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(In)consistency in the eye of the beholder: The roles of warmth, competence, and valence in lay perceptions of inconsistency☆

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ABSTRACT

Although perceived inconsistencies play a central role in how people understand the world, research on impression formation has largely neglected lay perceptions of inconsistency. The current research seeks to address this gap by investigating perceived inconsistencies between positive and negative information along the dimensions of warmth and competence. Using a memory-based measure of surprise, three studies found an expectancy-violation effect for behaviors that were incongruent with the valence of prior information. This effect generalized across warmth and competence, indicating that prior information along one dimension led to valence-congruent expectations along the other dimension. There was no evidence for valence asymmetries in expectancy-violations regardless of whether the impression dimension involved warmth or competence. A fourth study replicated these findings using a self-report measure of perceived inconsistency. Implications for research on person perception, attitudes, and cognitive consistency are discussed.

Inconsistencies between cognitions play a central role in how people understand the world by signaling potential errors in one's belief system that need to be resolved (Gawronski, 2012; Gawronski & Brannon, in press). The importance of cognitive consistency for understanding the world is demonstrated by the array of behaviors that follow perceptions of inconsistency. For example, perceived inconsistencies motivate exploration and learning in infants (Stahl & Feigenson, 2015), increased endorsement of ideological beliefs (Kay, Gaucher, Napier, Callan, & Laurin, 2008), and other compensatory and palliative responses (Proulx & Inzlicht, 2012), and their resolution has been dubbed by many as an important, and in some cases master, motivation (Gawronski & Strack, 2012; Harmon-Jones, Amodio, & Harmon-Jones, 2009; Heine, Proulx, & Vohs, 2006; Van den Bos, 2009).

Given the demonstrated importance of perceived inconsistency, it is surprising that previous research has largely neglected lay perceptions of inconsistency (see Johnson-Laird, Girotto, & Legrenzi, 2004, for a notable exception). This gap is particularly evident in the study of person perception, a topic that fundamentally implicates inconsistency. Although a significant amount of effort has been devoted to understanding how inconsistent information is integrated into the mental representation of an impression target (Roese & Sherman, 2007), no research has investigated actual perceptions of inconsistency between first impressions and new information. To compensate for this gap, researchers have typically used their own assumptions regarding inconsistencies to determine what qualifies as inconsistent information in their studies. Yet, an important foundation for understanding how people effectively deal with inconsistencies between their expectations and novel information is understanding what people actually perceive as inconsistent in their perceptions of others (see Gawronski & Brannon, in press).

The goal of the current research is to provide insights into lay perceptions of inconsistency in impression formation. Through a memory-based measure of expectancy-violation and direct questions tapping into perceived inconsistency, the current studies aim to understand which combinations of information people perceive as inconsistent rather than how they subsequently deal with inconsistencies (see Sherman, Allen, & Sacchi, 2012, for a review of research on the latter question). In doing so, we focus on two themes that have been at the center of the impression formation literature for decades: the dimensions of warmth and competence and the asymmetrical impact of negative versus positive information. By measuring perceptions of inconsistencies before they are resolved, the current studies allow us to test conflicting predictions regarding the roles of warmth and competence, as well as positive versus negative information, in lay conceptions of inconsistency.

Given the dearth of empirical findings and theoretical accounts addressing this question, we relied on theories regarding the integration of information into new impressions to guide our study designs and

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analyses. Below, we review extant literature on impression formation and discuss the implications of different theoretical accounts for potential interactions between warmth, competence, and valence in lay perceptions of inconsistency.

1. Impressions of warmth and competence

Since Solomon Asch's (1946) seminal work on impression formation, there has been a vast amount of research suggesting that warmth and competence are the two primary dimensions that underlie social judgments (see Cuddy, Fiske, & Glick, 2008, for a review). Based on previous findings in research on impression formation, three potential hypotheses can be derived regarding how warmth and competence may interact in lay perceptions of inconsistency.

According to the stereotype content model (SCM), perceptions of warmth and competence are orthogonal to one another, and categorizations of different groups may fall into one of four quadrants (Fiske, Cuddy, & Glick, 2006; Fiske, Cuddy, Glick, & Xu, 2002). Thus, a person may be perceived as high on both traits, low on both traits, or high on one and low on the other. The assumed orthogonality between warmth and competence suggests that information regarding one dimension tells a perceiver nothing about an impression target's traits along the other dimension. Thus, having an impression of a target as competent does not involve any expectation about the same target's degree of warmth, and vice versa. According to this hypothesis, inconsistency is perceived only within a given dimension, but not across the two dimensions.

Other researchers suggest that warmth and competence are not perceived as orthogonal constructs but rather as mutually informative dimensions (Judd, James-Hawkins, Yzerbyt, & Kashima, 2005). When forming impressions about individuals, people tend to view warmth and competence as positively related (Judd et al., 2005; Rosenberg, Nelson, & Vivenkananthan, 1968). That is, people assume that those who are high on one dimension are also high on the other. People also tend to assume a positive relation between warmth and competence when forming impressions of in-group members (Fiske et al., 2002). Yet, when forming comparative impressions of groups, the two dimensions are perceived as negatively related, a phenomenon known as the compensation effect (Kervyn, Judd, & Yzerbyt, 2009; Kervyn, Yzerbyt, & Judd, 2010, 2011). According to this research, a target group that is perceived as high on either warmth or competence tends to be judged as low on the other dimension, and ratings on the low dimension tend to be lower than those for the comparison group along the same dimension (Judd et al., 2005). Additionally, learning that one group is high on either warmth or competence leads the other group to be judged as high on the other dimension (Kervyn et al., 2010).

Whether the two dimensions are viewed as positively or negatively related, their assumed relation to one another (as opposed to their assumed orthogonality) suggests that information about one dimension may be perceived as inconsistent with prior impressions regarding the other dimension. If, for example, warmth and competence are viewed as negatively related, learning that a person performed positive (negative) actions along one dimension would be perceived as inconsistent with a positive (negative) impression of that person along the other dimension. In contrast, a positive relation between the two dimensions would breed a perception of inconsistency if positive information about one dimension followed a negative impression along the other dimension, and vice versa. According to this perspective, inconsistency is perceived not only within a given dimension, but also across the two dimensions, and the nature of their conflicting combinations depends on the assumed relation between the two.

2. Negativity bias

In addition to information about warmth and competence, information about others may vary in valence. Research on impression formation revealed a tendency for people to assign more weight to negative information than positive information (e.g., Anderson, 1965). This negativity bias is one of the most pervasive phenomena in social psychology and is especially well established in the impression formation literature (see Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Peeters & Czapinski, 1990; Rozin & Royzman, 2001, for reviews). In the context of impression formation, the negativity bias suggests that negative information about others is used to inform inferences about their personalities to a greater extent than positive information (Kanouse & Hanson, 1972; see Skowronski & Carlston, 1989, for a review). Additionally, Rothbart and Park (1986) showed that initial positive impressions require fewer negative observations to be reversed as compared to initial negative impressions, which tend to be more difficult to change. Although there is wide consensus regarding the occurrence of a negativity bias, several competing theories have been proposed to explain why it occurs. These theories do not explicitly address asymmetries in the perceived inconsistency between positive and negative information, but their assumptions can be used to derive competing predictions on this question.

According to range theories, negative behaviors are perceived to be associated with a smaller number of possible traits than positive behaviors. This asymmetry allows for greater certainty of trait inferences from negative behaviors. The assumption that negative behaviors allow for greater certainty of trait inferences than positive information precludes positive information from having an equal or greater influence on impression formation. Thus, a potential prediction that could be derived from range theories is that new negative information may be perceived as more inconsistent with an initial positive impression than the reverse, and this asymmetry should hold under all circumstances.

Other theories, although they still assume the dominance of negative information, do not preclude an equal or greater influence of positive information. Relying on the assumption that most people have positive worldviews, expectancy-contrast theories assume that negative information receives special attention during encoding because it stands out from the generally positive background against which it is compared (Helson, 1964; Sherif & Sherif, 1967; Skowronski & Carlston, 1989). Similarly, frequency-weight theories suggest that negative information is given more weight because it violates the generally positive expectations people tend to have and is thus assumed to be more diagnostic of a person's true traits (Skowronski & Carlston, 1989). In both cases, the prevalence of positive expectancies makes negative behaviors stand out, which increases their impact on impressions. Yet, to the extent that people have negative expectancies, positive behaviors should stand out and therefore have a stronger influence on impressions. Thus, expectancy-contrast and frequency-weight theories do not preclude a positivity bias; rather, they suggest that negativity bias is the default outcome because people are assumed to have generally positive views of the world. A potential prediction that could be derived from these theories is that negative and positive information may be perceived as equally inconsistent with impressions of the opposite valence, provided that the impressions involve expectancies of equal strength.

Finally, it is possible that the influence of positive and negative valence on perceived inconsistency depends on the trait dimension. Previous research suggests that negative information is perceived to be more diagnostic of traits related to warmth, whereas positive information is perceived to be more diagnostic of competence (Reeder & Brewer, 1979; Skowronski & Carlston, 1987, 1989). For example, immoral behaviors may be more indicative of corresponding negative traits along the warmth dimension because people tend to assume that only immoral people perform immoral actions. Moral actions, on the other hand, are assumed to be performed by both moral as well as immoral people. Along the competence dimension, the converse is true. Because people assume that circumstantial

influences cannot cause an incompetent person to perform competently, positive information is seen as more diagnostic on the competence dimension. Thus, negative information should be weighted more when forming warmth impressions, but positive information should be weighted more when forming competence impressions. This conclusion suggests that perceptions of inconsistency may depend on an interaction between valence and dimension. Specifically, new positive information about someone's competence may be seen as more inconsistent with an initial negative impression of that person's competence compared with the perceived inconsistency between new negative information and an initial positive impression regarding a person's competence. Conversely, new negative information about an individual's warmth may be perceived as more inconsistent with an initial positive impression of that person's warmth compared with the perceived inconsistency between new positive information and an initial negative impression regarding a person's warmth.

3. The current research

Although previous research has provided valuable insights into how people deal with inconsistencies between their expectancies and novel information (Sherman et al., 2012), no research has investigated what people actually perceive as inconsistent in their impressions of others. The main goal of the current research was to address this gap in the literature, focusing particularly on perceptions of warmth and competence as well as the impact of positive versus negative information. By using a paradigm that captures perceived inconsistencies before they are resolved, the current studies not only contribute to our understanding of lay perceptions of inconsistency; they also provide deeper insights into the perceived relation between warmth and competence as well as valence asymmetries in expectancy-violation.[1]

4. Experiment 1

Experiment 1 investigated lay perceptions of inconsistency in impression formation using a measure of expectancy-violation adapted from Gawronski et al. (2014). Participants viewed 30 behavioral statements about a target individual that were presented one-by-one against different background colors. The initial 20 statements suggested either a positive or a negative trait along either the warmth or competence dimension. The 21st statement was used as a target statement and described a behavior suggesting either high warmth, low warmth, high competence, or low competence. The target statement was followed by 9 distracter statements that matched the dimension and valence of the initial 20 statements. Participants' task was to form an impression of the target individual. After the impression formation task, participants completed a surprise recognition test, in which they had to identify the background color against which the target statement was presented during the impression formation task. The basic idea underlying this paradigm is that expectancy-violations resulting from perceived inconsistency between the initial impression and the target statement enhance attention, which should improve participants' memory for the incidental background color (see also Cacioppo, Crites, Berntson, & Coles, 1993; Noordewier & Breugelmans, 2013; Topolinski & Strack, 2015). Based on these considerations, memory for the background color of a given target statement as a function of initial impressions was used as an indicator of perceived inconsistency between the initial impression and the target statement, either one of which included either positive or negative information along either the warmth or the competence dimension.

4.1. Method

4.1.1. Participants and design

Participants were recruited via Amazon's Mechanical Turk (MTurk) service (see Buhrmester, Kwang, & Gosling, 2011) to complete a "psychological study on how people form impressions of other people." Eligibility for participation was limited to MTurk workers who had a HIT approval rate of at least 95% at the time of the study. Of the 749 MTurk workers who initially signed up for the study, a total of 640 participants (268 women, 372 men; M_{age} = 29.50 years, SD_{age} = 13.50 years) completed the study until the end and are included in the analyses. One participant failed an instructional attention check (see Oppenheimer, Meyvis, & Davidenko, 2009) and four participants indicated that they suffered from some form of color-blindness. Because excluding these participants did not alter the pattern of results, they were retained in the following analyses. In exchange for their participation, participants received $0.50. Participants were randomly assigned to one of sixteen conditions in a 2 (Impression Valence: positive vs. negative) × 2 2 (Impression Dimension: warmth vs. competence) × 2 (Target Valence: positive vs. negative) × 2 (Target Dimension: warmth vs. competence) between-subjects design. Data were collected using the online survey platform Qualtrics. The study took approximately 10 minutes to complete.

4.1.2. Impression formation task

Participants were instructed to form an impression of a target individual, Bob, based on behavioral descriptions. Each participant viewed 30 statements about the individual in the following order: 20 impression formation statements, 1 target statement, and 9 filler statements. The impression formation statements were either positive or negative and depicted information about either Bob's warmth or his competence. The target statement varied similarly across conditions, including either positive or negative information along either the warmth or competence dimension. The 9 distracter statements matched the valence and dimension of the 20 impression formation statements. The statements were selected such that that they had either high or low pretest scores on one of the two dimensions, and scores that were relatively neutral on the respective other dimension (see Supplementary Materials).[2] Each of the 30 statements was presented together with a picture of the target individual against 1 of 10 different background colors (each color being presented 3 times), with the target statement being presented against a blue background in all conditions. Each screen was presented for 5 seconds, with the next screen appearing immediately afterwards.

4.1.3. Background recognition task

Participants then completed a surprise recognition test in which they were asked to identify the background color against which a given statement was presented. The recognition test included seven

[1] For all studies reported in this article, we report all measures, all conditions, and all data exclusions. The data for each study were collected in one shot without intermittent statistical analyses. Based on previous studies in our lab using the same paradigms, the predetermined sample size for each study was set to 640 participants. Based on the average effect sizes for mean level differences in earlier research using the same expectancy-violation paradigm (Gawronski, Ye, Rydell, & De Houwer, 2014), a sample size of 640 participants provides a power of 0.998 to detect an expectancy-violation effect for the violation of positive expectancies within the two dimensions and a power of 0.964 to detect an expectancy-violation effect for the violation of negative expectancies. All materials, data, and analysis files are available at https://osf.io/8vmsa/.

[2] The statements used in our experiments were taken from a list of statements that were pretested for perceived kindness and perceived intelligence (Fuhrman, Bodenhausen, & Lichtenstein, 1989). After narrowing down statements from this list, we pre-tested the statements on MTurk to confirm their reflections of warmth and competence for the population used in our studies. In one study, we asked 100 MTurk workers to rate the level of warmth displayed by each statement, and in another study, we asked 100 MTurk workers to rate the level of competence displayed by each statement. The statements and the pre-test data are provided in the Supplementary Materials.

statements which were presented one-by-one in the following order: 3 statements that were randomly selected from the impression and filler statements, the target statement, and, finally, 3 more randomly selected impression statements.[3] The statements were presented at the bottom of the screen; small squares of the 10 background colors from the impression formation task were presented at the top of the screen together with numbers from 0 to 9 below each square. Participants were asked to identify the correct background color in a multiple choice list. Based on previous findings by Gawronski et al. (2014), exposure to expectancy-violating information was assumed to increase attention in the impression formation task, which should improve recognition memory for the background colors in the surprise recognition test. Thus, differential recognition memory for the background color of a given target statement as a function of initial impressions served as an indicator of whether the target statement was perceived as congruent or incongruent with the initially formed impression.

4.1.4. Attention check measure

In response to ongoing debates surrounding the attentiveness of MTurk workers (see Hauser & Schwarz, 2016, for a review), we included a brief attention check measure for cautionary purposes. To ensure that participants were not simple randomly selecting answers, participants responded to the question *On a clear day, what color is the sky?* by choosing one option from a multiple choice list including *pink*, *blue*, *purple*, and *green*. This question appeared immediately after the background recognition task.

4.2. Results

4.2.1. General analysis

Data were analyzed using binary logistic regression. All 4 variables (Impression Valence, Impression Dimension, Target Valence, Target Dimension) were dummy coded and entered into a block-wise model, with each level of interactions entered into a different block. Because SPSS, the software used to analyze the data, provides an accurate estimation for only the highest order interaction in each block (J. G. Hixon, personal communication, February 18, 2015),[4] the statistical significance of the highest order interaction (i.e., four-way interaction) was assessed in the fourth block, the statistical significance of the second highest order interactions (i.e., three-way interactions) was assessed in the third block, etc. In all of the following analyses, a mean accuracy rate of .10 indicates chance responding.

With all four variables in the model, the two-way interaction between Impression Valence and Target Valence was the only significant interaction, $B = 1.98$, $SE = 0.43$, Wald $Z = 21.56$, $p < .001$, $OR = 0.14$ (see Fig. 1).[5] This interaction indicated that the background color of the target statement was better remembered when a negative target statement followed positive impression statements ($M = .25$, 95% CI [.19, .31]) than when a negative target statement followed negative impression statements ($M = .11$, 95% CI [.04, .17]). Conversely, the recognition rate for the background color was higher when a positive target statement followed negative impression statements ($M = .31$, 95% CI [.25, .37]) than when a positive target statement followed positive impression statements ($M = .15$, 95% CI [.09, .21]). The two-way interaction between Impression Valence and Target Valence was not qualified by any higher-order interactions (all Wald Zs < 1.39, all ps > .112, OR for largest non-significant effect = 3.30).

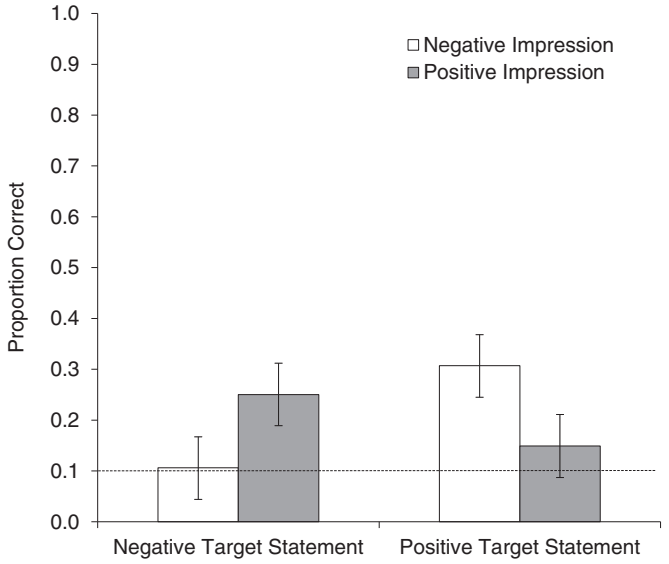

Fig. 1. Mean proportions of correct background recognition as a function of target statement valence and initial impression valence, Experiment 1. Dotted line represents chance responding. Error bars represent 95% confidence intervals.

4.2.2. Relationship between warmth and competence

The finding that the dimensions of the target and impression statements did not qualify the two-way interaction of Target Valence and Impression Valence provides preliminary evidence for the hypothesis that warmth and competence are positively related in lay perceptions of inconsistency. That is, a positive (negative) impression is perceived as inconsistent with new negative (positive) information irrespective of whether they match or mismatch with regard to their dimension. To provide a more stringent test of this hypothesis, we recoded Impression Dimension and Target Dimension into a single factor reflecting the dimensional match between impression and target statements. Correspondingly, Impression Valence and Target Valence were recoded into a single factor reflecting the valence congruence between impression and target statements. The data were then submitted to a binary logistic regression using Dimensional Match (match vs. mismatch) and Valence Congruence (congruent vs. incongruent) as dummy-coded predictors.

Perceived orthogonality of the warmth and competence dimension would be demonstrated by a significant interaction of the two factors, such that incongruent valence between target and impression statements should be associated with higher recognition rates than congruent valence when the impression and target statements were from matching dimensions. In contrast, when target statements and impression statements were from mismatching dimensions, recognition rates for congruent and incongruent valence between target and impression statements should not deviate from one another. This pattern would indicate that impressions of warmth or competence set up expectations along the same dimension, but not regarding the other dimension.

A positive relationship between the two dimensions would be indicated by a significant main effect of Valence Congruence regardless of whether impression and target statements were from matching or mismatching dimensions. That is, incongruent valence should be associated with higher recognition rates than congruent valence for both matching and mismatching dimensions. A significant recognition advantage for incongruent over congruent valence in the mismatching

[3] The analyses presented in the main text use responses on the target item only. The main conclusions did not differ when controlling for baseline memory on the non-target recognition items. For analyses controlling for memory on the non-target recognition items, see the Supplementary Materials.

[4] As with ordinary least squares regressions, it is necessary to remove higher-order interactions from the model in order to get accurate estimates of main effects or lower-order interactions. Higher-order interactions in both OLS and logistic regression models (1) use additional degrees of freedom and (2) change the beta estimates of main effects such that they no longer represent the change in the mean response per unit increase of the predictor variable (e.g., Kutner, Nachtsheim, Neter, & Li, 2005). For the blockwise-entry method in SPSS, each block provides a re-estimate of the remaining coefficients in that block in the absence of any terms dropped from the model.

[5] Odds Ratio (*OR*) can be interpreted as an effect size within logistic regression. An *OR* of 1 indicates no relationship between the variables, with greater deviations from 1 representing greater effect sizes. Whether the *OR* is greater than or <1 is a function of which group is coded as the reference.

dimension condition would demonstrate that an impression of high (low) warmth leads to expectations of similarly high (low) competence, and vice versa.

Finally, a negative relationship would be indicated by a significant interaction, such that incongruent valence between target and impression statements should be associated with higher recognition rates than congruent valence when the impression and target statements were from matching dimensions, whereas congruent valence between target and impression statements should be associated with higher recognition rates than incongruent valence when the impression and target statements were from mismatching dimensions. A reversed recognition advantage for congruent over incongruent valence in the mismatching dimension condition would indicate that an impression of high (low) warmth leads to expectations of low (high) competence, and vice versa.

The analysis revealed a significant main effect of Valence Congruence, $B = 0.97$, $SE = 0.21$, Wald $Z = 21.40$, $p < .001$, $OR = 0.38$, indicating that recognition rates were higher for incongruent valence ($M = .28$, 95% CI [.24, .32]) than congruent valence ($M = .13$, 95% CI [.09, .17]). This main effect was not qualified by a higher-order interaction with Dimensional Match, $B = 0.31$, $SE = 0.42$, Wald $Z = 0.56$, $p = .455$, $OR = 0.73$. The main effect of Valence Congruence was statistically significant in both the matching dimension condition, $B = 1.12$, $SE = 0.30$, Wald $Z = 14.35$, $p < .001$, and the mismatching dimension condition, $B = 0.81$, $SE = 0.30$, Wald $Z = 7.45$, $p = .006$. Together, these results suggest a positive relationship between warmth and competence in lay perceptions of inconsistency, such that impressions of high (low) warmth lead to expectations of high (low) competence, and vice versa.

4.2.3. Negativity bias

To determine whether new negative information violates positive expectations to a greater extent than positive information violates negative expectations, data were submitted to a binary logistic regression using Valence Congruence (congruent vs. incongruent) and Target Valence (positive vs. negative) as dummy-coded predictors. A negativity bias would be reflected in an interaction between Valence Congruence and Target Valence, such that incongruent valence should lead to a more pronounced recognition advantage over congruent valence for negative target statements than positive target statements. There was a significant main effect of Valence Congruence, $B = 0.97$, $SE = 0.21$, Wald $Z = 21.38$, $p < .001$, $OR = 0.38$, indicating that recognition rates were higher for incongruent valence ($M = .28$, 95% CI [.24, .32]) than congruent valence ($M = .13$, 95% CI [.09, .17]). This main effect was not qualified by a higher-order interaction with Target Valence, $B = 0.13$, $SE = 0.42$, Wald $Z = 0.09$, $p = .760$, $OR = 1.14$, indicating equal expectancy-violations for positive and negative information. The main effect of Valence Congruence was significant for both the negative target condition, $B = 1.04$, $SE = 0.32$, Wald $Z = 10.87$, $p = .001$, $OR = 0.35$, and the positive target condition, $B = 0.91$, $SE = 0.28$, Wald $Z = 10.54$, $p = .001$, $OR = 0.40$.

4.2.4. Dependence of valence asymmetries on dimension

A final analysis was conducted to test whether the nature of valence asymmetries depends on the particular trait dimension, as would be predicted by theories on the perceived diagnosticity of positive and negative behavior within each of the two dimensions (see Reeder & Brewer, 1979; Skowronski & Carlston, 1987, 1989). These theories assume that negative information has a stronger impact than positive information within the warmth dimension, whereas positive information has a stronger impact than negative information within the competence dimension. Thus, new negative information about an individual's warmth may be perceived as more inconsistent with an initial positive impression of that person's warmth compared with the perceived inconsistency between new positive information and an initial negative impression regarding a person's warmth. Conversely, new positive information about someone's competence may be seen as more inconsistent with an initial negative impression of that person's competence compared with the perceived inconsistency between new negative information and an initial positive impression regarding a person's competence.

To test this hypothesis, we selected those conditions where the dimensions matched across the impression and target statements, and then submitted the data to a binary logistic regression using Dimension (warmth vs. competence), Valence Congruence (congruent vs. incongruent), and Target Valence (positive vs. negative) as dummy-coded predictors. A dependence of valence asymmetries on impression dimension would be indicated by a significant three-way interaction between Dimension, Valence Congruence, and Target Valence. Specifically, within the warmth dimension, incongruent valence should lead to a more pronounced recognition advantage over congruent valence for negative target statements than positive target statements. In contrast, within the competence dimension, incongruent valence should lead to a more pronounced recognition advantage over congruent valence for positive target statements than negative target statements.

There was a significant main effect of Valence Congruence, $B = 1.12$, $SE = 0.30$, Wald $Z = 14.29$, $p < .001$, $OR = 0.33$, indicating that recognition rates were higher for incongruent valence ($M = .31$, 95% CI [.24, .37]) than congruent valence ($M = .28$, 95% CI [.06, .19]). This main effect was not qualified by any higher-order interactions (all Wald Zs < 1.13, all ps $> .289$, OR for largest non-significant effect $= 1.89$), nor were there any other significant main effects (all Wald Zs < 0.17, all ps $> .680$, OR for largest non-significant effect $= 1.12$). These results indicate that the relative impact of positive and negative information did not depend on the particular dimension, as would be predicted by the aforementioned theories. Such a dependence of valence asymmetries would have been indicated by a significant three-way interaction between Dimension, Valence Congruence, and Target Valence, which was not statistically significant, $B = 0.60$, $SE = 1.20$, Wald $Z = 0.26$, $p = .614$, $OR = 1.83$.

4.3. Discussion

Experiment 1 investigated lay perceptions of inconsistency, focusing on the relation between warmth and competence and the relative impact of positive versus negative information. Using recognition memory for task-irrelevant background colors as an indicator of expectancy-violation (see Gawronski et al., 2014), we found that participants were surprised by behavioral information that was incongruent with the valence of initial information about a target individual. Interestingly, valence-incongruent information led to expectancy-violations regardless of whether the initial impression and the new information matched or mismatched in terms of their dimensions. When participants initially received positive warmth (competence) information about the target, they expected him to behave positively in terms of competence (warmth). Conversely, when participants received negative information about the target's warmth (competence), they expected him to behave negatively in terms of competence (warmth). These results suggest that warmth and competence are positively related in lay perceptions of inconsistency, such that positive (negative) information along one dimension leads to expectations of positive (negative) behavior along the other dimension.

Somewhat to our surprise, our analyses revealed no evidence for a negativity bias in expectancy-violation. Participants were equally surprised by positive information that was counter to an initial negative impression as they were by negative information that conflicted with an initial positive impression. Additionally, expectancy-violation effects of valence-incongruent information did not depend on the dimension along which the impression was formed, as would be predicted by theories on the perceived diagnosticity of positive and negative behavior in different trait dimensions (see Reeder & Brewer, 1979; Skowronski & Carlston, 1989). According to these theories, new negative information

about an individual's warmth may be perceived as more inconsistent with an initial positive impression of that person's warmth compared with the perceived inconsistency between new positive information and an initial negative impression regarding a person's warmth. Conversely, new positive information about someone's competence may be seen as more inconsistent with an initial negative impression of that person's competence compared with the perceived inconsistency between new negative information and an initial positive impression regarding a person's competence. Counter to these predictions, participants were equally surprised by valence-incongruent information about the target's warmth or competence regardless of whether their initial impression along these dimensions was positive or negative.

5. Experiment 2

Although Experiment 1 provides interesting and valuable insights into lay perceptions of inconsistency, we deemed it important to replicate our findings in a follow-up study. In addition, we wanted to rule out the possibility that the obtained results were due to incidental features of our materials. To this end, Experiment 2 provides a replication with different target statements. All other aspects of the experimental design and the data analysis were identical to Experiment 1.

5.1. Method

As in Experiment 1, participants were recruited from MTurk. Eligibility for participation was limited to MTurk workers who (a) had a HIT approval rate of at least 95% at the time of the study and (b) had not participated in prior studies from our lab using the same paradigm.[6] Of the 704 participants who started the study, 648 participants (368 women, 276 men; $M_{age} = 35.27$ years, $SD_{age} = 12.10$ years; gender data missing for 4 participants; age data missing for 6 participants) completed all sections of the study. Three participants failed the attention check and six participants indicated that they suffered from some form of color-blindness. As in Experiment 1, excluding these participants did not alter the pattern of results, so they are included in all analyses. Participants were given $0.50 in exchange for their participation.[7] Participants were randomly assigned to 1 of 16 conditions in a 2 (Impression Valence: positive vs. negative) × 2 (Impression Dimension: warmth vs. competence) × 2 (Target Valence: positive vs. negative) × 2 (Target Dimension: warmth vs. competence) between-subjects design. The impression formation and background recognition tasks were identical to those in Experiment 1, the only modification being the content of the target statements.

5.2. Results

5.2.1. General analysis

Data were analyzed in the manner described in Experiment 1. A binary logistic regression with all 4 variables (Impression Valence, Impression Dimension, Target Valence, Target Dimension) as predictors revealed significant main effects of Impression Dimension, $B = 0.42$, $SE = 0.20$, Wald $Z = 4.50$, $p = .034$, $OR = 0.66$, Target Topic, $B = 0.42$, $SE = 0.20$, Wald $Z = 4.51$, $p = .033$, $OR = 0.66$, and Target Valence, $B = 0.40$, $SE = 0.20$, Wald $Z = 4.11$, $p = .043$, $OR = 1.49$. More important for the current investigation, there was a significant two-way interaction between Impression Valence and Target Valence, $B = 1.01$, $SE = 0.41$, Wald $Z = 6.09$, $p = .014$, $OR = 0.37$ (see Fig. 2). Replicating the pattern obtained in Experiment 1, participants showed better memory for the background color of the target statement when a negative target statement followed positive impression statements ($M = .23$, 95% CI [.16, .29]) than when a negative target statement followed negative impression statements ($M = .14$, 95% CI [.08, .20]). Conversely, recognition rates were higher when a positive target statement followed negative impression statements ($M = .28$, 95% CI [.21, .34]) than when a positive target statement followed positive impression statements ($M = .21$, 95% CI [.15, .27]).

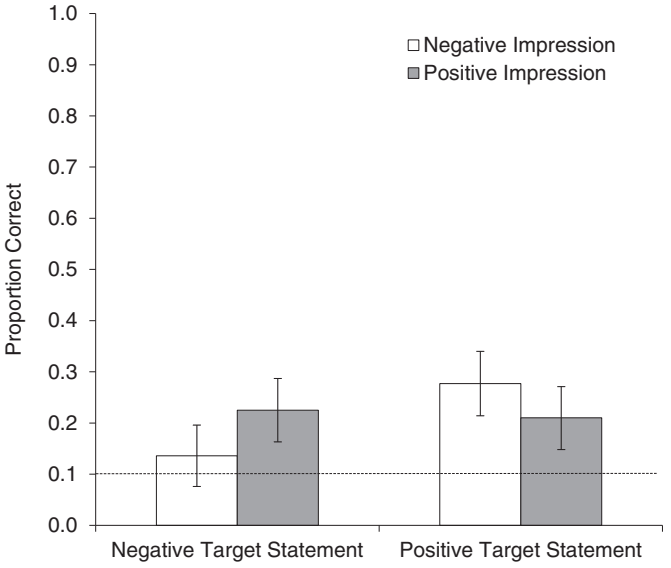

Fig. 2. Mean proportions of correct background recognition as a function of target statement valence and initial impression valence, Experiment 2. Dotted line represents chance responding. Error bars represent 95% confidence intervals.

In addition to the interaction between Impression Valence and Target Valence, there was a significant two-way interaction between Target Dimension and Target Valence, $B = 1.32$, $SE = 0.41$, Wald $Z = 10.40$, $p = .001$, $OR = 0.27$. This interaction indicated that the background recognition rate was higher for the positive warmth statement ($M = .33$, 95% CI [.27, .39]) compared with the positive competence statement ($M = .15$, 95% CI [.09, .22]). The background recognition rate for the positive warmth statement was also higher than the recognition rates for the negative warmth statement ($M = .16$, 95% CI [.10, .22]) and the negative competence statement ($M = .20$, 95% CI [.14, .26]). Because this unexpected interaction involved only the nature of the target statements independent of our manipulation of initial impressions, it most likely reflects an incidental effect of the target statements used. Importantly, neither of the obtained two-way interactions was qualified by higher-order interactions (all Wald Zs < 1.87, all ps > 0.172, OR for largest non-significant effect = 0.32).

5.2.2. Relationship between warmth and competence

To determine the relation between warmth and competence in lay perceptions of inconsistency, data were analyzed using a 2 (Dimensional Match: match vs. mismatch) × 2 (Valence Congruence: congruent vs. incongruent) model. The analysis revealed a significant main effect of Valence Congruence, $B = 0.49$, $SE = 0.20$, Wald $Z = 6.40$, $p = .011$, $OR = 0.61$, indicating that recognition rates were higher when the valence of the target statements was incongruent with the valence of the impression statements ($M = .25$, 95% CI [.21, .30]) than when their valence was congruent ($M = .17$, 95% CI [.13, .22]). Replicating the findings of Experiment 1, this main effect was not qualified by a higher-order interaction with Dimensional Match, $B = 0.37$, $SE = 0.39$, Wald $Z = 0.87$, $p = .352$, $OR = 0.70$. These results support our conclusion that warmth and competence are positively related in lay perceptions

[6] Participation was restricted using the Qualifications function on MTurk. Any time participants completed a study using the background recognition paradigm, they were assigned a qualification score. Then, when posting a subsequent study using the same paradigm, we created a requirement that specified that the qualification had not been granted in order to complete the study. To do so, we added a criterion under the worker requirement tab on the HIT creation page.

[7] Eight participants did not submit their compensation claim while the study was still active, which resulted in a slightly higher number of participants than the predetermined sample size of 640.

of inconsistency, such that positive (negative) impressions of warmth lead to positive (negative) expectations of competence, and vice versa.

5.2.3. Negativity bias

To investigate the occurrence of a negativity bias, data were analyzed using a 2 (Valence Congruence: congruent vs. incongruent) × 2 (Target Valence: negative vs. positive) model. There was a significant main effect of Target Valence, $B = 0.402$, $SE = 0.20$, Wald $Z = 4.25$, $p = .039$, $OR = 1.50$, indicating that the background color for positive target statements was better recognized ($M = .25$, 95% CI [.20, .29]) than the background color for negative target statements ($M = .18$, 95% CI [.14, .22]). More important, the analysis revealed a significant main effect of Valence Congruence, $B = 0.49$, $SE = 0.20$, Wald $Z = 6.37$, $p = .012$, $OR = 0.61$, indicating that background recognition rates were higher for target statements that were incongruent with the valence of the impression statements ($M = .25$, 95% CI [.21, .30]) compared to those that were congruent ($M = .17$, 95% CI [.13, .22]). Replicating the findings of Experiment 1, there was no significant interaction of the two factors, $B = 0.23$, $SE = 0.39$, Wald $Z = 0.33$, $p = .565$, $OR = 1.26$, suggesting equal expectancy-violations for positive and negative information.

5.2.4. Dependence of valence asymmetries on dimension

Finally, to determine whether the nature of valence asymmetries depends on the particular dimension, data were analyzed using a 2 (Dimension: warmth vs. competence) × 2 (Valence Congruence: congruent vs. incongruent) × 2 (Target Valence: positive vs. negative) model after preselecting the data from those conditions in which the impression and target statements matched in terms of their dimension. The analysis revealed a significant main effect of Valence Congruence, $B = 0.792$, $SE = 0.28$, Wald $Z = 5.88$, $p = .015$, $OR = 0.51$, indicating that the background recognition rates were higher for statements that were incongruent with the valence of the impression statements ($M = .29$, 95% CI [.22, .35]) compared to those that were congruent ($M = .18$, 95% CI [.11, .24]). Replicating the findings of Experiment 1, this main effect was not qualified by any higher-order interactions (all Wald Zs < 1.21, all ps > .271, OR for largest non-significant effect = 0.52).

The analysis also revealed significant main effects of Dimension, $B = 0.79$, $SE = 0.28$, Wald $Z = 8.10$, $p = .005$, $OR = 0.45$, and Target Valence, $B = 0.60$, $SE = 0.28$, Wald $Z = 4.75$, $p = .029$, $OR = 1.82$. These main effects were qualified by a significant two-way interaction between Dimension and Target Valence, $B = 1.27$, $SE = 0.57$, Wald $Z = 4.92$, $p = .026$, $OR = 0.28$, replicating the aforementioned incidental effect of the target statements used. Importantly, the three-way interaction of Dimension, Valence Congruence, and Target Valence was not statistically significant, $B = 0.71$, $SE = 1.18$, Wald $Z = 0.37$, $p = .547$, $OR = 2.03$, suggesting that the relative impact of positive and negative information did not depend on the particular dimension.

5.3. Discussion

Experiment 2 replicated the key findings from Experiment 1, which revealed a dimension-independent effect of valence congruence in lay perceptions of inconsistency. Specifically, we found an expectancy-violation effect of valence-incongruent information regardless of whether this information matched or mismatched the dimension of the initial impression. These results support the conclusion that warmth and competence are positively related in lay perceptions of inconsistency, such that a positive (negative) impression of warmth leads to corresponding positive (negative) expectations of competence, and vice versa. These effects were not qualified by the valence of the target statements, suggesting equal expectancy-violations for positive and negative information. Moreover, expectancy-violation effects of valence-incongruent information did not depend on the dimension along which the impression was formed. Replicating the findings of Experiment 1, participants were equally surprised by valence-incongruent information about the target's warmth or competence regardless of whether their initial impression along these dimensions was positive or negative. Although Experiment 2 revealed some unexpected effects of incidental features of our materials, these incidental effects did not qualify the critical effect of valence-congruence, which replicated across the two studies irrespective of the particular content of the target statements.

6. Experiment 3

To further establish the generality of the obtained results, Experiment 3 included a broader set of target statements, as well as a different target individual. Rather than using the same target statement for all participants within the same condition, participants were randomly presented with one of ten target statements of the same type (all of which differed from those used in Experiments 1 and 2; see Supplementary Materials). Additionally, to ensure that the results obtained in the previous two experiments were not attributable to idiosyncratic features of the target individual used, Experiment 3 used a picture of a different individual as the impression target. For exploratory purposes, Experiment 3 also measured participants' impressions of the target's likeability, warmth, and competence.

6.1. Methods

As in Experiments 1 and 2, participants were recruited via MTurk to participate in a study on impression formation. Eligibility for participation was limited to MTurk workers who (a) had a HIT approval rate of at least 95% at the time of the study and (b) had not participated in prior studies from our lab using the same paradigm. Participants received $0.50 in exchange for their participation. Of the 858 participants who initially clicked the link to begin the study, 640 participants submitted for payment on MTurk. Due to the complexity of the randomization necessary for including 10 target statements per condition, we used Inquisit Web (Version 4.0.9.0) by Millisecond Software instead of Qualtrics. The experiment was run in "window mode," which allowed participants to skip parts of the study or exit at any time if they wished to cease participation. As a result of this feature, the sample includes discrepancies between the number of participants who submitted for payment, the number of participants who are included in the background recognition analyses, and the number of participants who are included in the impression ratings analyses. Data were recorded for 692 participants who completed a portion of the impression formation task. Data from 3 of these participants had to be excluded from analyses due to duplicate assignments of subject numbers that could not be reconciled in the data files. For the remaining 689 participants, data from the background recognition task were missing for 33 participants. As a result, 656 participants (331 women, 268 men; $M_{age} = 33.85$ years, $SD_{age} = 11.00$ years; demographic data missing for 57 participants) are included in the analyses of background recognition data. Twenty-five participants failed an instructional attention check (see details below) and six participants indicated that they suffered from some form of color-blindness. Because excluding these participants did not alter the pattern of results, data from all participants are included in the following analyses. Participants were randomly assigned to 1 of 16 conditions in a 2 (Impression Valence: positive vs. negative) × 2 (Impression Dimension: warmth vs. competence) × 2 (Target Valence: positive vs. negative) × 2 (Target Dimension: warmth vs. competence) between-subjects design. The impression formation and background recognition tasks were identical to those in Experiment 1, the only modification being the content of the target statements and the picture used for the target individual. In addition, participants were asked to rate the target individual's general likeability, warmth, and competence on three 7-point rating scales after completion of the background recognition task. Because the rating data are not central to our main question, they are reported in the Supplementary Materials.

6.1.1. Attention check measure

Experiment three used an instructional manipulation check (see Oppenheimer et al., 2009), which differed from the attention check used in Experiments 1 and 2. Immediately after completing the background recognition task, participants were asked to answer the question *Which of these activities do you engage in regularly?* by choosing all answers that apply from a list of sporting activities. This question was preceded by a paragraph stating:

> *Most modern theories of decision-making recognize the fact that decisions do not take place in a vacuum. Individual preferences and knowledge, along with situational variables can greatly impact the decision process. In order to facilitate our research on decision-making we are interested in knowing certain factors about you, the decision maker. Specifically, we are interested in whether you actually take the time to read the directions; if not, then some of our manipulations that rely on changes in the instructions will be ineffective. So, in order to demonstrate that you have read the instructions, please ignore the sports items below. Instead, simply continue on to the next page after the options. Thank you very much.*

Thus, participants who selected any activities from the list were coded as having failed the attention check.

6.2. Results

6.2.1. General analysis

Data were analyzed in the same manner as in Experiments 1 and 2. A binary logistic regression with all four factors (Impression Valence, Impression Dimension, Target Valence, Target Dimension) as predictors revealed significant main effects of Target Dimension, $B = 0.48$, $SE = 0.20$, Wald $Z = 5.74$, $p = .017$, $OR = 1.61$, and Target Valence, $B = 0.41$, $SE = 0.20$, Wald $Z = 4.24$, $p = .040$, $OR = 1.51$. Both main effects were qualified by higher-order interactions.

There was a significant interaction between Impression Valence and Target Valence, $B = 1.21$, $SE = 0.41$, Wald $Z = 8.51$, $p = .004$, $OR = 0.30$ (see Fig. 3). Recognition rates for the background color were higher for negative target statements that followed positive impression statements ($M = .21$, 95% CI [.15, .27]) than for negative target statements that followed negative impression statements ($M = 0.13$, 95% CI [.07, .19]). Conversely, background recognition rates were higher for positive target statements that followed negative impression statements ($M = .28$, 95% CI [.22, .34]) than for positive target statements that followed positive impression statements ($M = .18$, 95% CI [.12, .24]). This result replicates the main findings of Experiments 1 and 2.

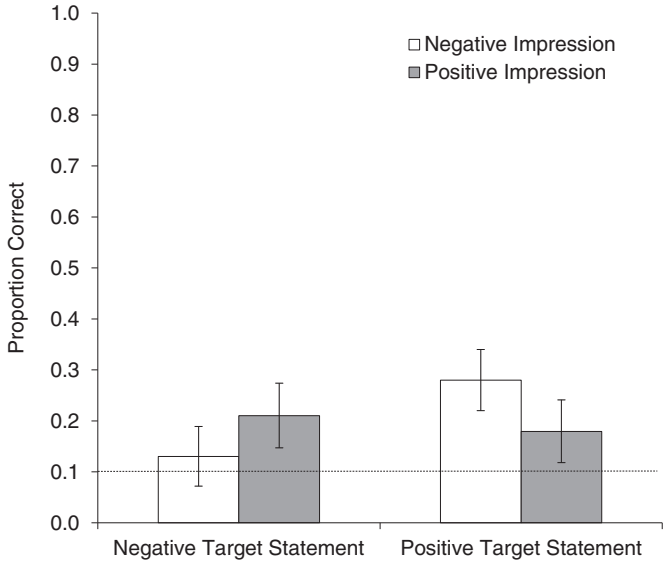

Fig. 3. Mean proportions of correct background recognition as a function of target statement valence and initial impression valence, Experiment 3. Dotted line represents chance responding. Error bars represent 95% confidence intervals.

In addition to the critical interaction between Impression Valence and Target Valence, the analysis also revealed a significant interaction between Target Valence and Target Dimension, $B = 1.16$, $SE = 0.42$, Wald $Z = 7.73$, $p = .005$, $OR = 3.19$. For target statements regarding competence, recognition rates for the background color were higher when these statements were positive ($M = .32$, 95% CI [.26, .38]) than when the statements were negative ($M = .16$, 95% CI [.10, .22]). For target statements regarding warmth, recognition rates for the background color did not differ for positive statements ($M = .14$, 95% CI [.08, .21]) and negative statements ($M = .18$, 95% CI [.12, .24]). Because this unexpected interaction involved only the nature of the target statements independent of our manipulation of initial impressions, this interaction likely reflects an incidental effect of the stimuli. Yet, this incidental effect is different than the one in Experiment 2, which indicated a higher background recognition rate for the positive warmth statement compared with the other three target statements. More important, neither of these interactions was qualified by higher-order interactions (all Wald $Zs < 1.53$, all $ps > .217$, OR for largest non-significant effect = 0.12), replicating the basic pattern obtained in Experiments 1 and 2.

6.2.2. Relationship between warmth and competence

As in Experiments 1 and 2, data were analyzed via a 2 (Dimensional Match: match vs. mismatch) × 2 (Valence Congruence: congruent vs. incongruent) model to assess the relationship between the warmth and competence dimensions. This analysis revealed a significant main effect of Valence Congruence, $B = 0.63$, $SE = 0.20$, Wald $Z = 9.96$, $p = .002$, $OR = 0.53$, indicating that background recognition rates were higher for target statements that were incongruent with the valence of the impression statements ($M = .25$, 95% CI [.21, .30]) compared to those that were congruent with the valence of the impression statements ($M = .15$, 95% CI [.11, .20]). Replicating the results from Experiments 1 and 2, this main effect was not qualified by an interaction with Dimension Match, $B = 0.57$, $SE = 0.40$, Wald $Z = 1.99$, $p = .158$, $OR = 0.57$. This result corroborates our conclusion from Experiments 1 and 2 that warmth and competence are perceived as positively related.

6.2.3. Negativity bias

To assess whether negative target statements resulted in greater expectancy-violations than positive target statements, data were analyzed via a 2 (Valence Congruence: congruent vs. incongruent) × 2 (Target Valence: positive vs. negative) model. This analysis revealed a significant main effect of Valence Congruence, $B = 0.61$, $SE = 0.20$, Wald $Z = 9.40$, $p = .002$, $OR = 0.54$. Recognition rates for the background color of the target statement were higher when the valence of the target statement was incongruent with the valence of the impression statements ($M = .25$, 95% CI [.21, .29]) than when the valence of the target statement was congruent with the valence of the impression statements ($M = .15$, 95% CI [.11, .20]). As in Experiments 1 and 2, this main effect was not qualified by an interaction with Target Valence, $B = 0.05$, $SE = 0.40$, Wald $Z = 0.01$, $p = .909$, $OR = .96$. This result corroborates our conclusion from Experiments 1 and 2 that positive and negative statements result in equal expectancy-violations.

6.2.4. Dependence of valence asymmetries on dimension

As in Experiments 1 and 2, data were analyzed using a 2 (Dimension: warmth vs. competence) × 2 (Valence Congruence: congruent vs. incongruent) × 2 (Target Valence: positive vs. negative) model. Only conditions in which the impression dimension and target dimension matched were included in this analysis. The analysis revealed a significant main effect of Valence Congruence, $B = 0.88$, $SE = 0.29$, Wald $Z = 9.31$, $p = .002$, $OR = 0.41$. Participants better recognized the

background color when the valence of the target statement was incongruent with the valence of the impression statements ($M = .27$, 95% CI [.21, .33]) than when the valence of the target statement was congruent with the valence of the impression statements ($M = .13$, 95% CI [.08, .19]). Replicating the results of Experiments 1 and 2, the main effect of Valence Congruence was not qualified by a higher-order interaction with Target Valence and Dimension, $B = 0.17$, $SE = 1.18$, Wald $Z = 0.02$, $p = .889$, $OR = 0.85$, indicating that the relative impact of positive and negative information did not depend on the particular dimension.

6.3. Discussion

The results from Experiment 3 corroborate the key findings from Experiments 1 and 2. Specifically, we replicated the finding that valence incongruence drives expectancy-violations, independent of impression dimension. These expectancy-violations occurred across impression dimensions, replicating the finding that warmth and competence are positively related in lay perceptions of inconsistency. Again replicating our previous findings, there was no evidence of a negativity bias, even when taking into account the dimension along which the impression was formed.

7. Combined analyses

Although Experiments 1–3 provide converging evidence for a dimension-independent effect of valence congruence on lay perceptions of inconsistency, some of our conclusions are based on null effects. To obtain greater statistical power for the identification of small effects, we combined the data from all three experiments ($N = 1944$), providing a stronger basis for theoretical interpretations of non-significant effects.

7.1. Results

7.1.1. General analysis

As in the three individual experiments, data were analyzed using binary logistic regression. When all four variables (Impression Valence, Impression Dimension, Target Valence, Target Dimension) were included as predictors, the analysis revealed a significant two-way interaction between Impression Valence and Target Valence, $B = 1.38$, $SE = 0.23$, Wald $Z = 34.93$, $p < .001$, $OR = 0.25$ (see Fig. 4).[8] Replicating the findings of the three individual studies, the background color of the target statement was better remembered when a negative target statement followed positive impression statements ($M = .23$, 95% CI [.19, .26]) than when a negative target statement followed negative impression statements ($M = .12$, 95% CI [.09, .16]). Conversely, recognition scores were higher when a positive target statement followed negative impression statements ($M = .29$, 95% CI [.26, .33]) than when a positive target statement followed positive impression statements ($M = .18$, 95% CI [.14, .21]). This two-way interaction was not qualified by any higher-order interactions (all Wald Zs < 2.98, all ps > .084, OR for largest non-significant effect = 0.20).

7.1.2. Relationship between warmth and competence

To investigate the perceived relation between warmth and competence, data were analyzed using a 2 (Dimensional Match: match vs. mismatch) × 2 (Valence Congruence: congruent vs. incongruent) model. The analysis revealed a significant main effect of Valence Congruence, $B = 0.69$, $SE = 0.12$, Wald $Z = 35.61$, $p < .001$, $OR = 0.50$, indicating that recognition rates were higher for incongruent valence ($M = .26$, 95% CI [.24, .29]) than congruent valence ($M = .15$, 95% CI [.13, .18]).

[8] Data were also analyzed with Experiment as three dummy coded variables in the model (see Supplementary Materials). Although this analysis revealed some incidental effects of the stimuli across the three studies, these effects did not qualify any of the main conclusions reported in the Combined Analyses.

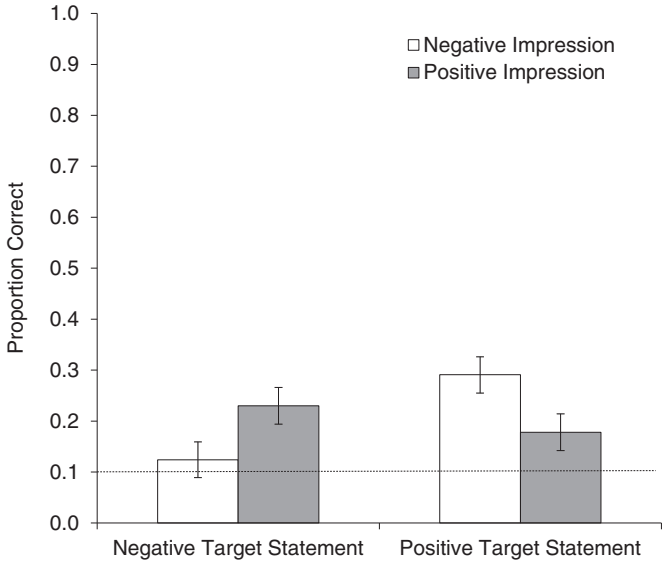

Fig. 4. Mean proportions of correct background recognition as a function of target statement valence and initial impression valence, combined data of Experiments 1, 2, and 3. Dotted line represents chance responding. Error bars represent 95% confidence intervals.

Replicating the findings of the three individual studies, this main effect was not qualified by a higher-order interaction with Dimensional Match, $B = 0.41$, $SE = 0.23$, Wald $Z = 3.14$, $p = .077$, $OR = 0.66$. The main effect of Valence Congruence was statistically significant in both the matching dimension condition, $B = 0.89$, $SE = 0.16$, Wald $Z = 29.79$, $p < .001$, $OR = 0.41$, and the mismatching dimension condition, $B = 0.48$, $SE = 0.16$, Wald $Z = 8.50$, $p = .004$, $OR = 0.62$. These results corroborate our conclusion that perceptions of warmth and competence are positively related, such that positive (negative) impressions along one dimension lead to corresponding positive (negative) expectations along the other dimension.

7.1.3. Negativity bias

To determine whether new negative information violates positive expectations to a greater extent than positive information violates negative expectations, data were analyzed in a 2 (Valence Congruence: congruent vs. incongruent) × 2 (Target Valence: negative vs. positive) model. The analysis revealed a significant main effect of Valence Congruence, $B = 0.68$, $SE = 0.12$, Wald $Z = 34.85$, $p < .001$, $OR = 0.51$, indicating higher recognition rates when the valence of the target statement was incongruent with the valence of the impression statements ($M = .26$, 95% CI [.24, .29]) than when it was congruent ($M = .15$, 95% CI [.13, .18]). Reflecting the incidental effects of some stimuli in Experiments 2 and 3, there was also a significant main effect of Target Valence, $B = 0.37$, $SE = 0.11$, Wald $Z = 10.23$, $p = .001$, $OR = 1.44$, indicating better recognition for positive target statements ($M = .24$, 95% CI [.21, .26]) than negative target statements ($M = .18$, 95% CI [.15, .20]). However, there was no significant interaction of Valence Congruence and Target Valence, $B = 0.11$, $SE = 0.23$, Wald $Z = 0.21$, $p = .646$, $OR = 1.11$, indicating equal expectancy-violations for positive and negative information. The main effect of Valence Congruence was significant for both the negative target condition, $B = 0.74$, $SE = 0.17$, Wald Z = 18.30, $p < .001$, $OR = 0.48$, and the positive target condition, $B = 0.64$, $SE = 0.16$, Wald Z = 16.72, $p = .001$, $OR = 0.53$.

7.1.4. Dependence of valence asymmetries on dimension

To investigate whether the nature of valence asymmetries depends on the particular dimension, we preselected the data from those conditions in which the impression and target statements matched in terms of their dimension and submitted them to a 2 (Dimension: warmth vs.

competence) × 2 (Valence Congruence: congruent vs. incongruent) × 2 (Target Valence: positive vs. negative) model. This analysis revealed a significant main effect of Valence Congruence, $B = 0.88$, $SE = 0.16$, Wald $Z = 29.20$, $p < .001$, $OR = 0.41$, indicating that background recognition rates were higher when the valence of the target statements was incongruent with the valence of the impression statements ($M = .29$, 95% CI [.25, .33]) than when it was congruent ($M = .15$, 95% CI [.11, .18]). There was also a significant main effect of Target Valence, $B = 0.41$, $SE = 0.16$, Wald $Z = 6.41$, $p = .011$, $OR = 1.50$, indicating that background recognition rates were higher for positive target statements ($M = .25$, 95% CI [.21, .29]) than for negative target statements ($M = .18$, 95% CI [.15, .22]). Importantly, the main effect of Valence Congruence was not qualified by a higher-order interaction with Target Valence and Dimension, $B = 0.33$, $SE = 0.66$, Wald $Z = 0.25$, $p = .619$, $OR = 1.39$, indicating that the relative impact of positive and negative information did not depend on the particular dimension.

7.2. Discussion

The results from the combined analyses support the conclusions drawn in Experiments 1–3. Alongside the first three experiments, the combined analyses provide converging evidence that lay perceptions of inconsistency are driven by valence incongruence. This effect generalized across warmth and competence, indicating that prior information along one dimension led to valence-congruent expectations along the other dimension. There was no evidence for valence asymmetries in expectancy-violations regardless of whether the impression dimension involved warmth or competence. Because these conclusions are partly based on non-significant effects, the large sample size in the combined analyses ($N = 1944$) provides a stronger basis for theoretical interpretations of null effects, including non-significant interactions with dimensional match and the lack of evidence for valence asymmetries in lay perceptions of inconsistency.

8. Experiment 4

Experiments 1–3 and the combined analyses provide converging evidence that (a) perceptions of inconsistency are driven by valence incongruence and (b) this effect generalized across the warmth and competence dimensions, such that prior information along one dimension led to valence-congruent expectations along the other dimension. Experiment 4 aims to build on Experiments 1–3 in two ways. First, because the same paradigm was utilized in all three previous studies, it is possible that the obtained effects reflect idiosyncratic features of the paradigm. For example, it is possible that participants' memory-performance was influenced by surprise-responses related to the task or the perceived novelty of the target statement rather than perceived inconsistencies in the behavior of the target. Second, because a single item served as the dependent measure in Experiments 1–3, it is possible that our results are biased by uncontrolled measurement error. To rule out these concerns, Experiment 4 used a multiple-item self-report measure of perceived inconsistency instead of a memory-based measure of surprise. Toward this end, we directly asked participants to indicate (a) how surprised they were that the individual performed the target behavior, (b) how inconsistent the new information was with his past behavior, and (c) how inconsistent the new information was with their previous impression of the individual. To control for measurement error, responses on the three items were combined in a single score, which served as the primary dependent measure.

8.1. Method

8.1.1. Participants and design

Participants were recruited via MTurk to complete a study on impression formation. Eligibility for participation was limited to MTurk workers who (a) had a HIT approval rate of at least 95% at the time of the study and (b) had not participated in prior studies from our lab using the expectancy-violation paradigm of Experiments 1–3. Participants received $0.50 in exchange for their participation. Of the 803 people who initially clicked the link to complete the study, 640 participants submitted requests for payment on MTurk. As in Experiment 3, data were collected via Inquisit, and participants were allowed to terminate the experiment or skip parts of the study at any time. Data were recorded for 674 participants who completed a portion of the impression formation task before dropping out of the study. Data from two of these participants had to be excluded from analyses due to duplicate assignments of subject numbers that could not be reconciled in the data files. Data from one additional participant had to be excluded due to a data recording error. For the remaining 671 participants, data from the dependent variable were missing for 25 participants. As a result, 646 participants (325 women, 277 men; $M_{age} = 35.53$ years, $SD_{age} = 11.59$ years; demographic data missing for an additional 44 participants) are included in the analyses. Twenty-eight participants failed an instructional attention check (see Oppenheimer et al., 2009).[9] Because excluding these participants did not alter the pattern of results, data from all participants are included in the following analyses. Participants were randomly assigned to 1 of 16 conditions in a 2 (Impression Valence: positive vs. negative) × 2 (Impression Dimension: warmth vs. competence) × 2 (Target Valence: positive vs. negative) × 2 (Target Dimension: warmth vs. competence) between-subjects design.

8.1.2. Impression formation task

As in Experiments 1–3, participants were asked to form an impression on the basis of behavioral statements. Each statement was presented against a white background below a picture of the target individual for 5000 milliseconds. Participants viewed 20 impression formation statements followed by the target statement. As in Experiment 3, the target statement was randomly selected from a list of 10 potential target statements. After reading the target statement, participants were asked to indicate their perceptions of the information in the target statement; no filler statements were presented between the target statement and the dependent measures.

8.1.3. Dependent measures

Participants were asked to indicate their perception of the target statement on three questions. The first question asked participants to indicate how surprised they were that Bob performed the behavior in the most recent statement on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). The second question asked participants to indicate how consistent they found Bob's behavior in the most recent statement with the behaviors in the previous statements on a 7-point scale ranging from 1 (*very inconsistent*) to 7 (*very consistent*). Finally, the third question asked participants to indicate how consistent they found Bob's behavior in the most recent statement with their overall impression of Bob on a 7-point scale ranging from 1 (*very inconsistent*) to 7 (*very consistent*). Each question was presented on a separate screen, and the target statement was displayed above each question as a reminder. The questions were displayed in a fixed order for all participants. To obtain an aggregate measure of perceived inconsistency, the second and third item were reverse scored and responses to the three items were averaged (Cronbach's $\alpha = .89$).[10] Higher scores on this index indicate higher levels of perceived inconsistency.

[9] The same instructional attention check from Experiment 3 was used for Experiment 4.

[10] Individual analyses with the three items revealed the same pattern of results that was obtained with the aggregate score. All of the reported results replicated for each of the three individual items.

8.2. Results

8.2.1. General analysis

Aggregate scores of perceived inconsistency were submitted to a 2 (Impression Valence: positive vs. negative) × 2 (Impression Dimension: warmth vs. competence) × 2 (Target Valence: positive vs. negative) × 2 (Target Dimension: warmth vs. competence) ANOVA. The analysis revealed a significant main effect of Target Dimension, $F(1, 630) = 3.88$, $p = .047$, $\eta_p^2 = .01$, which was qualified by a significant two-way interaction between Target Valence and Target Dimension, $F(1, 630) = 8.42$, $p = .004$, $\eta_p^2 = .01$. Additionally, there was a significant two-way interaction between Impression Valence and Target Valence, $F(1, 630) = 797.60$, $p < .001$, $\eta_p^2 = .56$, which replicated the valence incongruence effect obtained in Experiments 1–3. These two- way interactions were qualified by a significant three-way interaction between Impression Valence, Target Valence, and Target Dimension, $F(1, 630) = 9.94$, $p = .002$, $\eta_p^2 = .02$, and a significant three-way interaction between Impression Dimension, Target Valence, and Target Dimension, $F(1, 630) = 4.36$, $p = .039$, $\eta_p^2 = .01$. Finally, these three-way interactions were qualified by a significant four-way interaction between Impression Valence, Impression Dimension, Target Valence, and Target Dimension, $F(1, 630) = 82.55$, $p < .001$, $\eta_p^2 = .12$.

To decompose the four-way interaction, we conducted separate 2 (Impression Valence: positive vs. negative) × 2 (Target Valence: positive vs. negative) ANOVAs for each of the four conditions implied by the manipulations of Impression Dimension and Target Dimension (see Fig. 5). The two-way interaction between Impression Valence and Target Valence was statistically significant for all four combinations of Impression Dimension and Target Dimension. Yet, the strength of this interaction differed across the four combinations, driving the significant four-way interaction. The two-way interaction of Impression Valence and Target Valence was greatest when both the Impression Dimension and the Target Dimension involved warmth, $F(1, 152) = 594.03$, $p < .001$, $\eta_p^2 = .80$. The two-way interaction was somewhat smaller when both the Impression Dimension and the Target Dimension involved competence, $F(1, 164) = 244.03$, $p < .001$, $\eta_p^2 = .60$. Finally, the smallest two-way interactions occurred when the Impression Dimension involved warmth and the Target Dimension involved competence, $F(1, 147) = 92.49$, $p < .001$, $\eta_p^2 = .39$, and when the Impression Dimension involved competence and the Target Dimension involved warmth, $F(1, 167) = 78.64$, $p < .001$, $\eta_p^2 = .32$. Yet, despite these differences across the four conditions, the valence congruence effect obtained in Experiments 1–3 replicated for all four combinations. That is, participants perceived higher levels of inconsistency when the valence of the target statement was incongruent with the valence of the initial statements than when it was congruent, and this effect replicated for all four combinations of Impression Dimension and Target Dimension (see Fig. 5).

8.2.2. Relationship between warmth and competence

As in the previous experiments, data were analyzed via a 2 (Dimensional Match: match vs. mismatch) × 2 (Valence Congruence: congruent vs. incongruent) ANOVA to assess the relation between warmth and competence in lay perceptions of inconsistency. The analysis revealed a significant main effect of Valence Congruence, $F(1, 642) = 772.75$, $p < .001$, $\eta_p^2 = .55$, indicating higher levels of perceived inconsistency for incongruent valence ($M = 5.44$, 95% CI [5.29, 5.59]) than congruent valence ($M = 2.39$, 95% CI [2.24, 2.54]). This main effect was qualified by a significant two-way interaction between Dimensional Match and Valence Congruence, $F(1, 642) = 75.30$, $p < .001$, $\eta_p^2 = .11$. Further analyses revealed that the main effect of Valence Congruence was larger when the dimensions matched, $F(1, 642) = 667.43$, $p < .001$, $\eta_p^2 = .51$, than when the dimensions mismatched, $F(1, 642) = 182.21$, $p < .001$, $\eta_p^2 = .22$. Yet, the main effect of Valence Congruence was in the same direction and statistically significant in both conditions. That is, when the dimensions matched, participants perceived higher levels of inconsistency when the valence was incongruent ($M = 5.91$, 95% CI [5.70, 6.13]) than when the valence was congruent ($M = 1.91$, 95% CI [1.70, 2.12]). Similarly, when the dimensions mismatched, participants perceived higher levels of inconsistency when the valence was incongruent ($M = 4.97$, 95% CI [4.75, 5.19]) than when the valence was congruent ($M = 2.87$, 95% CI [2.66, 3.08]). Thus, despite the significant two-way interaction between Dimensional Match and Valence Congruence, the current findings provide further evidence for a positive relationship between warmth and competence in lay perceptions of inconsistency, such that positive (negative) impressions of warmth lead to positive (negative) expectations of competence, and vice versa.

8.2.3. Negativity bias

To assess whether new negative information violates positive expectations to a greater extent than positive information violates negative expectations, the data were submitted to a 2 (Valence Congruence: congruent vs. incongruent) × 2 (Target Valence: positive vs. negative) ANOVA. The analysis revealed only a significant main effect of Valence Congruence, $F(1, 642) = 692.96$, $p < .001$, $\eta_p^2 = .52$. Participants perceived higher levels of inconsistency when the impression statements and the target statement were evaluatively incongruent ($M = 2.39$, 95% CI [2.23, 2.55]) than when they evaluatively congruent ($M = 5.44$, 95% CI [5.28, 5.61]). Replicating the findings of Experiments 1–3, this main effect was not qualified by a higher-order interaction with Target Valence, $F(1, 642) = 2.25$, $p = .134$, $\eta_p^2 < .01$.

8.2.4. Dependence of valence asymmetries on dimension

Finally, to assess the impact of dimension on valence asymmetries, we preselected the data from those conditions in which the impression and target statements matched in terms of their dimension and submitted them to a 2 (Dimension: warmth vs. competence) × 2 (Valence Congruence: congruent vs. incongruent) × 2 (Target Valence: positive vs. negative) ANOVA. The analysis revealed a significant main effect of Valence Congruence, $F(1, 316) = 750.71$, $p < .001$, $\eta_p^2 = .70$, indicating that participants perceived higher levels of inconsistency when the impression statements and the target statement were evaluatively incongruent ($M = 5.93$, 95% CI [5.72, 6.13]) than when they were evaluatively congruent ($M = 1.90$, 95% CI [1.70, 2.10]). This main effect was qualified by a two-way interaction between Dimension and Valence Congruence, $F(1, 316) = 13.12$, $p < .001$, $\eta_p^2 = .04$. Further analyses revealed that the main effect of Valence Congruence was larger for the warmth dimension, $F(1, 316) = 463.94$, $p < .001$, $\eta_p^2 = .60$, compared to the competence dimension, $F(1, 316) = 293.56$, $p < .001$, $\eta_p^2 = .48$. Yet, the main effect of Valence Congruence was in the same direction and statistically significant for both dimensions. Critically, this interaction was not qualified by a higher-order interaction with Target Valence, $F(1, 316) = 0.02$, $p = .884$, $\eta_p^2 < .01$. These results replicate the main findings of Experiments 1–3, suggesting a lack of valence asymmetries in lay perceptions of inconsistency.

8.3. Discussion

Experiment 4 replicated the focal findings of Experiments 1–3 using a self-report measure of perceived inconsistency. As in our previous studies, valence incongruence was the primary determinant of perceived inconsistency, and this effect generalized across impression dimensions. Further, there was no evidence for valence asymmetries in lay perceptions of inconsistency, even when taking into account whether the impression was formed along the warmth or competence dimension. Because Experiment 4 utilized a multiple-item self-report measure of perceived inconsistency, these results rule out potential concerns that

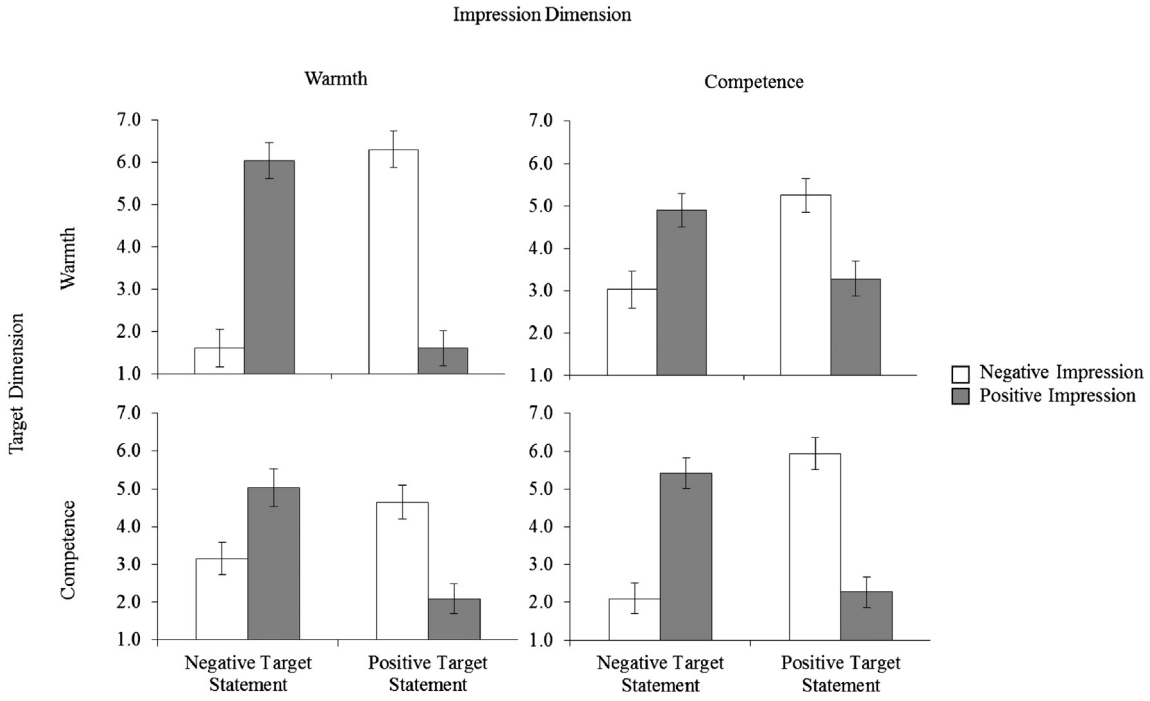

Fig. 5. Mean levels of perceived inconsistency as a function of Impression Dimension, Target Dimension, Target Valence, and Impression Valence, Experiment 4. Higher scores indicate higher levels of perceived inconsistency. Error bars represent 95% confidence intervals.

the obtained results (a) reflect idiosyncratic features of the paradigm or (b) were biased by uncontrolled measurement error.

9. General discussion

The goal of the current research was to investigate lay perceptions of inconsistency in impression formation. Using a memory-based measure of surprise (Experiments 1–3) and a self-report measure of perceived inconsistency (Experiment 4), we found an expectancy-violation effect of valence-incongruent information that generalized across the dimensions of warmth and competence: initial positive (negative) information along the warmth dimension led to a corresponding positive (negative) expectation along the competence dimension, and vice versa. Interestingly, our data showed no indication of a negativity bias in expectancy-violation. Expectancy-violation effects of positive information did not differ from expectancy-violation effects of negative information. Moreover, there was no evidence for differential valence asymmetries across the dimensions of warmth and competence. Instead, positive and negative information elicited equally strong expectancy-violation effects irrespective of the dimension along which the impression was formed. Together, these results suggest that (a) valence is a key determinant of perceived inconsistency in impression formation and (b) valence-incongruence effects generalize across the dimensions of warmth and competence.

The current studies diverge from previous research in several important ways. Primarily, the current research focuses on "psycho-logical" rather than logical consistency (see Gawronski & Brannon, in press). Although traditional definitions of inconsistency tend to emphasize logical relations between cognitive elements (e.g., Festinger, 1957), recent research suggests that people may rely on frameworks that allow logical inconsistencies to seem entirely consistent (e.g., unfalsifiable beliefs; Friesen, Campbell, & Kay, 2015). Conversely, people may view logically unrelated information as mutually constraining, as evidenced by the obtained relationships between warmth and competence (see also Judd et al., 2005; Kervyn et al., 2009, 2010, 2011). In the same vein, Johnson-Laird and colleagues (Johnson-Laird, 2012; Johnson-Laird et al., 2004) suggested that individuals untrained in formal logic can detect and reason about inconsistency via the use of mental models. According to their theory, individuals conclude that a set of propositions is consistent if they can conjure a mental model in which all of these propositions are true. If no such model can be accessed, the propositions are deemed as inconsistent. The current findings expand on these recent developments by identifying psycho-logical relations between positive and negative information about warmth and competence. Importantly, by focusing on lay perceptions of inconsistency before they are resolved, the current work provides novel insights for extant lines of research while also paving a new way for understanding how people identify, and subsequently resolve, inconsistencies between new information and currently held beliefs.

9.1. Theoretical implications

In addition to providing novel insights into lay perceptions of inconsistency, our results have important implications for extant theories of impression formation. Consistent with research by Judd et al. (2005), our data suggest a positive relation between warmth and competence in lay perceptions of inconsistency, implying that positive (negative) impressions along the warmth dimension lead to corresponding positive (negative) expectations along the competence dimension, and vice versa. Our data do not support perceived orthogonality between the two dimensions in lay perceptions of inconsistency, a possibility suggested by the SCM (Fiske et al., 2002, 2006).

Additionally, our studies failed to obtain evidence for a negativity bias in lay perceptions of inconsistency. In the current studies, expectancy-violation effects of valence-incongruent information did not depend on the valence of the novel information. Although this result may seem surprising, it is entirely consistent with expectancy-contrast and frequency-weight theories, which attribute the negativity bias to the prevalence of positive expectancies (Helson, 1964; Sherif & Sherif, 1967; Skowronski & Carlston, 1989). To the extent that people have strong negative expectancies, as might be claimed for the negative impression conditions of the current studies, impression-incongruent positive information may be as surprising as impression-incongruent negative information when people have strong positive expectancies.

In fact, the current work is not the only research to suggest that positive and negative information can elicit expectancy-violations of equal strength. Using the P300 wave as an indicator of surprise, Cacioppo et al. (1993) also found no evidence for valence asymmetries, in that participants showed similar neural activity in response to expectancy-violating information regardless of whether this information was positive or negative. Although the ERP literature has advanced since Cacioppo et al.'s findings were published, the convergence between their results, the results from our studies, and the aforementioned theoretical assumptions regarding the necessary conditions for negativity biases to occur raises important implications for lay perceptions of inconsistency. Together, these findings suggest that the negativity bias in impression formation may be due to processes involved in weighting and use of evaluative information, and these processes may not generalize to lay perceptions of inconsistency during encoding.

The finding that valence-incongruence effects generalized across the dimensions of warmth and competence also disconfirms the hypothesis of differential valence asymmetries, a possibility suggested by theories on the differential diagnosticity of positive and negative information (e.g., Reeder & Brewer, 1979; Skowronski & Carlston, 1987, 1989). Our data suggest that valence-incongruent information elicits equally strong expectancy-violation effects regardless of the impression dimension and regardless of whether the initial impression is positive or negative. Again, these results suggest that valence asymmetries in impression formation may be due to processes involved in the weighting and use of evaluative information, and these processes may not generalize to lay perceptions of inconsistency during encoding.

Although our data conflict with several predictions derived from extant theories, it is important to note that they do not disconfirm these theories. Instead, our data impose valuable constraints on the interpretation of these theories by suggesting that past findings might be specific to how novel information is integrated into an overall impression. However, the determinants of information integration do not seem to generalize to perceived inconsistencies between new information and existing impressions during encoding. Although a considerable body of research has investigated the integration of expectancy-congruent and expectancy-incongruent information into existing representations (for reviews, see Roese & Sherman, 2007; Sherman et al., 2012), the abovementioned theories revolve around the question of how initial information about unknown individuals is integrated into newly formed representations. The current research expands on these theories by focusing on the perception of novel information after the formation of expectancies. Because expectancies have a fundamental impact on information processing, the same information is often processed differently in the presence of expectancies compared to conditions without expectancies (Hamilton, 1998; see also Roese & Sherman, 2007). Thus, although our predictions were inspired by extant theories of impression formation, it does not seem surprising that our findings on what is perceived as inconsistent with prior impressions deviate from previously confirmed predictions regarding the formation of initial impressions (e.g., the impact of schematic beliefs about trait-behavior relations).

Our findings also have important implications for research on attitudes. Expanding on the notion of contextual renewal in animal learning, recent research suggests that counterattitudinal information often becomes mentally bound to the context in which it is learned (Gawronski & Cesario, 2013). As a result, evaluations tend to reflect the valence of counterattitudinal information only in the context in which this information had been acquired, and the valence of initial attitudinal information in any other context (e.g., Gawronski, Rydell, Vervliet, & De Houwer, 2010; Gawronski et al., 2014; Rydell & Gawronski, 2009). A central assumption in this research is that contextual renewal effects result from enhanced attention to contextual cues during exposure to expectancy-violating information, which leads to an integration of these cues into the representation of the expectancy-violating information. By showing that expectancy-violation effects of valence-incongruent information generalize across the dimensions of warmth and competence, the current research suggests that contextual renewal effects may be driven by the evaluative incongruence of initial impressions and novel information rather than their semantic incongruence at the level of specific impression dimensions.

9.2. Potential concerns

A potential concern that might be raised against the current findings is that the concept of warmth conflates sociability and morality. Although warmth and competence have been claimed to be the primary dimensions of impression formation (e.g., Cuddy et al., 2008; Judd et al., 2005), recent research suggests that morality is conceptually separate from social warmth and of primary importance in impression formation (Goodwin, 2015; Goodwin, Piazza, & Rozin, 2014). The current research treated social warmth and morality as overlapping constructs for two reasons. First, our research was informed by the more established literature in which these constructs were treated as one. We wanted to follow these conceptualizations as closely as possible to more easily identify the source of any potential discrepancies between our data and past findings. Second, Goodwin et al. (2014) pointed out that, although not fully overlapping, social warmth and morality are closely related and difficult to separate. Because our main question presupposes clearly defined, non-overlapping dimensions, warmth and competence were better suited for the purpose of the current studies. Nevertheless, future research investigating the influence of morality (as distinct from social warmth) would be beneficial. Considering that a person's moral traits moderate whether sociability and competence are viewed as desirable traits (Landy, Piazza, & Goodwin, 2016), it is possible that someone's moral traits also moderate how trait dimensions are implicated in perceived inconsistencies.

Another potential concern is that our findings may be driven by novelty detection, rather than expectancy-violation. For example, it is possible that attention to the background color of a positive target statement was increased not because the target statement was inconsistent with a previous negative impression, but because the positive statement constituted a novel stimulus that had not been previously presented in the task. There are a few pieces of evidence that (a) speak against such an interpretation and (b) support our claim that attention is enhanced as a result of expectancy-violation. First, the novelty detection argument does not explain why memory-performance was unaffected when a target statement regarding competence followed statements about warmth, and vice versa. After all, a change in dimension would also involve a novel type of stimulus that had not been previously presented. Yet, as our results suggest, a mere change in dimension did not significantly increase memory for the background color. Second, the conclusions drawn from the experiments using memory performance as an indicator of expectancy-violation were corroborated by Experiment 4, which did not rely on the assumption that expectancy-violations are responsible for enhanced attention to the context. In this study, participants were asked to rate the perceived inconsistency between (a) the target statement and the preceding statements and (b) the target statement and their initial impressions. Despite this difference, Experiment 4 replicated the main findings obtained with our memory paradigm. Finally, in support of our interpretation, past research aimed toward teasing apart effects of novelty and expectancy-violation suggests that enhanced attention is driven by expectancy-violations rather than novelty detection (Valchon, Hughes, & Jones, 2012). Together, these considerations support our interpretation in terms of expectancy-violation and rule out alternative interpretations in terms of novelty detection.

9.3. Future directions

Although the current research provides valuable insights into lay perceptions of inconsistency, more research is needed to determine the generality of the obtained effects. For example, research on

compensation effects (Kervyn et al., 2009, 2010, 2011) suggests that the integration of information regarding warmth and competence depends on whether the impression target is a group or an individual, and whether one target is being compared to another. Although previous research on this question speaks primarily to the integration of conflicting information, similar effects may occur at the level of expectancy-violation. By comparing expectancy-violation effects for individuals and groups in comparative and non-comparative contexts, research using the current paradigm would provide further insights into how inconsistencies are perceived before they are resolved.

Finally, the lack of research on lay perceptions of inconsistency is not limited to person perception. Cognitive consistency is implicated in many areas of research, including self-views (e.g., Swann, 1983), attitude change (e.g., Harmon-Jones et al., 2009), meaning-making (e.g., Proulx & Inzlicht, 2012), world-view defense (e.g., Friesen et al., 2015), and exploration in infants (e.g., Stahl & Feigenson, 2015). Yet, very few studies exist that operationalize (in)consistency from a lay perspective. Thus, adopting the approach taken in the current research could greatly improve theories and behavioral prediction in many domains.

10. Conclusion

The current research provides valuable insights into lay perceptions of inconsistency, addressing a major gap in the literature on impression formation. By investigating perceptions of inconsistency before they are resolved, our findings help to specify the processing stages at which the mechanisms hypothesized by extant theories come into play. We hope that the current research will inspire more research on lay perceptions of inconsistency, a topic that has received relatively little attention despite its significance for many important phenomena in social psychology.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jesp.2016.12.011.

References

Anderson, N. H. (1965). Averaging versus adding as a stimulus-combination rule in impression formation. *Journal of Experimental Psychology*, *70*, 394–400.

Asch, S. E. (1946). Forming impressions of personality. *The Journal of Abnormal and Social Psychology*, *41*, 258–290.

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, *5*, 323–370.

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*, *6*, 3–5.

Cacioppo, J. T., Crites, S. L., Jr., Berntson, G. G., & Coles, M. G. H. (1993). If attitudes affect how stimuli are processed, should they not affect the event-related brain potential? *Psychological Science*, *4*, 108–112.

Cuddy, A. J. C., Fiske, S. T., & Glick, P. (2008). Warmth and competence as universal dimensions of social perception: The stereotype content model and the BIAS map. *Advances in Experimental Social Psychology*, *30*, 61–149.

Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, IL: Row Peterson.

Fiske, S. T., Cuddy, A. J. C., & Glick, P. (2006). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences*, *11*, 77–83.

Fiske, S. T., Cuddy, A. J. C., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology*, *82*, 878–902.

Friesen, J. P., Campbell, T., & Kay, A. C. (2015). The psychological advantage of unfalsifiability: The appeal of untestable religious and political ideologies. *Journal of Personality and Social Psychology*, *108*, 515–529.

Fuhrman, R. W., Bodenhausen, G. V., & Lichtenstein, M. (1989). On the trait implications of social behaviors: Kindness, intelligence, goodness, and normality ratings for 400 behavior statements. *Behavior Research Methods, Instruments, & Computers*, *21*, 587–591.

Gawronski, B. (2012). Back to the future of dissonance theory: Cognitive consistency as a core motive. *Social Cognition*, *30*, 652–668.

Gawronski, B., & Brannon, S. M. (2016). What is cognitive consistency and why does it matter? In E. Harmon-Jones (Ed.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (2nd ed.). Washington, DC: American Psychological Association (in press).

Gawronski, B., & Cesario, J. (2013). Of mice and men: What animal research can tell us about context effects on automatic responses in humans. *Personality and Social Psychology Review*, *17*, 187–215.

Gawronski, B., & Strack, F. (Eds.). (2012). *Cognitive consistency: A fundamental principle in social cognition*. New York: Guilford Press.

Gawronski, B., Rydell, R. J., Vervliet, B., & De Houwer, J. (2010). Generalization versus contextualization in automatic evaluation. *Journal of Experimental Psychology: General*, *139*, 683–701.

Gawronski, B., Ye, Y., Rydell, R. J., & De Houwer, J. (2014). Formation, representation, and activation of contextualized attitudes. *Journal of Experimental Social Psychology*, *54*, 188–203.

Goodwin, G. P. (2015). Moral character in person perception. *Current Directions in Psychological Science*, *24*, 38–44.

Goodwin, G. P., Piazza, J., & Rozin, P. (2014). Moral character predominates in person perception and evaluation. *Journal of Personality and Social Psychology*, *106*, 148–168.

Hamilton, D. L. (1998). Dispositional and attributional inferences in person perception. In J. M. Darley, & J. Cooper (Eds.), *Attribution and social interaction: The legacy of Edward E. Jones* (pp. 99–114). Washington: DC: American Psychological Association.

Harmon-Jones, E., Amodio, D., & Harmon-Jones, C. (2009). Action based model of dissonance: A review, integration, and expansion of conceptions of cognitive conflict. *Advances in Experimental Social Psychology*, *41*, 119–166.

Hauser, D. J., & Schwarz, N. (2016). Attentive Turkers: MTurk participants perform better on online attention checks than do subject pool participants. *Behavior Research Methods*, *48*, 400–407.

Heine, S. J., Proulx, T., & Vohs, K. D. (2006). The meaning maintenance model: On the coherence of social motivations. *Personality and Social Psychological Review*, *10*, 88–111.

Helson, H. (1964). *Adaptation-level theory*. New York: Harper.

Johnson-Laird, P. N. (2012). Mental models and consistency. In B. Gawronski, & F. Strack (Eds.), *Cognitive consistency: A fundamental principle in social cognition* (pp. 225–244). New York, NY: Guilford Press.

Johnson-Laird, P. N., Girotto, V., & Legrenzi, P. (2004). Reasoning from inconsistency to consistency. *Psychological Review*, *111*, 640–661.

Judd, C. M., James-Hawkins, L., Yzerbyt, V., & Kashima, Y. (2005). Fundamental dimensions of social judgment: Understanding the relations between judgments of competence and warmth. *Journal of Personality and Social Psychology*, *89*, 899–913.

Kanouse, D. E., & Hanson, L. R., Jr. (1972). Negativity in evaluations. In E. E. Jones, D. E. Kanouse, H. H. Kelley, R. E. Nisbett, S. Valins, & B. Weiner (Eds.), *Attribution: Perceiving the causes of behavior* (pp. 47–62). Hillsdale, NJ: Lawrence Erlbaum Associates.

Kay, A. C., Gaucher, D., Napier, J. L., Callan, M. J., & Laurin, K. (2008). God and the government: Testing a compensatory control mechanism for the support of external systems. *Journal of Personality and Social Psychology*, *95*, 18–35.

Kervyn, N., Judd, C. M., & Yzerbyt, V. Y. (2009). You want to appear competent? Be mean! You want to appear sociable? Be lazy! Group differentiation and the compensation effect. *Journal of Experimental Social Psychology*, *45*, 363–367.

Kervyn, N., Yzerbyt, V. Y., & Judd, C. M. (2010). Compensation between warmth and competence: Antecedents and consequences of a negative relation between the two fundamental dimensions of social perception. *European Review of Social Psychology*, *21*, 155–187.

Kervyn, N., Yzerbyt, V. Y., & Judd, C. M. (2011). When compensation guides inferences: Indirect and implicit measures of the compensation effect. *European Journal of Social Psychology*, *41*, 144–150.

Kutner, M. H., Nachtsheim, C. J., Neter, J., & Li, W. (2005). *Applied linear statistical models* (5th ed.). New York, NY: McGraw-Hill/Irwin.

Landy, J. F., Piazza, J., & Goodwin, G. P. (2016). When it's bad to be friendly and smart: The desirability of sociability and competence depends on morality. *Personality and Social Psychological Bulletin*, *42*, 1272–1290.

Noordewier, M., & Breugelmans, S. M. (2013). On the valence of surprise. *Cognition and Emotion*, *27*, 1326–1334.

Oppenheimer, D. M., Meyvis, T., & Davidenko, N. (2009). Instructional manipulation checks: Detecting satisficing to increase statistical power. *Journal of Experimental Social Psychology*, *45*, 867–872.

Peeters, G., & Czapinski, J. (1990). Positive-negative asymmetry in evaluations: The distinction between affective and informational negativity effects. *European Review of Social Psychology*, *1*, 33–60.

Proulx, T., & Inzlicht, M. (2012). The five "A"s of meaning maintenance: Finding meaning in the theories of sense-making. *Psychological Inquiry*, *23*, 317–335.

Reeder, G. D., & Brewer, M. B. (1979). A schematic model of dispositional attribution in interpersonal perception. *Psychological Review*, *86*, 61–79.

Roese, N. J., & Sherman, J. W. (2007). Expectancies. In E. T. Higgins, & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 91–115) (2nd ed.). New York: Guilford Press.

Rosenberg, S., Nelson, C., & Vivenkananthan, P. S. (1968). A multidimensional approach to the structure of personality impressions. *Journal of Personality and Social Psychology*, *9*, 283–294.

Rothbart, M., & Park, B. (1986). On the confirmability and disconfirmability of trait concepts. *Journal of Personality and Social Psychology*, *50*, 131–142.

Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, *5*, 296–320.

Rydell, R. J., & Gawronski, B. (2009). I like you, I like you not: Understanding the formation of context-dependent automatic attitudes. *Cognition and Emotion*, *23*, 1118–1152.

Sherif, M., & Sherif, C. W. (1967). Attitudes as the individual's own categories: The social judgment approach to attitude change. In C. W. Sherif, & M. Sherif (Eds.), *Attitude, ego involvement, and change* (pp. 105–139). New York: Wiley.

Sherman, J. W., Allen, T. J., & Sacchi, D. L. M. (2012). Stereotype confirmation and disconfirmation. In B. Gawronski, & F. Strack (Eds.), *Cognitive consistency: A fundamental principle in social cognition* (pp. 390–423). New York: Guilford Press.

Skowronski, J. J., & Carlston, D. E. (1987). Social judgment and social memory: The role of cue diagnosticity in negativity, positivity, and extremity biases. *Journal of Personality and Social Psychology*, *52*, 689–699.
Skowronski, J. J., & Carlston, D. E. (1989). Negativity and extremity biases in impression formation: A review of explanations. *Psychological Bulletin*, *105*, 131–142.
Stahl, A. E., & Feigenson, L. (2015). Observing the unexpected enhances infants' learning and exploration. *Science*, *348*, 91–94.
Swann, W. B., Jr. (1983). Self-verification: Bringing social reality into harmony with the self. In J. Suls, & A. G. Greenwald (Eds.), *Social psychological perspectives on the self. Vol. 2*. (pp. 33–66). Hillsdale, NJ: Erlbaum.
Topolinski, S., & Strack, F. (2015). Corrugator activity confirms immediate negative affect in surprise. *Frontiers in Psychology*, *6*, 134.
Valchon, F., Hughes, R. W., & Jones, D. M. (2012). Broken expectations: Violation of expectancies, not novelty, captures auditory attention. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *38*, 164–177.
Van den Bos, K. (2009). Making sense of life: The existential self trying to deal with personal uncertainty. *Psychological Inquiry*, *20*, 197–217.