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Decomposing Forecasting: The Salience-Assessment-Weighting (SAW) Model

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Abstract
The act of forecasting one's behavior or performance is both commonplace and consequential, but it is also difficult. Previous research has identified a host of systematic forecasting errors. We suggest that existing findings can be better synthesized, and future research can proceed in a less piecemeal fashion, through the introduction of a general model that describes how forecasts unfold. In our salience-assessment-weighting (SAW) model, we outline three steps that describe how people translate information at their disposal into an accurate forecast of a future outcome. Dimensions potentially relevant to the outcome become *salient*; one's standing on that dimension must be accurately *assessed*; and one must appropriately *weight* the importance of that dimension to translate it into a forecast. We illustrate how this SAW model is helpful in unifying previous research findings, identifying how and when forecasts go astray, and suggesting questions for future research.

Keywords
forecasting, optimism, accuracy, judgment and decision making

In order to successfully navigate the present, we must frequently make predictions about our future performance or behavior. When deciding whether to register for a marathon, runners predict whether they will be able to stick to the necessary training schedule. When deciding whether to start guitar lessons, teenagers predict how long it will take before they are good enough to play in a garage band. When deciding whether to agree to review another journal article, we predict how long it will take us to finish the review already underway.

As a broad domain with many research questions worth pursuing, forecasting has been studied in many ways. In particular, psychologists have examined specific forecasting problems (e.g., the systematic underestimation of task completion times: Buehler, Griffin, & MacDonald, 1997), highlighted judgment contexts that influence accuracy (e.g., whether one is in the same emotional state that the forecasted context will evoke: Van Boven, Lowenstein, Welch, & Dunning, 2012), identified individual differences in forecasting patterns (e.g., depression: Alloy & Ahrens, 1987), and uncovered multiple motives influencing predictions (e.g., defensive pessimism: Norem & Cantor, 1986).

We introduce a more general model of how forecasts often unfold, thereby providing a unifying framework through which previous research can be understood and on which future research can be built. Our descriptive model rests on a simple assumption: Forecasting involves using what we know (*cues*) to make predictions (*forecasts*) about what we do not know (*outcomes*). Our salience-assessment-weighting (SAW) model outlines a three-step process by which forecasts are made and, in doing so, highlights pathways to both accuracy and error.

Consider the following illustrative example. Jake takes his daughter to the carnival, where she begs him to win her the giant teddy bear that hangs over the ring-toss game. Jake needs to forecast his ring-toss performance in order to decide whether to play or distract his daughter with cotton candy. What goes into this forecast? First, one or more dimensions that could be related to the outcome must be *salient*; perhaps a taunting sign reading "Don't get jittery fingers!" makes hand-eye coordination focal. Jake then must *assess* his standing on salient dimensions. Considering his experience as a high-school baseball player, he assesses his hand-eye coordination as

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excellent. Finally, he must decide how heavily to *weight* this forecasting cue. He estimates that ring-toss performance is almost completely determined by hand-eye coordination, which leaves him confident of his success.

Jake pays for three rings, tosses them, and misses each time. Continuing to feel that success is just a throw away, Jake plunks down bill after bill after bill. Eventually, Jake leaves with a dispirited daughter, a light wallet, and confusion about where his forecast went wrong. His mistake can be localized in one of the three SAW steps. First, although hand-eye coordination was a *salient* dimension, other diagnostic dimensions (e.g., nervousness, distance to the target) may never have come to mind. Second, even if hand-eye coordination was particularly diagnostic of ring-toss success, Jake may have assessed his own coordination more positively than was warranted. Third, even if Jake's hand-eye coordination was indeed as good as he thought, he may have overweighted this cue, failing to realize that it only weakly correlates with ring-toss success.

Salience

Just as scientists must think of an independent variable before they can hypothesize about how it predicts a dependent measure, forecasters lean on only a subset of dimensions—those that are salient—in formulating forecasts. In some cases, the prediction context makes specific dimensions focal. For example, the act of predicting future spending behavior tends to make savings goals spontaneously salient (Peetz & Buehler, 2009). Unfortunately, this cue is not particularly diagnostic, so unless more valid cues are made salient, these forecasts are doomed from the start. Dimensions can also be chronically salient for the forecaster. People with power tend to focus on their own ambitious goals rather than obstacles to them, which helps explain their optimistic planning forecasts (Weick & Guinote, 2010).

Empirically, there are two primary ways to determine whether salience (or lack of it) is responsible for forecasting biases. First, if merely drawing people's attention to a dimension improves their forecasts, this suggests that the dimension was not spontaneously salient. For example, in our own recent work (Critcher & Rosenzweig, 2014), participants who were asked to predict whether they would improve on an anagram task neglected to consider how much potential they had for future growth, as indicated by the fact that merely asking participants to consider this dimension improved their forecasts. A similar pattern can be seen with respect to the planning fallacy, a forecasting problem in which people consistently underestimate how long future tasks will take them to complete. Prompting participants to unpack the steps involved in a multifaceted task—in essence, making the subtasks salient—increases the accuracy of predictions about how long that task will take (Kruger & Evans, 2004). Note that if attention is drawn to a valid dimension and forecasts do not change, this does not rule out (lack of) salience as a cause of people's poor predictions. A dimension may not be salient initially, but even once attention is drawn to it, people may mistakenly give it no weight.

Second, researchers can use think-aloud protocols to determine what is salient during the forecasting process. For example, Gilovich, Kerr, and Medvec (1993) used a think-aloud protocol to understand why people made more optimistic forecasts when the performance they were predicting was further away in time. When asked to list factors that would influence task performance, participants in the distant condition tended to name factors that would facilitate success, whereas those in the near condition tended to list factors that would inhibit it. This difference in salience partially mediated the relationship between temporal distance and prediction optimism.

Assessment

Even if a valid (i.e., outcome-predictive) dimension is salient, people need to correctly assess their standing on that dimension before it can be used as a cue to guide accurate forecasting. In essence, they must determine what value to assign to their independent variable. Errors in assessment can emerge because people fail to accurately remember these cues (e.g., by misremembering their score on a previous exam), because their present perception of the cues is distorted (e.g., by seeing the basketball rim as wider than it actually is), or because they cannot forecast what the cue will be like at the time of performance (e.g., by failing to appreciate how nervous they will be when it comes time to perform).

People's memory for cues is not merely imperfect but also shows systematic errors. For example, people tend to underestimate how long it took them to complete a task in the past, which then biases their forecasts of their performance on similar tasks in the future (Roy & Christenfeld, 2007). But even cues that are observed in the present may still be read out or interpreted inaccurately (see Ross & Ward, 1996). For example, individuals who believed they were especially skilled at abstract reasoning felt they were solving abstract-reasoning test items more quickly even though they were not, a faulty assessment that ultimately influenced their forecasts of what score they would achieve (Critcher & Dunning, 2009).

Finally, people may be systematically misguided in assessing cues that will become available only in the future, closer to the time the forecasted outcome will be revealed. For example, forecasters often envision an unrealistically optimal performance context in which their own commitment to a task is high and situational distractions are low. When performance is imminent, it becomes clear that people have misassessed these cues (Armor & Sackett, 2006). Furthermore, some cues are difficult to assess before the heat of the moment. When forecasting from a cold, dispassionate present, it can be hard to imagine just how strong one's emotions will be at the time of future performance. Thus, people display an "illusion of courage," assuming that they will be more likely to perform potentially embarrassing feats (e.g., dancing in front of their class) than they ultimately are (Van Boven et al., 2012). Van Boven and colleagues found that letting people feel the debilitating sting of anxiety (and thus facilitating accurate assessment of the cue) while making forecasts helped them realize just how unlikely they would be to go through with the performance.

Weighting

Even if people are considering cues they assess accurately, they must know how to weight those cues—both in direction and strength—to arrive at accurate forecasts. In some cases, people believe that a cue is diagnostic when it is not (Peetz & Buehler, 2009; Taylor & Shepperd, 1998). For example, people lean on their level of anxiety as a cue in predicting the outcome of a medical test. Unfortunately, such anxiety is more a function of how soon they will receive the test results than it is of their true medical status (Taylor & Shepperd, 1998). In other cases, people believe that a dimension is not diagnostic when in fact it is. For example, the length of time it took students to complete a previous assignment is a strong predictor of how long it will take them to complete a similar one in the future. But in a study conducted by Buehler, Griffin, and Ross (1994), more than seven in eight students indicated that such information did not factor into their forecasts, even when their attention had just been drawn to this valid cue.

Although most misweighting involves over- or underestimating the influence of a dimension, in some extreme cases, people misestimate the *directional* influence of said dimension. For example, in estimating their likelihood of improving on a task, people lean on their own past performance as a positive predictor of improvement, when in fact it is a negative predictor (Critcher & Rosenzweig, 2014). Similarly, people think that the speed with which they solve test problems positively predicts their performance, even when it is a negative predictor (Critcher & Dunning, 2009). Although these directional errors may appear quite dramatic, we believe they ultimately may be the easiest to correct. It may be difficult to teach people that a dimension correlates with an outcome at .30 instead of .60, but it should be relatively easier to help them realize that high standing on a dimension portends relatively good, not bad, performance.

SAW: Additional Considerations

In considering the SAW model, questions naturally arise as to its descriptive accuracy and its scope. Our account depicts forecasters as intuitive statisticians constructing a regression model: identifying independent variables (salience), attributing a value to each (assessment), and assigning a beta weight to them (weighting). Although we believe that forecasting steps have to proceed in this sequence (e.g., how could one weight a cue that was not salient?), this does not mean that people consciously reflect on each step. Furthermore, it may also be the case that earlier steps influence later ones. For example, Moore and Healy (2008) have argued that we assess our own abilities with more confidence than we assess those of others. This differential confidence in part explains why we overweight self-knowledge when comparing ourselves to others. Similarly, the same factor can bias forecasting at different SAW steps. For instance, those low in self-control are known to be shortsighted, which might not only make them blind to some future impediments to their goal commitment (a salience failure) but also lead them to deemphasize the future impediments they do manage to identify (a weighting failure; Gottfredson & Hirschi, 1990).

We do not claim that the model applies to all forecasting efforts; rather, it applies to those situations in which people attempt to estimate the future by leaning on information from their present and past. This stands in contrast to forecasting in which people attempt to predict purely chance outcomes with known probabilities (Krizan & Windschitl, 2009) or predict the future by simulating it directly (Gilbert, Gill, & Wilson, 2002). For example, in estimating how they would *feel* if they won the lottery (an affective forecast), people may mentally simulate holding the winning ticket and use the feeling of exhilaration that simulation generates to inform their prediction. In other cases, people will simulate a possible outcome and judge its likelihood based on the metacognitive ease, sharpness, or fluency with which they can simulate it (Risen & Critcher, 2011). Of course, some forecasting problems may be solved either through reliance on past and present cues or through direct simulation of the future; for example, when Buehler and McFarland (2001) increased the salience of relevant past experiences, the extent to which people relied on direct simulation in affective forecasting was reduced. Determining when each of these two approaches to forecasting—SAW or simulation—is most likely to be used is itself a question for future research.

General Discussion

Now we turn to how the SAW model may guide more general questions of accuracy and error in forecasting, and in so doing lay out challenges for future research.

Chronic accessibility and individual differences

If salience exerts a systematic influence on forecasting, there are two obvious candidates for why certain dimensions are accessible in a particular forecasting context. In some cases, a forecasting problem makes a certain type of information salient for almost everyone (e.g., *heuristic* cues in judgment; Kahneman & Frederick, 2002). But in other circumstances, a particular type of information is chronically salient for most forecasters. For example, the self is typically future-oriented, with an ever-present eye to its own plans, goals, and intentions (Packard & Conway, 2006; Williams & Gilovich, 2008). These rich, forward-looking inner lives that are central to the self's own experience are largely hidden from view in considerations of others (Pronin, 2008). Thus, for others, we more naturally focus on what is observable—those environmental factors that can thwart one's good intentions (Buehler, Griffin, & Peetz, 2010).

There are also important individual differences in what is chronically accessible. For example, prevention-focused individuals and the chronically anxious may be pessimistic because they are always focusing on obstacles to success (Helweg-Larsen & Shepperd, 2001; Slovic & Peters, 2006). Additional research that links individual differences to the salience of specific dimensions will help us better predict not merely who will be optimistic or pessimistic but for which forecasting tasks such optimism or pessimism is most likely to be realized.

Achieving accuracy in assessments

In determining why people fail to accurately assess their standing on dimensions that are relevant to a forecasted outcome, it is tempting to blame lack of access to necessary information. Had Narcissus never discovered a pond, he would have had considerable trouble assessing his attractiveness. However, whereas a lack of information may be a barrier to assessment, too much of it may present its own problem. Given that we often make forecasts in contexts in which we have a vested interest in the outcome, having access to more information may more easily permit a motivated distortion of our summary assessment of it.

For example, people who were asked to choose the most representative photo of themselves out of a set of twelve tended to select an especially flattering picture, but did not display a similar bias when selecting for others (Williams & Gilovich, 2012). Thus, people were able to exploit the variability that is inherent in multiple data points to assess the self in a particularly flattering light, although social evidence—even when similarly plentiful—was assessed more impartially. Especially given the sheer volume of people's self-knowledge, future research should examine how people can apply impartial decision rules to help sidestep the influence of motivated reasoning on self-assessment. Until then, people may benefit from "phoning a friend" when forecasting their own futures.

Which weighting errors are most easily corrected?

Unlike errors in salience and assessment, errors in weighting are essentially errors in people's lay theories (about which dimensions predict which outcomes). As such, it may seem easiest to improve forecasts at this stage of the SAW model; correcting lay theories may be more tractable than requiring people to spontaneously attend to information they would not attend to otherwise, or to reinterpret information whose meaning had previously seemed clear. But before expending effort on interventions to remedy weighting errors, we would be wise to determine which type of errors will be most and least amenable to our efforts.

In the case of some weighting errors, people show evidence of understanding the appropriate weighting for a cue when forecasting *others*' outcomes, but lose this wisdom when forecasting for the self (Helzer & Dunning, 2012; Koehler, White, & John, 2011). For example, people recognize that situational factors, such as an e-mail reminder, will heavily influence how likely others are to give blood, but they do not similarly weight this factor when predicting for themselves (Koehler & Poon, 2006). At first glance, these situations might appear particularly amenable to debiasing, given that individuals have already displayed knowledge of a dimension's correct weight and now simply need to apply that knowledge to themselves. But instead of reflecting that people are half-way to accuracy, self–other differences may instead reflect an additional challenge to overcome—the intuition that the self is an exception to a rule. For example, it is difficult to embrace the idea that our own lofty goals and aspirations carry little predictive weight even if we easily understand the limited power of others' ambitions (Helzer & Dunning, 2012). Furthermore, attempts to correct forecasts in these contexts may require interventions that combat both cognitive errors and motivated reasoning. Thus, ironically, debiasing through education may be most achievable in contexts in which forecasters are wholly wrong, making the same errors for the self and others.

Conclusion

Finally, although currently the field is largely focused on forecasting errors, the SAW model may also be useful in illuminating forecasting accuracy. That is, domain-general markers of self-insight may be most obviously found in salience (are some people better able to call to mind a full set of relevant dimensions instead of focusing on a particularly salient one?), assessment (are some people better at distilling evidence than others?), or weighting (do people differ in their lay wisdom about what dimensions predict what outcomes?). Furthermore, our model provides a three-point "checklist" for those looking to design forecasting contexts that are most likely to yield accuracy. In conclusion, we believe that the SAW model serves as a useful taxonomy for categorizing forecast effects, a descriptive framework for considering the forecasting process in a domain-general way, and a guide for future researchers as they think about how forecasts can be led astray or improved.

Recommended Reading

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