Emotions in lay explanations of behavior

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Abstract

Humans use rich intuitive theories to explain other people's behavior. Previous work in lay psychology of behavior have tended to treat emotion as causing primarily unintentional behavior (e.g., being sad causes one to cry), neglecting how people incorporate emotions into explanations of rational, intentional actions. Here, we provide preliminary explorations into integrating emotions into a theory of folk psychology. Specifically, we show that in the lay theory, people are willing to endorse emotions as causes of intentional actions. Moreover, people readily attribute beliefs and desires as explanations for emotional expressions. This work provides a first step in elaborating people's rich understanding of emotions as an important component of intuitive social cognition.

Keywords: Intuitive Psychology, Emotions, Affective Cognition, Explanations

"... men in rage strike those that wish them best" — Iago (Shakespeare, trans. 1996, 2.3.205)

In his plays, the Bard of Avon makes masterful use of the layperson's understanding of emotion: in *Othello*, the audience is privy to Iago's deliberate manipulation of Othello's jealousy and rage, and can effortlessly predict Othello's murder of Desdemona before it happens. Consider the counterfactual scenario: would Othello still have killed Desdemona had he not been feeling those emotions? This seems unlikely; intuitively, emotions played a key, irreplaceable role in Othello's decision making process.

We have a rich intuitive understanding of others and their emotions (Ong, Zaki, & Goodman, 2015), and extend this reasoning to explain others' behavior. Reasoning about others' mental states and behaviors is often called folk, intuitive, or lay psychology (e.g., Heider, 1958; Malle, 2011). Many modern theories posit a "belief-desire psychology" (e.g., Bartsch & Wellman, 1995; Dennett, 1989; Gopnik & Meltzoff, 1997; Malle, 1999, 2011), in which an agent has a set of goals (often termed **desires**), and a set of ideas about the world that help them understand how to achieve those goals (often termed **beliefs**). The agent then forms an intention to act upon his beliefs to achieve his desires, resulting in **intentional action**. When laypeople are asked to explain an agent's behavior, they often appeal to both the beliefs and desires of the agent: "Sue went to the store at 3pm, because she wanted a drink, and she thinks that the store sells alcohol". **Unintentional behavior**, on the other hand, are often described as a result of **situational factors** via physical causality (or *impersonal causality*; Heider, 1958): "Sue slipped and fell because there was ice on the floor (not because she intended to)". This taxonomy[1] has proven fruitful in describing how laypeople explain behavior.

These models relegate emotions to the bin of other, situational causes—feeling sad simply makes one cry. There is an implicit assumption that emotion-driven behavior is unintentional, or otherwise "irrational". See Figure 1a for an illustration, where we specifically distinguish **Emotions** (e.g., sadness) from **Situational Factors** (e.g., the ground is icy). Additionally, although most theories do not differentiate **Emotional Expressions** (e.g., crying, laughing) from **Unintentional Behavior** (e.g., slipping on ice, snoring), we separate them in this model. This model is likely an insufficient description as it does not account for how lay people use emotions in causal explanations of intentional behavior, such as how an agent's emotional state might influence the formation of intentions. Returning to the example of Othello, we argue that even his (false) belief (that Desdemona cheated on him) and his desires (perhaps, to punish her) alone, without any rage, would not have led him to murder his wife.

How can we incorporate emotions into an intuitive psychology of behavior? In this paper, we seek to explore two questions. First, are intentional actions actually independent of emotions? It is worth noting that many scientific theories of emotion include both "automatic" and "intentional" behavior as a crucial part of their definitions of emotion. On one hand, emotions cause characteristic "automatic" behavioral responses like facial expressions and vocalizations (e.g., Ekman, 1992). On the other hand, emotions also bias agents towards certain types of actions via *action tendencies* (Frijda, Kuipers, & Ter Schure, 1989; Fontaine, Scherer, Roesch, & Ellsworth, 2007) or approach/avoid motivations (e.g., Carver & Scheier, 2004). For example, being in a state of happiness predisposes one towards helping others (Isen & Levin, 1972) and risk-taking (Isen & Patrick, 1983). Thus, emotions have already been incorporated into psychological (e.g., Schwarz, 2000), economic (e.g., Loewenstein & Lerner, 2003), and philosophical (e.g., Zhu & Thagard, 2002) theories of behavior, but they are still lacking from most theories of lay psychology. Consider Figure 1b, which posits an intuitive theory in which emotions directly influence the intentional decision making process—in the Discussion, we return to how exactly this influence might occur.

Second, in the intuitive theory, are emotion-caused actions—specifically, emotional expressions—independent of beliefs and desires? Intuitively, this seems unlikely. For one, emotional display rules dictate what expressions are

[1] There are also other explanations that people give for intentional actions, such as upstream events that result in beliefs or desires (Malle, 1999's "Causal History of Reasons") and events that facilitated but not instigated the action (often called Enabling Factors). We do not discuss them in this paper.

more appropriate in some contexts rather than other (e.g., Matsumoto, 1990). Display rules also subsume prosocial or politeness considerations: presumably, one might want to force a laugh at a boss' joke, or hide their joy from a recent promotion when comforting a friend who has just lost their dog. Alternatively, crocodile tears and other deliberately deceptive strategies (e.g., DePaulo et al., 2003) are a common, if distasteful, intentional use of emotional expressions as a means to obtain some desired outcome. Figure 1c illustrates this possibility by allowing an agent's beliefs and desires to influence their emotional expressions. Indeed, emotional expressions form an interesting category of behavior that does not fall neatly into the "Intentional" vs. "Unintentional" dichotomy, as there are clear examples of both. Under this model, beliefs and desires can impact expressions (thus, expressions do not fall into "Unintentional"), but at the same time are not required for expressions (thus, they do not fall into "Intentional" either). The place of emotional expressions in the lay theory deserves further attention, and Figure 1c provides one interpretation.

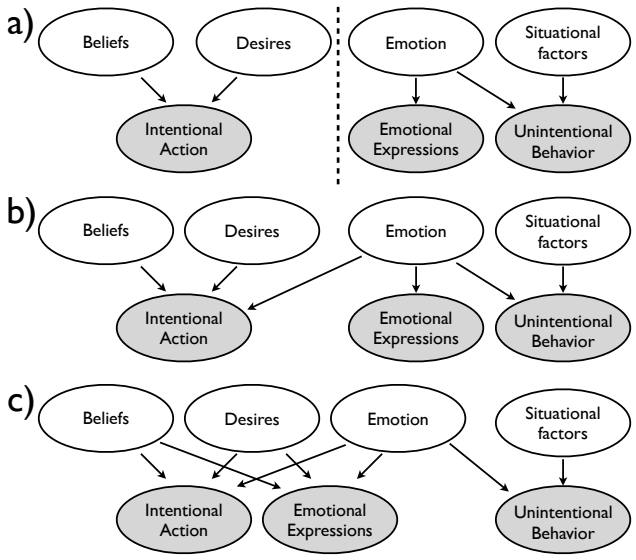

Figure 1: Possible lay theories of behavior. (a) Two distinct types of behavioral responses: Left, beliefs and desires influence an intentional decision-making process, resulting in intentional action; Right, unintentional behavior and emotional expressions are simply caused by situational factors and emotions, without the need for an agent's intentionality. (b) Emotions influence the intentional decision making process. (c) Beliefs and desires also influence emotional expressions.

In this paper we provide some preliminary explorations of how emotions are incorporated into intuitive belief-desire psychology, and specifically, how emotions are used or judged as explanations of intentional actions. The three possible models that we discussed in Fig. 1 each provides distinct, testable predictions. In Study 1, we study the types of actions that laypeople think emotions cause, and show that the top emotion-caused actions are judged to have been caused by emotions only about half of the time. In Study 2, we show that laypeople are willing to endorse emotions as causes of intentional actions. We also find that people are willing to endorse beliefs and desires as likely causes of emotional expressions (e.g., smiling), which have been treated as unintentional behavior in previous lay theories. This paper provides a first step in exploring how emotions are used by laypeople in explaining behavior, and we end by discussing future directions that are inspired by this research.

Study 1a: Emotions to Actions

In Study 1a, we asked participants to freely generate actions that would be likely caused by different emotions. We then obtained judgments of the counterfactual likelihood (i.e., how likely were the generated actions if the agent had not been feeling the given emotion). This allowed us to find the actions most likely to be "emotion expressions" (as described above) and to explore whether the emotions are causally necessary to bring about these actions (via the counterfactual judgments).[2]

Participants and Procedures. We recruited 100 participants (99% had English as their native language) through Amazon's Mechanical Turk (AMT). Participants saw statements of the form "Bob ____ because he was [**emotion**]", and were asked to give sentence completions. The presented **emotion** was one of: {happy, calm, angry, sad, surprised}[3]. On each page, participants saw one emotion, and gave 5 different completions (for a total of 25 completions). Emotions were presented in a random order; names were randomized on every sentence.

After participants had given completions to all 5 emotions, they were then presented with their answers, and asked to rate the likelihood of the counterfactual: "You wrote that '*Bob [cried] because he was [sad]*'. If Bob was not feeling [sad], would he still have [cried]?" Participants gave responses on a 7 point Likert scale from "Very Unlikely" to "Very Likely".

Results. Two coders (the first author and a naive coder) independently coded the free-responses into prototype actions, by removing adverbs and modifiers, and grouping by synonyms (e.g., "smiled", "smiled widely", and "beamed"). There was agreement on 99.6% of the responses; disagreements were resolved by consensus. The top 5 responses for each emotion is given in Table 1, and these 900 responses make up 36% of all responses. As expected, the majority of these modal responses would easily be judged to be emotional expressions: some notable exceptions are "killed himself", "punched the wall", "slept", and "sat down".

We turn next to the counterfactual rating task, to investigate

[2] All studies, data, and coding analyses are available at: https://github.com/desmond-ong/shakespeare/

[3] We chose a high-arousal positively valenced ("happy"), a low-arousal positively valenced ("calm"), a high-arousal negatively valenced ("angry"), a low-arousal negatively valenced ("sad"), and a high-arousal neutral valenced ("surprised") emotion.

Happy	**Calm**	**Sad**	**Anger**	**Surprised**
smiled: 73	relaxed: 52	cried: 97	"hit X": 69	jumped: 65
laughed: 52	slept: 46	frowned: 17	yelled: 56	laughed: 41
jumped: 42	sat down: 34	slept: 14	screamed: 27	screamed: 30
danced: 23	smiled: 26	killed himself: 13	cried: 16	yelled: 26
cried: 21	sighed: 10	yelled: 13	cursed: 14	smiled: 23

Table 1: Study 1a Results: Top 5 responses for each emotion (frequency counts in parentheses). The most common responses for anger were variants of "hit X", where X is an object or person (of these, the modal was: "punched the wall").

necessity of emotion for the elicited actions. First, we note that the mean counterfactual ratings (i.e., how likely is the action to occur if the emotion was absent, $P(A|\neg E)$) for the modal responses (M(SD)=3.08(1.92)) was significantly lower than that of the non-modal responses (M(SD)=3.32(1.85); t=3.14, $p < .001$): people judged the modal responses to be less likely to occur in the absence of the emotion, than the non-modal actions. Additionally, we hypothesized that the more often a particular action a is generated *across all participants* for emotion e, the more *necessary* is emotion e for action a to occur. To test this, we regressed participants' counterfactual likelihood ratings against the frequency of that action being generated across the sample, with random intercepts by participant and emotion. We find that, across all emotions, the more frequently an action is generated by all participants, the less likely participants rate it to occur in the absence of the corresponding emotion ($b = -0.0083, 95\%$ CI : $[-0.0106, -0.0060], t = -7.15, p <$ 0.001; See Fig. 2). Thus, in participants' lay theories, the corresponding emotions are more necessary for these modal actions to occur: we shall use this result in Study 1b.

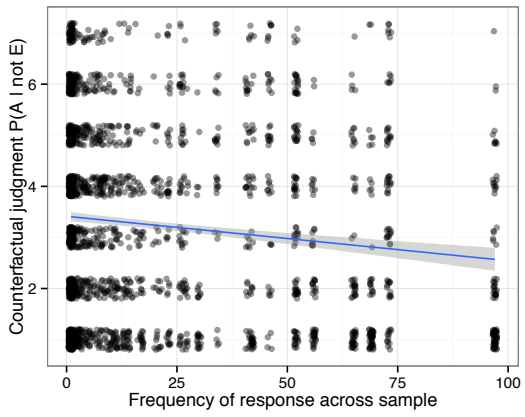

Figure 2: Study 1a Results. Individual counterfactual likelihood ratings ($P(A|\neg E)$) against frequency of an action's generation across the sample. Data points are slightly transparent and jittered for clarity.

Study 1b: Causes of Actions

In Study 1b, we recruited a separate group of participants to give explanations for the modal actions generated from Study 1a. This allows us to explore the sufficiency of emotions to cause the actions elicited above, and to test among causal models of "emotional expressions." If Model 1 (Fig. 1a) is correct then in Study 1b we should only find explanations due to emotions (and perhaps, situational factors), and not explanations that appeal to beliefs or desires.

Participants and Procedures. We recruited 100 participants through AMT (98% had English as their native language). Participants saw statements of the form "Bob [**action**] because ____", and were asked to complete the sentence. The presented **action** was one of the fifteen actions drawn from the most popular responses from Study 1a (the 15 unique actions in Table 1, with "punched the wall" used in place of "hit X"). Participants saw the actions in a random order and gave 1 completion per action.

Results. Two coders coded the free-response completion into one of five categories. The two main categories of interest are: (a) "**Emotion**" (if the explanation was due to an explicitly mentioned emotion), and (b) "**Cause of Emotion**" (if there was a mention of an event that is very likely to cause an emotion, e.g., "his dog died"). We explicitly added a category of coding for Causes of Emotion, because laypeople often give events that caused emotions as explanations for emotional displays. For example, if someone asks, "why is he crying?", "because he is sad" is a somewhat unsatisfying explanation (because presumably, laypeople find it obvious), as compared to, "because his dog died (and hence he is sad)". We also coded for (c) "**Physical state**" (if the explanation referenced a physical state like tiredness or pain), (d) "**Mental state**" (if the explanation referenced a desire or a belief); (e) "**Situation**" (for other situation factors that does not cause emotions). The two coders achieved a high agreement (Cohen's $\kappa = 0.935$ over 1500 responses), and the responses with disagreements were discarded $(< 5\%)$.

The distribution of coded free-responses is given in Figure 3. If the actions generated from Study 1a were characteristic of those emotions, and if they could only have been caused by emotions (i.e., Fig. 1a), then we should expect the vast majority of the explanations to be due to emotions or to upstream causes of emotions. However, we see that in fact, only 40.0% of explanations appeal to an Emotion, and 50.1% appeal to either an Emotion or to a Cause of an Emotion. There are many references to Physical states (e.g. physical pain as a cause for "cursing" or "yelling"; fatigue as a cause of "sat down" or "slept"), or to Mental states (e.g. a belief or a desire). Thus, it seems very likely that lay people's judgments of emotion-caused actions are not, in fact, predominantly caused only by emotions. The results of Studies 1a-b provides some preliminary support for the model in Figure 1c, which does not distinguish intention-caused from emotion-caused actions. We test this model more precisely in Study 2.

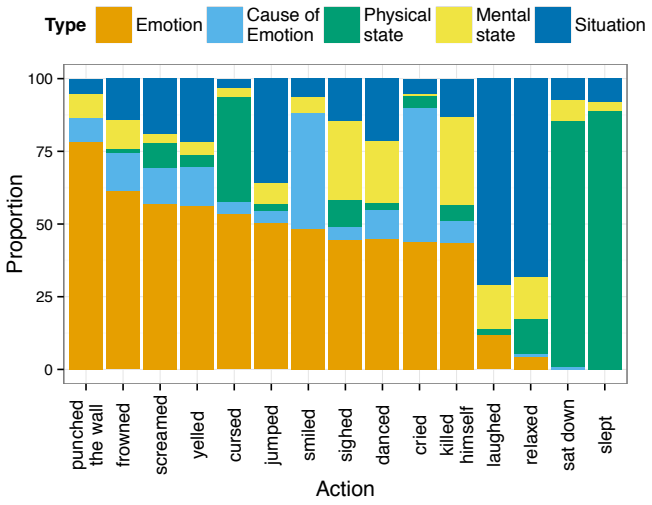

Figure 3: Study 1b Results: Distribution of explanation types.

Study 2: Rating explanations for actions

In order to further test the models in Figure 1, we explored a broader set of actions in Study 2. We chose a set comprising Intentional Actions, Emotional Expressions, and Unintentional Behavior, and asked participants to rate how likely it was that each action was caused by Belief, Desire, Emotion, and Situational Factor explanations[4]. First, we aimed to determine if people judge emotions as suitable explanations for intentional behavior. Second, we aimed to confirm the finding from Study 1 that people will judge beliefs and desires as suitable explanations for emotional expressions. Specifically, we would predict, under the model in Figure 1c, that for Intentional Actions, beliefs and desires will be rated as the most likely causes, and emotion ratings will be in the middle. For Emotional Expressions, emotion explanations will be rated as the most likely causes, while ratings of beliefs and desires will be endorsed to a small extent. For Unintentional Behavior, we predict high ratings for situational factor causes and low endorsements for other types.

Stimuli Selection. We selected a set of 20 actions, comprising a mix of 6 intentional actions, 6 emotional expressions, 5 unintentional behaviors, and 3 ambiguous behaviors. The full set is given in Fig. 4. Of the 6 intentional actions, we chose 3 ("stole a pound of peaches"; "invited Sue to have lunch"; "watered his new plants") from Malle (1999)'s study as they were previously rated as highly intentional.We chose 6 emotional expressions from the modal responses of Study 1a. We used two unintentional behaviors ("yawned during a lecture", "won the lottery") from Malle (1999), as they were rated as being low on intentionality. Finally, we chose 3 "ambiguous" behaviors ("interrupted his mother"; "ignored Greg's arguments"; "drove above the speed limit") from Malle (1999), which had been rated by some participants as being intentional, and others as being unintentional. We predicted that ambiguous behaviors would elicit uniform endorsements across all explanation types.

Participants and Procedures. We recruited 100 participants through AMT (98% had English as their native language; 1% did not report). First, participants were told about different types of explanations, with examples of each. (1) People have **thoughts** or beliefs about the way the world is that make them behave so ("Bob moved to Iowa because he **thinks** people are nice there"); (2) People feel certain **Emotions** that make them behave so, ("Bob ran away because he was **feeling** scared"); (3) People behave that way to achieve certain **Aims** ("Bob kicked the ball because he **wanted to** win the game"); and (4) People behave that way because of the **Situation** ("Bob shivered because it was cold outside").

Next, participants saw statements of the form "Bob [**action**] because ...", and descriptions of four explanation types: ("... he was motivated by some thoughts or beliefs about the way the world is"; "... he felt some emotions"; "... he wanted to achieve some aims of his"; "of some situational causes"). They then used continuous, 100 point sliders to rate how likely it was that the behavior was caused by each type of cause, from "Not at all likely" to "Extremely likely". Participants completed the 20 actions in a random order.

Results. We used k-means clustering to cluster participants' responses into specific "explanation profiles". We took each participant's response to each item as a 4-dimensional vector corresponding to the 4 ratings they gave (belief, desire, emotion, situation). Although we had an *a priori* prediction that there would be $k = 4$ clusters, we ran bootstrap clustering stability analyses (Hennig, 2007) that revealed that solutions with 5 or more clusters were unstable across nonparametric resampling. Further analyses confirmed that $k = 4$ was the maximal stable solution. Indeed, when we inspect the centroids of the 4 clusters, shown in Figure 4 (left column), we confirmed that the stable cluster solutions correspond to our predicted explanation profiles.

The 4 cluster profiles look similar to what we predicted: an Intentional profile (b=26.7, d=79.5, e=20.0, s=38.7) predominantly driven by Desire ratings, an Emotion Expressions profile (23.6, 20.5, 83.8, 56.1) predominantly driven by Emotions, an Unintentional profile (4.8, 6.9, 7.2, 87.7) driven by Situation causes , and an Ambiguous profile (57.1, 63.6, 66.6, 61.1) resulting from uniform ratings across all explanation types. First, we note that the Intentional profile seems to be driven primarily by only Desire, and that Belief seems to be only weakly associated with it. Second, we note that there is a significant amount of rating of Emotions in the profile for Intentional Actions, with an average of e=20.0 points on a 100 point scale (just slightly behind Beliefs at b=26.7). We also note that there is a significant amount of Beliefs (23.6) and Desires (20.5) in the Expressions profile; confirming both

[4]Although the three models do not differentiate between the causes of Unintentional Behavior, we included Unintentional Behavior and Situational Factors in order to calibrate against baseline predictions that all three models should make.

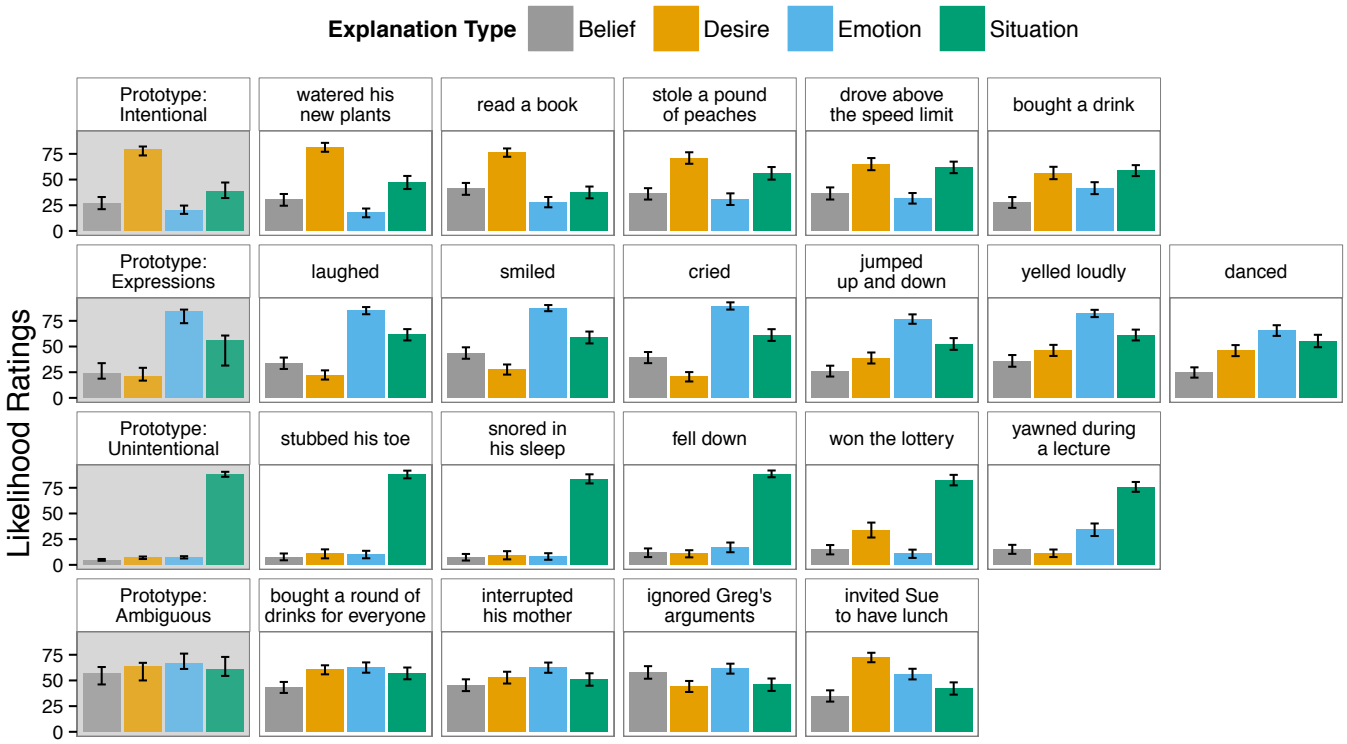

Figure 4: Study 2 Results. Mean ratings, with 95% confidence intervals (CIs), of how likely each explanation type was to have caused the action. Left most column: cluster prototypes from clustering analyses, with CIs obtained from 100 bootstraps.

our hypotheses. The Ambiguous profile is an interesting case that result from variations in participants' appraisal. Some participants may judge a given action as Intentional; others, Unintentional; and yet others, as Expressions.

Participants' ratings for the causes of different actions are shown in Figure 4. In each row, we show the actions that were assigned to the prototype cluster shown on the left. While the unsupervised clustering results for the Expressions and Unintentional Behavior matched our a priori predictions exactly, we note that there were a few actions that were not classified according to our initial hypothesized groupings. Importantly, "drove above the speed limit", fit more closely with the Intentional profile than the Ambiguous profile, while "bought a round of drinks for everyone", and "invited Sue to have lunch", more closely resembled the Ambiguous profile than the Intentional profile. Finally, we visualized the explanation profiles using multidimensional scaling and projecting down to a two-dimensional plot (Fig. 5). In this visualization, we see that the Intentional, Ambiguous, and Expressions clusters seem to fall along a spectrum, suggesting some structure in a higher-dimensional semantic space that future work should verify and explore.

Figure 5: Visualization of explanation profiles via multidimensional scaling. Cluster centroids are marked with dots.

Discussion

Laypeople have rich intuitive theories of emotion that they use to explain many types of behavior, although emotion has been neglected in work on intuitive theories. Using both an unstructured free-response, sentence completion task (Study 1a/1b) and a more structured explanation rating task (Study 2), we show that people judge beliefs and desires to be explanations of emotional expressions and endorse emotions as causes of intentional actions. Our results suggest the need to expand the belief-desire model of lay psychology to appropriately capture how people make sense of emotion-driven and

emotion-influenced actions.

Measuring lay theories is difficult, as one must elicit participants' judgments without imposing too much of the researcher's own bias. We tried to mitigate this by using two approaches, but limitations remain. The space of emotions and the space of actions (intentional, emotional expressions, and unintentional) are both large; by focusing on a small set of emotions and actions, we risk the chance of conclusions being driven by idiosyncratic emotion or action choices. We elicited a wide variety of actions in Study 1a, but had to focus on modal responses for analysis; some of the modal actions that we observed (e.g., "punched the wall") may be driven by cultural stereotypes. The approach we employed in Study 2 allowed us to examine what types of explanation profiles people attribute to a set of actions, but again, the set of actions was necessarily restricted. Future work should aim to achieve a more unbiased sampling of actions. Extending the approaches taken here to may lead to new and more precise ways to measure lay theories.

Many questions remain about how emotions affect intentional actions in the lay theory. Borrowing ideas from affective science, emotions might impact an agent's beliefs, by affecting their subjective judgments of probability (Wright & Bower, 1992) or influencing the processing of novel information (Forgas, 1995). Alternatively, emotions might influence desires, by introducing new goals via approach/avoid motivations (Carver & Scheier, 2004), or by introducing emotional states as regulatory goals in and of themselves (Gross, Richards, & John, 2006). Finally, emotions might have a direct impact on intentional action that is independent of beliefs and desires; this possibility might be needed for lay explanations of "rash" decisions (such as crimes of passion, like Othello). Any of these causal pathways may be part of the lay theory of psychology—or none of them.

We have focused on lay explanations of behavior, especially those that go beyond beliefs and desires. This work builds towards a larger research program on how humans use rich intuitive theories of emotion to reason about others—what we call Affective Cognition (Ong et al., 2015). These intuitive theories have broad and wide-reaching impact on all forms of social cognition, from understanding family, friends and colleagues, to making attributions in moral and legal judgments. And of course, they help us enjoy a little theatre.

Acknowledgments

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