e.g., “People keep in mind *few* possibilities”) are the principles that are constitutive of our rational competence. They may be efficient or instructive or reassuring in some of the ways that Byrne sketches (on pp. 209–12), but they do not take account of all relevant alternatives. If, when considering how things might have been different, we restrict ourselves to imagining changes in controllable factors only, or changes in only the most recent events, surely we are not fully exercising our capacity for rationality.

If, as seems plausible, human reasoning rightly relies on a combination of logical principles and pragmatic principles, then it is not surprising that counterfactual reasoning and counterfactual imagining also rely on a combination of logical and pragmatic principles. That is not a surprising conclusion, and it is not where the real interest of Byrne’s book lies. The most significant contribution of this book is her description of the ways in which certain possibilities are usually *not* imagined when we reason with counterfactuals – ways in which our rationality is, understandably, limited.

Beyond rationality: Counterfactual thinking and behavior regulation

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Abstract: Counterfactual thinking may be described as disciplined, realistic, and rational, but we move a step further to describe a theoretical perspective centering on behavior regulation. According to this perspective, counterfactual thinking primarily centers on coordination of ongoing behavior. In short, most “if only” thoughts in daily life center on the acquisition of goals; hence, counterfactual thinking may be illuminated by considering the large literature on goal cognition.

In her book *The Rational Imagination*, Byrne (2005) describes some of the cognitive mechanisms underlying counterfactual thinking. Her guiding theoretical framework is informed primarily by the mental models tradition (Johnson-Laird 1983) but also by norm theory (Kahneman & Miller 1986), which emphasize the lower-order building blocks of cognition. Byrne’s main claim is that counterfactual thinking is inherently rational, which is to say disciplined, rooted to accurate inferences about reality rather than mere whimsy. We agree completely with this claim, but suggest that it perhaps does not go far enough. Counterfactual thinking is not only rational, but motivated (and motivating). Connected deeply to goal-oriented cognition, counterfactual thoughts contribute to the effective management of ongoing behavior. Bundled under a functional theory of counterfactual thinking (Epstude & Roese, submitted; Roese 1994; 1997; Roese & Olson 1997), we argue that taking into account the motivational and regulatory basis of the imagination helps to explain key findings about which the mental models tradition remains silent.

Consider the following empirical observations. Counterfactual thoughts are idealistic: they are more likely to focus on how the past might have been better than on how it might have been worse (Nasco & Marsh 1999; Summerville & Roese, in press). Counterfactual thoughts are situationally reactive: they are more likely to appear after failure than after success (Roese & Hur 1997). Counterfactual thoughts are problem-focused: they are more likely to focus on fixing a problem than on random life events (Roese et al. 1999). Counterfactual thoughts are ego-centric: they are more likely to focus on the actions of oneself

than on those of other people (White & Roese, submitted). Finally, counterfactual thoughts involve activation of the orbitofrontal region of the brain, a region previously linked to planning and problem solving (Coricelli et al. 2005; Ursu & Carter 2005). What do these observations tell us about counterfactual thinking?

Taking these findings in hand, it becomes clear that the abundant research on goal pursuit (Carver & Scheier 1998; Fishbach & Ferguson 2007; Higgins 2006; Lewin 1935) provides us with important insights into the form, function, and effect of counterfactual thinking. Goals may be defined as cognitive representations of desired ends and the means to achieve such ends (Fishbach & Ferguson 2007). Counterfactual thoughts that occur in everyday life involve, for the most part, alternative means that “might have been” implemented so as to have obtained a desired end. We recently described how principles of motivation and goal cognition might explain counterfactual thinking (Epstude & Roese, submitted). Encountering a problem typically triggers an upward counterfactual (e.g., “If only I had studied harder, I would have passed”). Counterfactual thoughts themselves have as an inherent property such causal implications, and these directly fuel the activation of corresponding behavioral intentions (“I intend to study harder next time”), which in turn unleash corresponding corrective behavior (the student indeed studies harder the next time). To the extent that such behavior alleviates the original problem, this mechanism is effective in terms of regulating behavior in terms of goal pursuit. This regulatory mechanism is content-specific; that is, the information contained in the counterfactual directly translates into a related action.

In addition to a content-specific mechanism by which counterfactual thinking influences behavior, evidence also suggests a content-neutral mechanism. A content-neutral mechanism reflects *how* rather than *what* information is handled. For example, independent of their specific meaning, counterfactuals can exert an influence on attention and information processing, as in demonstrations of a counterfactual mind-set, which involves a heightened albeit generic tendency to consider alternatives (e.g., Galinsky et al. 2000). As another example, the negative affect that often springs from upward counterfactuals (which make the present look less desirable in contrast to a better alternative) may itself motivate behavior change (Markman et al. 2006). In addition, structural properties of counterfactual thoughts may evoke either approach or avoidance motivation (e.g., Roese et al. 1999).

The interplay between emotion and counterfactual thinking is pivotal. Regret is an unpleasant feeling state that depends on an upward counterfactual, an aching despair born of the realization that one might have made a better decision or achieved a better outcome (Roese 2005). People are motivated to manage their regret experiences even as they draw insights from their regrets (Zeelenberg & Pieters 2007). Moreover, recent studies have linked mental health dysfunction to both an excess and a deficit in counterfactual thinking and regret. The principal consequences of upward counterfactual thinking (i.e., regret) are problem-solving insights and negative emotion; hence, excessive counterfactual thinking has been found to be associated with pathology rooted to excessive problem-focused cognitions (e.g., anxiety; Kocovski et al. 2005) and excessive negative affect (e.g., depression; Markman & Miller 2006). By contrast, a deficit of counterfactual thinking is associated with a deficit of problem-focused cognition (e.g., underachievement, work difficulty, social dysfunction) along with an absence of negative affect. Along these latter lines, schizophrenia has been shown to be associated with impaired counterfactual thinking (Roese et al., in press) and deficits in goal-related cognition (Brandstätter et al. 2001). These studies suggest that there is an optimal level of counterfactual thinking and emotional reactivity to such inferences, and that both too much and too little may spell trouble for mental health.

An earlier generation of research on counterfactual thinking, dating from the 1980s and stimulated by the writings of Kahneman and Tversky (1982), treated such thoughts as

instances of bias, and hence, impediments to sound judgment and shrewd action. The work of Byrne and others has illuminated counterfactual thinking in a different light, as an instance of principled and rational imagination. Counterfactual thoughts do sometimes bring bias, yet balancing this cost is the larger benefit of the effective management of daily behavior. Counterfactual thinking, we argue, is best understood as an input to course correction, as an instance of goal cognition, and as an essential component of behavior regulation.

Semifactual: Byrne’s account of even-if

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Abstract: Byrne’s approach to the semifactual conditional captures the reasoning data. However, we argue that it does not account for the processes or principles by which people arrive at representations of even-if conditionals, upon which their reasoning is said to be based. Drawing upon recent work on the suppositional conditional we present such an account.

In choosing to write a book primarily about counterfactuals, Ruth Byrne has been able to integrate the literatures on reasoning and social cognitive aspects of decision making and judgment. In so doing, she has performed an invaluable service to cognitive and social psychologists alike. Thus, there is much to applaud in *The Rational Imagination* (Byrne 2005) and there are several of its aspects upon which we could comment. Because we have commented elsewhere on Byrne’s application of mental model theory to judgmental phenomena such as the action effect (see Feeney & Handley 2006), in this commentary we focus on the mental model account that she outlines of how people reason about semifactual conditionals.

According to Byrne, a subjunctive semifactual conditional such as

- (1) Even if Pete had studied hard he would have failed the exam

usually conveys the conjecture that its antecedent is false and its consequent true, and is often used to assert that the antecedent could not have prevented the consequent from occurring. Even-if conditionals call for the representation of two possibilities: one where the antecedent occurs and the consequent occurs, and one where the antecedent does not occur and the consequent occurs. If we consider the foregoing example, people represent the conjecture, “He studied hard and failed the exam,” and they represent the presupposed facts, “He didn’t study hard and failed the exam.” This mental representation is said to explain people’s tendency not to affirm the consequent (i.e., that he studied hard, from being told that he failed the exam) and to infer the opposite to the standard conclusion (i.e., that he failed rather than passed the exam) from a denial of the antecedent (see Handley & Feeney 2004; 2007; Moreno-Rios et al. 2004). It also provides an explanation for one of the most intriguing characteristics of concessive conditionals – their compelling invitation to the listener to infer the consequent, a characteristic much commented on in linguistics and philosophy (Konig 1986).

It has been recognised in these literatures that the study of less common conditional forms can provide significant insights into the way in which the ordinary conditional is represented and