Illusory trust

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RESEARCH ARTICLE

Illusory trust: Kanizsa shapes incidentally increase trust and willingness to invest

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Abstract

Previous research has shown that the completion of basic perceptual processes is intrinsically pleasant. In the absence of diagnostic and objective cues to trustworthiness, nondiagnostic factors such as positive affect can incidentally lead to reported and behavioral trust. On the basis of these two premises, it was tested whether positive affect from the completion of perceptual processes has implications for the formation of trust in first-time business-consumer interactions. We tested this hypothesis in four experiments, using the famous Kanizsa illusion as an exemplary perceptual process that has been shown to trigger positive affect. We found that participants trusted companies who featured a Kanizsa shape as their logo more than companies with closely matched logos that did not allow for the completion of a basic perceptual process. This was evident on self-reported (Experiment 1) as well as behavioral (Experiments 2–4) measures of trust. This effect even persisted under incentivized conditions (Experiment 4) and was partially mediated by the intrinsic pleasantness of perception (Experiment 3). These findings for the first time demonstrate that positive affect is not the only consequence of perception, but rather has further trickle-down consequences for social judgments and economic decision making. Perceptual illusions seem to elicit illusory trust. Therefore, these novel findings bear important implications not only for both logo design and marketing but also for consumer decision making.

KEYWORDS
affect, economic behavior, illusory contours, Kanizsa shapes, trust

1 | INTRODUCTION

Trust is commonly defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectations that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or to control that other party" (Mayer, Davis, & Schoorman, 1995, p. 712). As decisions based on trust always involve risk, trustworthiness is a universally admired quality in both informal and professional contexts such as business relations (Huang & Wilkinson, 2013; Jaeger, Sleegers, Evans, Stel, & van Beest, 2019). Studies have shown that trust increases the satisfaction and long-term orientation of companies toward their business partners even when controlling for the economic outcome of the business relation (for a meta-analysis, see Geyskens, Steenkamp, & Kumar, 1998).

Although clearly important, trust is hard to establish and easy to disrupt (for overviews, see Kramer, 1999; Rousseau, Sitkin, Burt, & Camerer, 1998). In general, there are two routes to trustworthiness. First, behaving in a cooperative and reciprocal manner breeds trust. Reciprocating the trust of another party in a cooperative way is one of the most important objective, that is, diagnostic trust cues (e.g., King-Casas et al., 2005; Zürn & Topolinski, 2019). However, in most cases, establishing trust by such means takes time and necessitates the interaction partner's capacity to encode that one behaved in a trustworthy manner.

A notable exception in this regard are gaze cues, which are diagnostic but can affect trustworthiness even under conditions where participants are asked to ignore them (Strachan, Kirkham, Manssuer, & Tipper, 2016). For instance, in an early study on the effects of gaze cueing on trustworthiness, participants were asked to react to the location of a target object as quickly as possible (Bayliss & Tipper, 2006). In addition, two faces were presented around the target object, but participants were asked to ignore those faces. Importantly, one of the two faces always provided a valid gaze cue for the location of the target (i.e., by looking at the location where the target would eventually appear), whereas the other provided invalid cues. Although participants were instructed to ignore the gaze cues, subsequent ratings of the two faces' trustworthiness indicated that participants picked up on this (valid) cue to trustworthiness (Bayliss & Tipper, 2006; see also Strachan et al., 2016).

Secondly, in many situations, for instance, first-time interactions, objective information about the trustworthiness of another party is not available. In such situations, hard economic facts are often not the central cues for decision making (Dunning, Fetchenhauer, & Schlösser, 2012). Without objective trust cues, incidental factors can become important for the formation of trust. For instance, even though facial features and expressions can be feasible cues to correctly determine the trustworthiness of others (Centorrino, Djemai, Hopfensitz, Milinski, & Seabright, 2015; De Neys, Hopfensitz, & Bonnefon, 2015), smiling or attractive interaction partners are also generally trusted more (Jaeger, Evans, Stel, & van Beest, 2019; Krumhuber et al., 2007). Often, these cues are nondiagnostic for the trustworthiness of a party, and trust is rather based on feelings that an interaction partner is trustworthy. Past research has shown that in the absence of objective trust cues, individuals rely on nondiagnostic features such as incidentally elicited positive mood (Mislin, Williams, & Shaughnessy, 2015), the articulatory fluency of an interaction partner's name (Zürn & Topolinski, 2017) and also felt sympathy for (Erle, Ruessmann, & Topolinski, 2018) and similarity to (Plötner, Over, Carpenter, & Tomasello, 2015) an interaction partner. A common theme between these incidental cues is that trustworthiness is based on feelings of interpersonal closeness or positive affect.

In this paper, we explore a novel incidental route to trustworthiness that is related to basic perceptual processing. Specifically, recent research has shown that perceptual processing is intrinsically pleasant. Multiple series of studies have demonstrated that the completion of basic perceptual processes (e.g., visual disambiguation, Gestalt completion, or illusory contour perception) triggers positive affect (Erle, Reber, & Topolinski, 2017; Topolinski, Erle, & Reber, 2015). Further studies have shown that these effects are independent of fluency (Erle & Topolinski, 2019; Flavell, Tipper, & Over, 2018) and thus directly emanate from perception, irrespective of how effortful it is. Finally, these momentary inductions of positive affect are immediate and do not hinge on the conscious recognition that a perceptual process was completed (Topolinski et al., 2015). Although past research thoroughly established that perception is intrinsically pleasant, an important open question is whether this positive affect has further downstream consequences for judgments and decision making.

The present research explores such consequences, specifically the effects of basic perceptual processing on reported and behavioral trust. As incidental trust is closely tied to feelings of positive affect, we predicted that completing an intrinsically pleasant perceptual process incidentally increases trust, too. As an exemplary perceptual process that has been used in previous research (e.g., Erle et al., 2017; Erle & Topolinski, 2019; Flavell et al., 2018) we chose the well-known Kanizsa illusion (Kanizsa, 1955, 1976); see right of Figure 1. Almost universally, a white square is perceived in the middle of the four inwards-oriented inducer disks, although objectively there is no change in color or luminance along the borders of the illusorily completed square. The Kanizsa illusion occurs automatically, almost immediately (Seghier & Vuilleumier, 2006) and cannot be prevented or "unseen" (Keane,
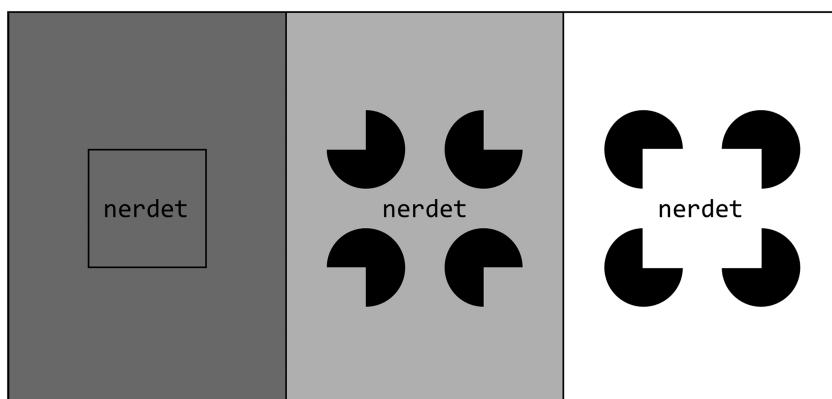
FIGURE 1 Exemplary stimuli used across all experiments. Left: Contour-matched control shape. Middle: Perceptually matched control shape. Right: Kanizsa shape allowing for illusory contour perception. Experiments 2–4 used the contrast displayed in the middle panel

Lu, Papathomas, Silverstein, & Kellman, 2012; Keane, Mettler, Tsoi, & Kellman, 2011). On the basis of research showing that it is also intrinsically pleasant (Erle et al., 2017; Flavell et al., 2018), we predicted that the perception of an illusory contour creates illusory trust because it triggers positive affect.

In the context of business–consumer relations, the Kanizsa illusion can easily be implemented by manipulating the logo of a company or brand to (not) allow for illusory contour perception. In fact, in first-time business interactions, logos are the most immediate sources of information a consumer will attend to outside of the desired product (Park, Eisingerich, Pol, & Park, 2013; Pieters & Wedel, 2004). In the present set of experiments, we removed information about brands and companies to directly investigate whether having a logo allowing for the completion of an intrinsically pleasant perceptual process would prompt people to put their trust in an unknown company.

Thus, in addition to expanding research on social–cognitive properties of perception, this project is also important for researchers interested in trust. For instance, illusory trust from perception would have direct applied economic implications for companies that want to appear trustworthy. In contrast to trust based on objective cues (e.g., reciprocity), the presently investigated method can establish trust quickly—without any history of reciprocity and irrespective of the consumers' ability to encode the company's behavior as trustworthy.

To summarize, we predicted that companies with a Kanizsa shape as their logo would be liked more and therefore trusted more than companies with closely matched control logos. As experimental control stimuli, we chose one stimulus that was matched to the perceptual entropy of a Kanizsa square (middle of Figure 1; see Senkowski, Röttger, Grimm, Foxe, & Herrmann, 2005) and one stimulus that differed in perceptual entropy but was comparable in figural closure—a regular square (left of Figure 1).

2 | OPEN PRACTICES, DATA HANDLING, AND DATA ANALYSIS

All data, analysis scripts, and materials are openly available at https://osf.io/fnkjm/. The sample size of Experiment 1 was based on previous research on affective consequences of illusory contour perception (Erle et al., 2017; Experiment 1). Experiment 2 aimed to mirror the number of observations of Experiment 1. In Experiment 1, $N = 20$ participants contributed 24 data points to the focal analysis for a total of 480. Thus, for Experiment 2, where participants contributed only three data points, we aimed for a sample of $N = 160$ people, which was slightly adjusted for Experiment 3 given the observed effect size of Experiment 2 for a target $N = 168$. Finally, we decided to double the target sample size for the final (incentivized) Experiment 4, anticipating that more participants would be unwilling to risk their compensation for the experiment (target $N = 336$). All experiments, conditions, and measures are reported. No participant was excluded from any experiment.

3 | EXPERIMENT 1

Experiment 1 sought to demonstrate that companies with a Kanizsa shape as their logo are rated as more trustworthy than companies with comparable logos that do not involve an illusory contour. The study was framed as investigating intuitive trust in business interactions. Participants had to imagine being investors looking to expand their portfolio by acquiring stocks of different companies. Participants were presented with only company names and logos and had to decide which of two presented companies they would rather entrust with an investment.

It was predicted that in the absence of objective cues to trustworthiness, participants would rely on incidental trust cues. Because people intuitively trust agents they like (e.g., Erle et al., 2018; also in monetary transactions, see Zürn & Topolinski, 2017) and because illusory contour perception is intrinsically pleasant (see Erle et al., 2017; Flavell et al., 2018), it was predicted that participants would trust companies with Kanizsa logos more than other companies because the perception of illusory contours feels good.

3.1 | Method

Participants completed a binary choice task. During every trial, they were presented with the logos and names of two companies and they had to decide which company they trusted more (i.e., which company's stock they would rather acquire). In Experiment 1, company names were easy-to-pronounce nonanagrams with a length of 6–10 letters, adapted from Topolinski, Bakhtiari, and Erle (2016), that is, pronounceable letter strings without any meaning. Company names were randomly drawn from a larger list for every trial (for all stimuli, see https://osf.io/fnkjm/).

There were three company logos: (1) logos where the company name was printed inside a Kanizsa square, (2) logos where the company name was printed within an inverted Kanizsa shape (perceptually matched controls), and (3) logos where the company name was printed within a regular square (contour-matched controls); see Figure 1. The first type of control stimuli was matched to the perceptual entropy of Kanizsa shapes (adopted from Senkowski et al., 2005). Regular geometric shapes were added because whereas Kanizsa shapes imply a square in their middle, inverted Kanizsa shapes do not. All logos were presented against either white or gray backgrounds to create a more varied stimulus set. Company names and logos were presented for an unconstrained period. All stimuli are available at https://osf.io/fnkjm/.

Participants were instructed to respond with the S and K keys on every trial. The S key indicated that they trusted the company presented on the left more and the K key indicated that they trusted the company presented on the right more. For every level of contrast, every company logo appeared once on the left and once on the right side in combination with a company logo of both other types. Thus, there was a total of 36 trials. Out of those 36 trials, 24 involved Kanizsa shapes. Those trials were the target

of the main analyses. In a secondary analysis, selections for the remaining 12 trials involving the two control stimuli were compared.

3.1.1 | Sample

Participants were recruited on Prolific Academic (Damer & Bradley, 2014) for a 9-min study and were compensated with 0.75 £. The sample consisted of $N = 21$ participants ($n = 9$ female, $n = 11$ male, $n = 1$ demographic data lost; age: $M = 28.10$, $SD = 10.00$).

3.2 | Results

Data of the 24 focal trials were analyzed in a mixed model analysis. In a logistic regression framework (Bates, Maechler, Bolker, & Walker, 2014), selections (Kanizsa stimuli coded as 1, control stimuli coded as 0) were predicted by a fixed intercept (the effect of interest), a fixed effect for control (comparisons between Kanizsa and contour-matched control stimuli coded as 1, comparisons with perceptually matched control stimuli coded as 0), and random intercepts for subject and stimulus. Because the model did not converge with the planned random effects structure, we removed the random intercept for stimulus in line with common recommendations (Barr, Levy, Scheepers, & Tily, 2013).

Additionally, data of the 12 nonfocal trials, that is, trials involving only control stimuli, were analyzed by fitting a similar mixed model (contour-matched controls coded as 1, perceptually matched controls coded as 0) and the same random effect structure. A positive intercept here indicated a preference of regular squares over inverted Kanizsa shapes.

3.2.1 | Main analysis

In line with the prediction, the mixed model analysis yielded a significant positive fixed effect of intercept, $b = 2.18$, $SE = 0.45$, $z = 4.81$, $p < .001$, indicating that generally, Kanizsa stimuli were selected as more trustworthy than the control stimuli (in 70.03% of the cases). In addition, there was an unexpected fixed effect of control, $b = -1.53$, $SE = 0.25$, $z = -6.10$, $p < .001$, indicating that this preference was smaller for the comparison between Kanizsa and contour-matched controls. To explore this unexpected effect, we computed binomial tests comparing the observed selection frequencies for Kanizsa logos against a random distribution. These tests indicated that Kanizsa stimuli were preferred significantly in both cases, but the preference was stronger for outwards-oriented Kanizsa shapes (perceptually matched controls; 80.95% Kanizsa selections, $p < .001$) than for regular squares (contour-matched controls; 59.12% Kanizsa selections, $p = .004$). Finally, the random effect variance was quite small, $s^2 = 3.24$, indicating that the

overall preference for Kanizsa stimuli was quite uniform across participants.

3.2.2 | Secondary analysis

This mixed model also yielded a significant positive effect of intercept, $b = 2.75$, $SE = 1.27$, $z = 2.17$, $p = .030$. Participants preferred regular squares (contour-matched controls) over outwards-oriented Kanizsa shapes (perceptually matched controls), selecting them as more trustworthy in 70.24% of the trials. The random effect variance indicated that this preference varied much more across participants, $s^2 = 19.85$, than the preference for Kanizsa stimuli over these two categories, although it should be noted that the main analysis included an additional fixed effect.

3.3 | Discussion

Experiment 1 demonstrated that participants show higher levels of intuitive trust in companies that feature an intrinsically pleasant Kanizsa shape in their logo. Moreover, a preference for contour-matched over perceptually matched control stimuli was observed. Similarly, although significant in both cases, the preference for Kanizsa stimuli over contour-matched stimuli was also smaller than for perceptually-matched controls. Although this is of lesser theoretical interest, it is in line with previous research showing that inverted Kanizsa shapes can lead to visual disappointment when contrasted with "real" Kanizsa shapes (Erle & Topolinski, 2019). However, it should be noted that this preference varied a lot between participants, and an alternative conclusion is that some participants prefer closure over complexity, whereas others prefer higher perceptual entropy over figural closure. Potentially, the selected sample might not have been representative for the frequencies of these two preferences.

Although the main analysis demonstrated the theoretically predicted effect, the study is limited in three ways. First, participants were forced to select a company during every trial. Second, trust was assessed at a nominal scale level, not allowing inferences about the magnitude of the effect. Finally, the mediator of positive affect was not assessed, and trust could have arisen for other reasons. Before testing the theoretically predicted mediation, Experiment 2 expanded these findings to more ecologically valid investment scenarios.

4 | EXPERIMENT 2

The second experiment was a conceptual replication of Experiment 1. Participants again imagined being investors who seek to expand their portfolios by acquiring stocks of different companies. This time, however, they did so in a resource allocation task where they could invest resources in different volatile stocks. This had the advantage that participants could decide not to invest in any

company and that investments were assessed continuously rather than as a binary choice. Moreover, constrained optimization of this kind is the prototypical decision problem in economic theorizing, and rational choice would predict indifference regarding the allocation of resources when no diagnostic information about the alternatives is available. Furthermore, from a risk-aversion account, decision makers should invest nothing if they assume that the stocks' expected payoffs do not differ from the safe alternative (i.e., keeping the resources). However, if Kanizsa shapes can induce illusory trust, investments should be biased toward companies featuring the visual illusion in their logo.

4.1 | Method

Participants were first presented with the logos and names of three companies for 5 s each in a random order. Again, participants were not given any information about the companies. Except for two minor deviations, the stimuli were the same as in Experiment 1. First, the background color did not vary anymore and was set to one shade of gray from Experiment 1. Second, the length of the company names was restricted to six letters. Both changes were implemented because in this experiment, brands were presented alone rather than in pairs, and we wanted to avoid systematic differences on unrelated features such as contrast or name length between the three companies. All stimuli are available at https://osf.io/fnkjm/.

After being familiarized with the three companies, participants were endowed with 500 investment units for the resource allocation task. Participants could allocate their resources to the three companies but could also keep as many investment units as they want to themselves if they felt that they did not sufficiently trust any company. Each investment unit represented the acquisition of one stock. Participants were told that they would not learn how the companies developed after their investment and thus whether their trust paid off.

4.1.1 | Sample

Participants were recruited on Prolific Academic for a 5-min study and were compensated with 0.50£. The sample consisted of $N = 155$ participants ($n = 66$ female, $n = 85$ male, $n = 4$ demographic data lost; age: $M = 29.85$, $SD = 10.18$). Trust data of $n = 1$ participant were lost.

4.2 | Results

Data were analyzed using a repeated-measures analysis of variance (ANOVA) with logo (Kanizsa vs. Contour-matched vs. Perceptually matched logos) as the sole independent variable. Subsequently, paired-samples t tests comparing the investments in the Kanizsa and the other two companies were computed. A secondary analysis compared investments between the control companies.
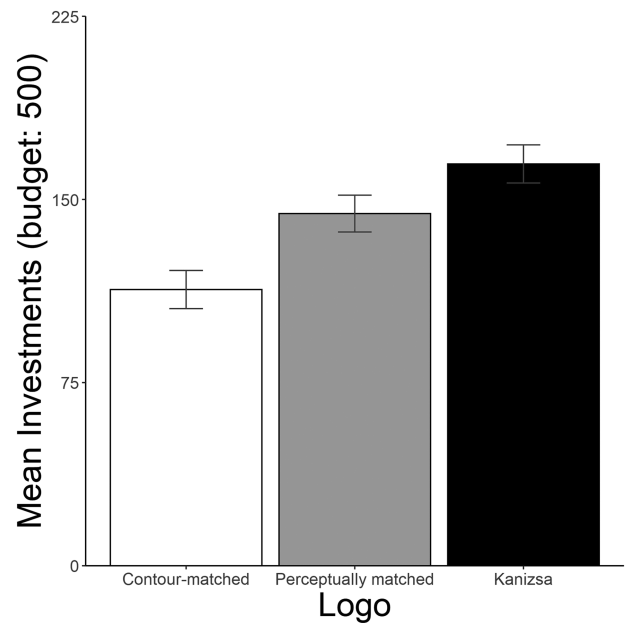
FIGURE 2 Mean investments as a function of company logo in Experiment 2. Error bars indicate $+/-1$ SE

4.2.1 | Main analysis

The ANOVA yielded a significant main effect, $F(2, 306) = 9.52$, $p < .001$. As can be seen in Figure 2, participants on average invested significantly more investment units in companies with Kanizsa logos than in the contour-matched companies ($\Delta_{allocations} = 51.49$ units, $CI_{95\%}$ [26.90, 76.10]), $t(153) = 4.14$, $p < .001$, $d_z = 0.34$. For the perceptually matched controls, this effect was not significant on the basis of classical significance thresholds, $t(153) = 1.81$, $p = .073$, $d_z = 0.15$, although the effect ($\Delta_{allocations} = 20.31$ units, $CI_{95\%}$ [−1.95, 42.58]) was in the expected direction. Even in this unincentivized study, participants decided to keep around 15% of their investment units ($M = 78.09$, $SD = 131.28$).

4.2.2 | Secondary analysis

In contrast to Experiment 1 where participants preferred contour-matched over perceptually matched control logos, here participants invested more in the perceptually matched over the contour-matched companies ($\Delta_{allocations} = 31.17$ units, $CI_{95\%}$ [7.62, 54.73]), $t(153) = 2.61$, $p = .010$, $d_z = 0.21$.

4.3 | Discussion

Experiment 2 again demonstrated that participants develop illusory trust in companies that feature a Kanizsa shape in their logo. Compared with Experiment 1, this experiment had the advantage that

participants were not forced to trust and invest in any of the companies. In fact, although the experiment was not incentivized, on average, participants decided to keep around 15% of their budget even though investing bore no financial risk at all. Also, this experiment allows us to quantify the effect size on the metric of allocated resources: Participants on average invested more in stocks of companies with Kanizsa logos, compared with both perceptually matched (14.08% more) and contour-matched control logos (45.53% more).

Additionally, the comparison between the two control shapes yielded the opposite result as in Experiment 1, and companies with perceptually matched control logos were trusted more than companies with contour-matched control logos (27.57% more). One explanation for this reversal could be differences in the experimental designs of Experiment 1 and 2: Previous research has shown that outwards-oriented Kanizsa stimuli are rated as somewhat pleasant in the absence of "real" inwards-oriented Kanizsa stimuli (Erle & Topolinski, 2019). By themselves, participants consider them an idiosyncratic geometric arrangement. Only when they are contrasted with shapes that allow for illusory contour perception, they become visually disappointing because they prevent an anticipated and intrinsically pleasant perceptual process. Whereas in Experiment 1, outwards-oriented and real Kanizsa stimuli were juxtaposed quite frequently, in Experiment 2, each shape was presented only once, and this might have limited visual disappointment for perceptually matched control stimuli. Because this pattern persisted in the remaining experiments, we will return to it in the general discussion.

5 | EXPERIMENT 3

Experiment 3 was a direct replication and extension of Experiment 2. The goal of this study was to assess the theoretically predicted mediator of the effect Kanizsa shapes have on trust. Specifically, it was predicted that participants trust a company more because of the positive affect that is caused by the perception of an illusory contour. This prediction was tested in a mediation analysis.

5.1 | Method

All parameters were the same as in Experiment 2. The only change was that between the exposition to the companies and the resource allocation task, participants were asked to rate how much they liked the three companies on a scale of 0 ("not at all") to 10 ("very much"). Previous research has shown that this measure validly captures momentary changes in positive as well as negative affect (Erle et al., 2017; Exp. 2).

5.1.1 | Sample

Participants were recruited on Prolific Academic for a 5-min study and were compensated with 0.50£. The sample consisted of $N = 177$ participants ($n = 71$ female, $n = 98$ male, $n = 2$ preferred not to say, $n = 6$ demographic data lost; age: $M = 30.91$, $SD = 10.59$).

5.2 | Results

Both affective reactions and investments were subjected to the same analysis as in Experiment 2. Additionally, a mediation analysis was conducted following the procedure suggested by Baron and Kenny (1986).

5.2.1 | Liking

The ANOVA yielded a significant main effect, $F(2, 352) = 25.31$, $p < .001$. As can be seen in Figure 3, participants on average liked companies with Kanizsa logos significantly more than in the contour-matched companies, $t(176) = 6.63$, $p < .001$, $d_z = 0.50$. For the perceptually matched controls, this effect was not significant on the basis of classical significance thresholds, $t(176) = 1.88$, $p = .061$, $d_z = 0.14$,
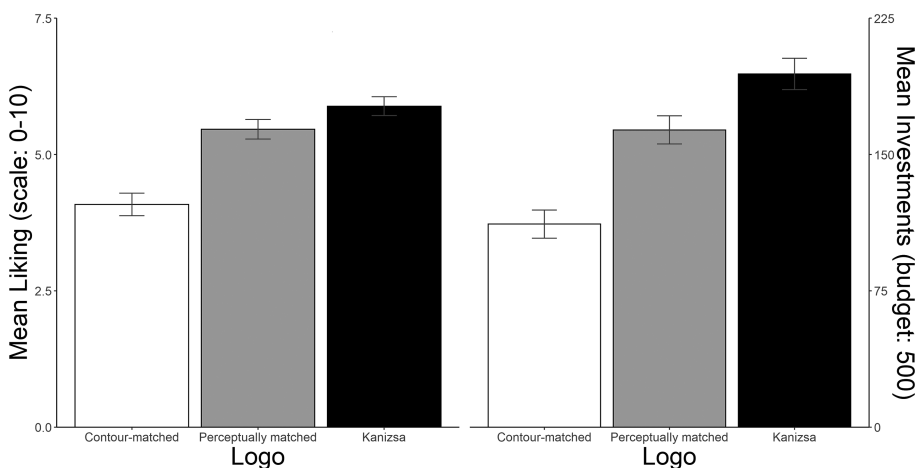
FIGURE 3 Left: Mean liking of the companies as a function of company logo in Experiment 3. Right: Mean investments as a function of company logo in Experiment 3. Error bars indicate +/−1 SE

although the effect was in the expected direction and has been demonstrated multiple times before (Erle et al., 2017; Flavell et al., 2018).

5.2.2 | Investments

The ANOVA yielded a significant main effect, $F(2, 352) = 19.26$, $p < .001$. As can be seen in Figure 3, participants on average invested significantly more investment units in companies with Kanizsa logos than in both the contour-matched ($\Delta_{allocations}$ = 82.58 units, $CI_{95\%}$ [55.00, 110.00]), $t(176) = 5.91$, $p < .001$, $d_z = 0.45$, and the perceptually matched controls ($\Delta_{allocations}$ = 30.74 units, $CI_{95\%}$ [3.82, 57.66]), $t(176) = 2.25$, $p = .025$, $d_z = 0.17$. Also, participants generally invested more, keeping only around 6% of their investment units ($M = 30.44$, $SD = 86.74$).

5.2.3 | Mediation analysis

The mediation analysis followed the classical approach of testing component paths between independent variables, mediator, and dependent variable (Baron & Kenny, 1986). Bootstrap confidence intervals were calculated with 5,000 iterations (using the R package lme4; Bates et al., 2014).

In the first step, we predicted investments by a contrast comparing Kanizsa logos with both control conditions, a second contrast comparing both control conditions with each other, and an intercept. To specify the contrasts, we followed Hayes and Preacher (2014). In addition to these fixed effects, we included random slopes for both contrasts. On average, participants invested 156.52 units per company, $\beta = 156.52$, $CI_{95\%}$ = [152.15, 160.76]. In line with the ANOVA, investments were higher for Kanizsa logos, $\beta = 56.66$, $CI_{95\%}$ = [31.95, 81.46], compared with the control conditions. Moreover, perceptually matched control logos received more investments than contour matched logos, $\beta = 51.84$, $CI_{95\%}$ = [26.98, 77.31]. For the second step, we conducted a parallel analysis predicting affective reactions to the logos (z-standardized). Crucially, affective reactions to Kanizsa logos were more positive than reactions to the control logos, $\beta = 0.43$, $CI_{95\%}$ = [0.27, 0.59]. Also, affective reactions were more positive toward the perceptually matched control logos, $\beta = 0.53$, $CI_{95\%}$ = [0.32, 0.76]. In the final step, we added z-standardized affective reactions as a predictor in the model specified in Step 1 (also including the interactions with the contrasts). The results suggest a partial mediation of the logo effects by the affective reactions toward them. That is, although affective reactions significantly predicted investments, $\beta = 37.54$, $CI_{95\%}$ = [30.55, 44.54], both the contrast comparing Kanizsa logos with the control logos, $\beta = 40.08$, $CI_{95\%}$ = [18.51, 62.46], and the contrast comparing the control logos with each other, $\beta = 31.70$, $CI_{95\%}$ = [11.00, 51.92], remained significantly positive. The analysis did not indicate any significant interactions.

5.3 | Discussion

In Experiment 3, companies with a Kanizsa shape as their logo again elicited illusory trust, leading participants to invest more in their stocks (18.80% and 73.92% more compared with perceptually and contour-matched controls, respectively). In addition, Experiment 3 for the first time tested the theoretically predicted mediator of this effect, positive affect. Experiment 3 also replicated previous works showing that the perception of an illusory contour is intrinsically pleasant (e.g., Erle et al., 2017; Flavell et al., 2018). In contrast to earlier studies, a mediation analysis showed that this positive affect is not merely an epiphenomenon of perception, but rather that it also influences important corollaries such as economic decisions and judgments of trustworthiness.

Furthermore, given that participants invested significantly more units compared with Experiment 2, $F(1,329) = 15.53$, $p < .001$, assessing affective reactions might have slightly changed participants strategies in the investment task. Possibly, participants might have paid more attention to fully spending their budget in Experiment 3 because they felt that their previously assessed affective reaction serves as a valid argument for doing so. In this sense, the assessment of affective reactions served as a quasi-objective cue to trustworthiness; that is, participants generated an argument for investing, which in fact was nondiagnostic in the present setup. In line with this speculation, the share of participants exhausting their full budget increased from 60% in Experiment 2 to 82% in Experiment 3, $X^2(1, 331) = 19.98$, $p < .001$. To further corroborate this patter, future experiments could experimentally vary the order in which investments are made and affective reactions are assessed, although the general pattern of results was the same across the present Experiments 2 and 3, which limits this concern to an extent.

To some degree, Experiments 1–3 can be criticized because although the decisions were framed as economic decisions, all experiments were not incentivized. Thus, it is debatable whether the incidental effect of illusory contour perception on trust would persist in situations where decisions carry more weight.

6 | EXPERIMENT 4

Experiment 4 was a direct replication of Experiment 2 with only one change: The study was incentivized. Participants were told that they would learn about the development of the companies' stocks after their investment and that half of their compensation for this study was contingent on this. Participants received half of their compensation regardless because it was deemed unethical to potentially not pay participants anything for their participation.

6.1 | Method

The only difference to Experiment 2 was that participants now learned about the stocks' development after their investments and

that their payment was contingent on this. They received a detailed explanation on how the task worked including an example of how different investment outcomes might affect their compensation for the experiment. They were explicitly made aware of the option to make no investments at all if they felt that they did not intuitively trust any of the companies and that they should only invest in a given company if they intuitively trusted that specific companies. All materials and the instructions are available at https://osf.io/fnkjm/.

After the exposition and the allocation task (same as in Experiment 2), the development of the three stocks was determined randomly. The number of units spent on each company was multiplied with a random number between 0 (meaning the stock lost all its value) and 2 (meaning the stock doubled in value). The expected value of the investment task was thus neutral, but these metrics were not disclosed to participants.

6.1.1 | Sample

Participants were again recruited on Prolific Academic for a 5-min study and were compensated with 0.25£. The sample consisted of $N = 337$ participants ($n = 163$ female, $n = 169$ male, $n = 2$ preferred not to say, $n = 3$ data lost; age: $M = 33.29$, SD = 11.52).

6.1.2 | Incentivization

In addition to the 0.25£ that every participant earned regardless of their investments, they received 0.25£ for the allocation task. Participants were informed that if they decided to keep all their budget, they would simply receive an additional 0.25£. If, however, they decided to invest any part of this budget, the value of the stocks they bought might change and thus they would end up with a different total compensation for the study.

6.2 | Results

All analyses were the same as in Experiment 2.

6.2.1 | Main analysis

The ANOVA yielded a significant main effect, $F(2, 670) = 6.26$, $p = .002$. As can be seen in Figure 4, participants on average invested significantly more money in companies with Kanizsa logos than in the contour-matched companies ($\Delta_{allocations} = 24.19$ units, $CI_{95\%}$ [9.42, 38.97]), $t(335) = 3.22$, $p < .001$, $d_z = 0.18$. In this experiment, there was clearly no significant difference between Kanizsa and the perceptually matched controls, $t(335) = 0.83$, $p = .410$, $d_z = 0.05$, although the effect ($\Delta_{allocations} = 5.39$ units, $CI_{95\%}$ [−7.44, 18.22]) was again in the expected direction. In this incentivized experiment, participants furthermore decided to keep more investment units ($M = 101.77$,
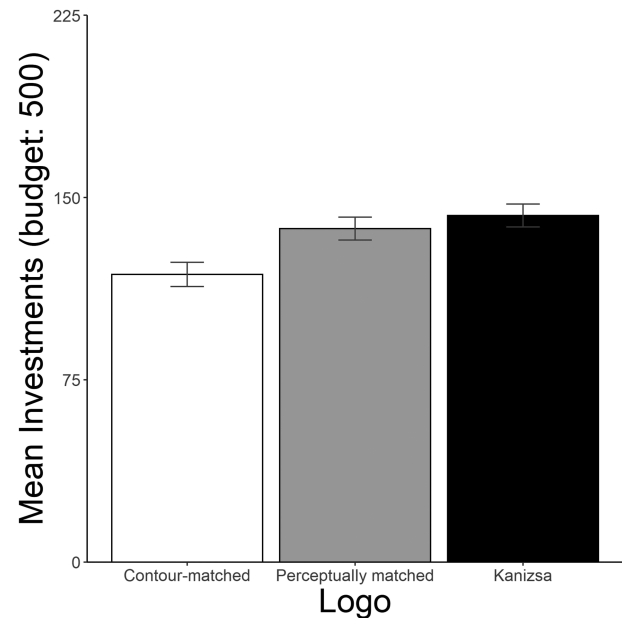
FIGURE 4 Mean investments as a function of company logo in Experiment 4. Error bars indicate +/−1 *SE*

SD = 133.54; around 20% of their total budget) for themselves (compared with around 10% in Experiments 2 and 3). Thus, participants insured themselves more against bad stock developments.

6.2.2 | Secondary analysis

In line with Experiments 2 and 3, compared with contour-matched control stimuli, participants again invested more money into companies with a perceptually matched logo ($\Delta_{allocations} = 18.80$ units, $CI_{95\%}$ [4.11, 33.50]), $t(335) = 2.52$, $p = .012$, $d_z = 0.14$.

6.3 | Discussion

In Experiment 4, participants showed higher intuitive trust in companies with a Kanizsa shape as their logo compared with contour matched controls, investing on average 11.57% more in stocks of these companies. However, compared with perceptually matched controls, this difference was statistically not significant and practically very small (3.92%). Thus, although Kanizsa shapes increased intuitive trust in unknown companies even under incentivized conditions, the effect size was greatly reduced, indicating that this incidental trust cue became less important to participants once something was at stake.

7 | COMBINED ANALYSIS

Finally, given the mixed pattern of effects in the individual studies and to estimate the effects of illusory trust on investments with the highest precision possible, we analyzed the data of
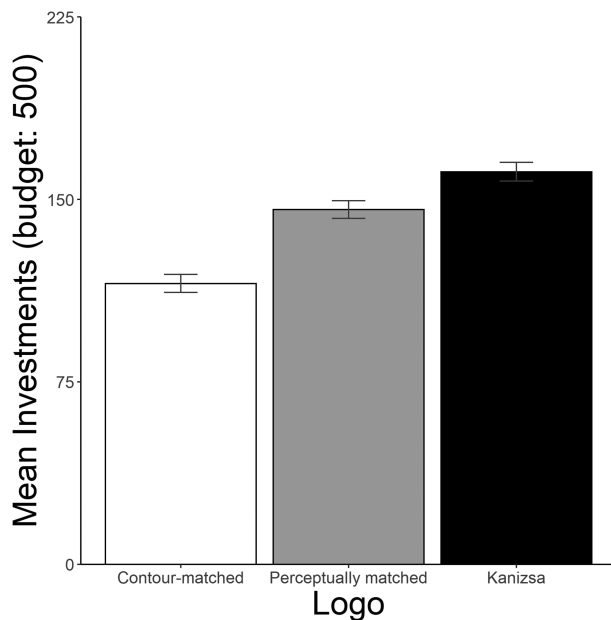
FIGURE 5 Mean investments across Experiments 2–4 as a function of company logo. Error bars indicate +/−1 SE

Experiments 2–4 conjointly using a 3 (Logo: as before) × 3 (Experiment: 2 vs. 3 vs. 4) mixed ANOVA. The ANOVA yielded significant main effects of Logo, $F(2, 1,328) = 38.26$, $p < .001$, Experiment, $F(2, 664) = 19.71$, $p < .001$, and a significant interaction, $F(4, 1,328) = 4.55$, $p = .001$. The interaction reflects the mixed pattern observed in the individual experiments, and the main effect of Experiment reflects the differences regarding how many investment units were kept between the different experiments. We will return to these issues in the general discussion.

More important for the purpose of the combined analysis and as can be seen in Figure 5, companies with Kanizsa logos received significantly higher investments than companies with perceptually, $t(666) = 2.81$, $p = .005$, $d_z = 0.11$, $\Delta_{allocations} = 15.56$, $CI_{95\%}$ [4.68, 26.45], and contour-matched logos, $t(666) = 7.55$, $p < .001$, $d_z = 0.29$, $\Delta_{allocations} = 45.99$, $CI_{95\%}$ [34.03, 57.95]. Similarly, perceptually matched control logos received higher investments than contour-matched control logos, $t(666) = 5.27$, $p < .001$, $d_z = 0.20$, $\Delta_{allocations} = 30.43$, $CI_{95\%}$ [19.10, 41.75]. Although the preference of Kanizsa logos over perceptually matched controls was smaller, it nonetheless amounted to 10.67% higher investments (compared with 39.85% higher investments than in contour-matched control logos).

8 | GENERAL DISCUSSION

Across four experiments, we demonstrated that companies that feature a Kanizsa illusion in their logo are considered more trustworthy than companies with perceptually and contour-matched logos (Experiment 1), that participants are willing to invest more investment units (Experiments 2 and 3) and money (Experiment 4) into such companies, and that this effect is partially mediated by the intrinsic

pleasantness of perception (Experiment 3). Therefore, perceptual illusions may indeed create illusory trust in economic interactions. These findings have implications for basic and applied research, both on trust and basic perception.

First, these findings are the first insight into further trickle-down consequences of the intrinsic affectivity of basic perceptual processes. Optical illusions are fun, which is why people readily pay for books or exhibitions on them. This fact has now garnered extensive empirical support for multiple illusions (Topolinski et al., 2015) both on self-reported and physiological measures (e.g., Erle et al., 2017). Such findings are especially impressive as they go against the notion of perceptual fluency (see Reber, Schwarz, & Winkielman, 2004; Reber, Winkielman, & Schwarz, 1998): The perpetual disambiguation of a Necker Cube (Necker, 1832), for instance, creates additional cognitive effort for the visual cortex. Thus, visual disambiguation should reduce positive affect, rather than increasing it, as it reduces the fluency of processing.

As a caveat, recent research has shown that in some cases, more effortful perception positively affects preferences (Flavell, Over, & Tipper, 2020). In these studies, participants had to identify camouflaged stimuli as quickly as possible and subsequently had to indicate how much they liked or how interesting they found them. Notably, the positive effects of additional perceptual effort were limited to the dimension of interestingness (Flavell et al., 2020). In the present research, however, we demonstrated positive effects on the dimension of liking, too. Nonetheless, it should be noted that Flavell et al.'s (2020) research experimentally manipulated perceptual effort using camouflage, whereas in the present research, we did not specifically manipulate perceptual effort, but rather the absence or presence of an optical illusion. Future research should take on this challenge and combine the two approaches by experimentally varying the effort needed to perceive an optical illusion or the disruption thereof. Perception research offers a wide array of options to do so, such as manipulations of contrast or presentation timing (Reber et al., 1998) or, in the case of the Kanizsa illusion, the support ratio of the Kanizsa illusion (Shipley & Kellman, 1992).

Irrespective of this, we show for the first time that the enjoyment of stimuli that enable basic perceptual processes is not the end-all be-all of perception. Although most companies certainly would consider more positive consumer attitudes as desirable already, in terms of consumer behavior, trust trumps mere positivity. Even in the absence of the empirical evidence provided here, many company logos already implement optical illusions. For instance, the USA Network logo features an illusory contour, the Tour de France logo allows for the perceptual grouping of a cyclist, or the Pittsburgh Zoo logo is a bistable illusion. On the basis of the present findings, it would be predicted that people will develop a more positive attitude toward those companies and, more importantly (and especially interesting for a TV network), higher levels of illusory trust.

Conversely, previous research has shown that the disruption of basic perceptual processes can cause negative affect and visual disappointment (Erle & Topolinski, 2019; Topolinski et al., 2015; Experiments 4 and 5), which might be of interest for some companies.

Ironically, the Center for Open Science, whose mission is to increase the integrity and trustworthiness of scientific results, designed a logo that mixes different occlusion illusions, which work against each other when focusing different parts of the logo. Similarly, the Penrose triangle and comparable works by famed artist M. C. Escher are frequently used in graphic and logo design. On the basis of the present and previous findings, such designs likely induce negative affect and thus might incidentally reduce trust in a company. On the flipside and as discussed above, however, previous research also shows that such disruptions of perceptual processing can be seen as more interesting (Flavell et al., 2020). Thus, a more appropriate implication would be to tailor the basic perceptual properties of a company logo to the company's purpose.

The second implication of the present results is that we add another incidental route to trust to the already vast arsenal of existing incidental trust cues. Whereas some incidental trust cues, for instance, facial features, smiling, or attractiveness (e.g., Jaeger et al., 2019; Jaeger et al., 2019; Krumhuber et al., 2007), lend themselves only to specific contexts such as the selection of a spokesperson or the design of an advertisement that features human beings, the presently identified route is quite universal as a company's logos is usually omnipresent. Importantly, the current findings do not only apply to the concrete stimuli and shapes used in the current experiment but should also generalize to all other shapes allowing for the completion of basic perceptual processes (see Flavell et al., 2018). Thus, illusory trust may be elicited by a wide variety of shapes and logos.

Finally, a more cautionary implication from the consumer's perspective is that one should not base one's consumer behavior on such incidental cues to trustworthiness. After all, the pleasantness of a company's logo is irrelevant for the product one wants to purchase. A malevolent actor could even use the present insights to simply pretend being trustworthy to manipulate customers. Impulsive purchases, for instance those done online, should be affected most by this. Fortunately, most e-commerce platforms offer a variety of objective trust cues alongside a seller's logo (e.g., user reviews and price comparisons), alleviating such concerns. Furthermore, electronic reputation mechanisms can also be an effective instrument to increase trust on the basis of objective information (Bolton, Katok, & Ockenfels, 2004).

Given this, let us now turn to the limitations of the present work. First, and relating to the last implication, in the present studies, the effect of illusory contour perception on trust was only studied in isolation. An important open question is whether the observed effects would persist in the presence of other incidental or even objective trust cues. For other incidental trust cues, we would predict additive effects in that any source of positive affect adds to the incidentally formed trust in a company. Concerning objective trust cues, on the one hand, previous research has shown that when both objective and incidental trust cues are present, the incidental cue is ignored at least at the behavioral level (Erle et al., 2018; Zürn & Topolinski, 2019). On the other hand, research has also demonstrated fluently named stocks outperform nonfluently named stocks in the most naturalistic setting of real stock markets (Alter & Oppenheimer, 2006). While these authors investigated processing fluency instead of perceptual fluency,

they found that the profit made from investments in stocks with easy-to-read ticker abbreviations (e.g., KAR) compared with nonfluently abbreviated stocks (e.g., RDO) was 11.2% higher after 1 day of trading. Furthermore, this effect vanished after 1 week of trading, arguably because additional (diagnostic) information was available by then (Alter & Oppenheimer, 2006).

To create a situation comparable with Alter and Oppenheimer's (2006) research, participants could repeat the present Experiment 4 repeatedly and learn about the return on their investment after each round. In such an experiment, in addition to a company's logo, whether the company improves its stock price or squanders the invested money could be manipulated, thereby also creating an objective cue to the company's trustworthiness. In such an experiment, it could be analyzed whether participants initially invest more money in companies with Kanizsa logos, whether this pattern persists even in the presence of objective cues to a company's untrustworthiness, and whether the rate by which participants learn that a company is not to be trusted differs between Kanizsa and control companies.

A second limitation is that although trust certainly is an important precursor of financial investments, a company is rarely solely responsible for the return on investments in stocks. To confirm the validity of the present results, future studies should replicate the present studies either using a variation of the present task where it is stated that companies are solely responsible for the development of their stock or alternatively using established measures of behavioral trust, such as the trust game (Berg, Dickhaut, & McCabe, 1995). However, resource allocation tasks, such as the one presently used, are common in research on economic decision making and seem to be face valid as a measure of trust.

Third, although Experiment 3 provided evidence for a partial mediation of the effect of Kanizsa logos on behavioral trust, another open question is what accounts for the remaining variance. On the one hand, the partial mediation could be caused by imperfect measurement (e.g., liking was assessed using only one item). On the other hand, it might be possible that other sources of variability have been neglected in Experiment 3. For instance, given the famousness of the Kanizsa illusion, it is likely that more participants were generally familiar with Kanizsa logos than with perceptually matched control logos, and familiarity is another incidental trust cue (Plötner et al., 2015).

In a similar vein, it is possible that we neglected additional mediators that explain the remaining variance that we could not account for. For instance, previous research has shown that perceptual processing is related not only to judgments of pleasantness or positive affect but also to judgments of truth (Reber & Schwarz, 1999). Arguably, impressions of truthfulness are conceptually close to trustworthiness. However, although Reber and Schwarz (1999) generally subscribe to the idea that perceptual effort accounts for these effects, they did not actively assess affective reactions, and the present setup did not lend itself to questions about the "truthfulness" of a logo. It is nonetheless conceivable, and a potential avenue for future research, that a full mediation of the present effects might be observed if a

more elaborate mediation model that includes all correlates of perceptual processing that could meaningfully affect trustworthiness were constructed. However, instead of contradicting or limiting the present argumentation, this would rather demonstrate the more general principle that people rely on different incidental trust cues in the same way.

Finally, another source of variance that might contribute to the preference for Kanizsa logos in the present studies is nonperceptual and closely related to the last limitation of the present studies: Across Experiments 2–4, participants consistently preferred perceptually matched control logos over contour-matched control logos. One explanation for this is that participants judge the innovativeness of a company by its logo design. While a regular square is prototypically uncreative, both inwards- and outwards-oriented Kanizsa shapes are unconventional. It is possible that participants used this as a decision criterion for making their investments. Previous research has already alluded to the possibility that a company's logo is related to impressions of innovativeness: "An innovative brand considers the importance of color and logo in its brand elements" (e.g., Shams, Alpert, & Brown, 2015). This point is undercut to an extent by the results of Experiment 1, where participants preferred contour-matched over perceptually matched control stimuli. A potential explanation for these results is that whereas Experiment 1 assessed feelings of trust at a very basic level, Experiments 2–4 might have more strongly emphasized behavioral implications of trust, alerting participants to (assumed) features of the companies more strongly. Consequently, participants might have based their responses on different criteria such as how interesting they find the company (Flavell et al., 2020).

Even despite these limitations, the present results demonstrated that basic perception plays a role for the formation of trust in first-time business–consumer interactions and even under incentivized conditions. Given that companies invest billions in logo design every year oftentimes without an empirical basis for doing so, future research should investigate which other judgments are affected by the pleasantness of early perceptual processing as this has important implications both on basic and applied levels.

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