

Trusting Beliefs: A Functional Measurement Study

Giulio Vidotto*, Davide Massidda, Stefano Noventa, & Marco Vicentini

University of Padua, Italy

Trust is a fundamental aspect of everyday life. Several authors define trust as the wish to depend on another entity and split the concept of trust into several interconnected components such as trusting beliefs (e.g., benevolence, competence, honesty, and predictability), trusting intentions, trusting behaviors, disposition to trust, and institution-based trust. According to McKnight, Cummings, and Chervany's (1998) model, beliefs yield behavioral intentions, which in turn are manifested in behavior. In the present research, we applied functional measurement to explain trust-related judgments in terms of information integration among different beliefs. Our results suggest that averaging models could help to describe the observed judgments in terms of beliefs and to comprehend the role and relevance of each belief in a variety of social contexts

Trust seriously influences interactions among individuals and organizations, but it has often been considered a vague trait to describe and evaluate (McEvily & Tortoriello, 2012; Stack, 1978; Wrightsman, 1991).

Rotter (1967) defines *trust* as the expectancy held by an individual or group (trustor) that the word, promise, and verbal or written statement of another individual or group (trustee) can be relied upon. Trust basically refers to how people experience the strain of voluntarily depending on others' behavior instead of controlling it.

According to Bromiley and Cummings (1995), trust should be conceived as an individual's belief (or a common belief within a group) that, when another individual (or group) makes an effort to act in agreement

Acknowledgments: The authors thank Gloria Meneghelli and Michela Zicari for preparing the presentation graphic software and for collecting data. Moreover, they are grateful to Joeri Hofmans and an anonymous referee for their suggestions and comments.

*Correspondence address: Giulio Vidotto. Department of General Psychology, University of Padua, Via Venezia 8, 35131 Padova, Italy. Tel +39 049 8276683. Fax +39 049 8276600. Email: giulio.vidotto@unipd.it

with any overt or implicit promise, he/she is honest in discussions ahead of such a promise, and he/she does not subtract undue benefits from the other even when the opportunity exists.

In line with Bromiley and Cummings (1995), McKnight, Cummings, and Chervany (1998) also identify beliefs as a key component of trust. In particular, they propose five different yet interrelated concepts: trusting beliefs, trusting intentions, trusting behaviors, disposition to trust, and institution-based trust. Trusting beliefs are a solid conviction that the trustee has favorable attributes to induce trusting intentions. Trusting intentions, in turn, are a solid willingness to depend upon the trustee to induce trusting behaviors. Trusting behaviors are actions that demonstrate how a trustor relies upon a trustee, thereby avoiding any kind of control. Disposition to trust is a general tendency to trust others. Finally, institution-based trust is a contextual propitiousness that supports trust. According to McKnight (1998), both disposition to trust and institution-based trust promote trusting beliefs, intentions, and behaviors.

As can be seen from the foregoing, trusting beliefs are a relevant factor in causing an individual to consider another individual to be trustworthy. In particular, they modulate the extent to which a trustor feels confident in believing that a trustee is trustworthy.

According to McKnight et al. (1998), the most-cited trusting beliefs are: benevolence (trustor cares about the prosperity of the trustee and is moved to act in the trustee's interest); competence (trustee has the required skills to accomplish what the trustor needs to have done); honesty/integrity (trustee makes good faith agreements, tells the truth, and fulfills promises); and predictability (trustee's actions are consistent with the trustor's forecasting). We suggest that those beliefs are cognitively integrated in the attribute of trustworthiness with some weighting processes. For example, almost anyone will give a high trust judgment to people who are described as highly competent, but what will happen to this evaluation if another attribute is added—for example, low honesty or moderate benevolence? To answer this question, the present study aims to determine the integration rules (Anderson, 1981) that underlie the multi-attribute evaluation of trustworthiness.

AVERAGING MODELS

In a typical functional measurement experiment (Anderson, 1982) where subjects respond to a set of two stimulus factors (A and B) that are manipulated by the researcher, the equation for averaging models may be written as

$$(1) \quad R_{ij} = \frac{w_{Ai}S_{Ai} + w_{Bj}S_{Bj}}{w_{Ai} + w_{Bj}}$$

where the integrated response (R) depends on the psychological scale values (s) and their relative weights (w) of the attributes of the overt dimensions A and B ; i and j index the levels of the corresponding factors.

A factor is said to be equally weighted when all its levels have the same weight—that is, when $w_{Ai} = w_A$ for each i . Thus, the denominator of equation (1) has the same value for the levels of the factors in the design and can be absorbed into an arbitrary scale unit. When all the factors are equally weighted, the model is called an Equal-weight Averaging Model (EAM). An EAM cannot describe interactions between factors. Accounting for crossover effects requires a change in weights. When the weight of some level of at least one factor is different from the others, the model is called a Differential-weight Averaging Model (DAM).

The DAM allows each stimulus to have its own weight and its own scale value. The sum of the weights in the denominator of equation (1) is therefore variable for the different conditions in the experimental design, and the model becomes inherently non-linear. This non-linearity generally involves analytical and statistical problems concerning uniqueness, bias, convergence, reliability, and goodness of fit (Zalinski & Anderson, 1990).

Individual differences are obvious in human nature, although statistical techniques (i.e., analysis of variance) often subsume almost all subjects to show similar response patterns where individual differences appear as magnitude parameters. As a second question for the present study, we wonder whether trust judgments could (or could not) be explained by a common response pattern based upon a given set of beliefs. For this reason, we prefer to consider a new specific methodology to single out a response pattern for each individual and later look for a general law (Anderson, 2001).

METHODS

Three experimental conditions with different background contexts (institutional, interpersonal, or organizational) were presented to three different groups of participants. They were asked to read the 6 different situational descriptions inherent in their own contexts (see Appendix). Then, for each one of them, they read each single item and, according to their personal preferences, placed a mark on a response scale; i.e., they judged the trustworthiness of an individual represented by different levels

(low, medium, high) of two attributes out of four (competence, benevolence, honesty, and predictability) as situated in their own specific context. This question appeared below each profile: "How much do you believe in the trustworthiness of a person with these characteristics?" (e.g. in a preliminary scenario we asked: "How much do you believe in the trustworthiness of a policeman with these characteristics?"). A 20-point rating scale appeared beneath the question. The left-hand anchor was labeled "Not at all" and the right-hand anchor "Completely."

The stimuli were presented in a random order. It is worth noting that a first step, just to get acquainted with the procedure and the use of the category scale before beginning the experiment, consisted of reading a preliminary vignette and giving a response for all the stimuli. The participants worked individually, at their own pace.

Person mentioned in the vignettes were described in terms of attribute combination, where each attribute had one of the three different levels (e.g., a medical doctor with high honesty and low competence). For each vignette there were 54 two-attribute stimuli: i.e., the 6 combinations of the 4 attributes (competence, benevolence, honesty, and predictability) taken 2 at a time without repetition by the 3 levels (low, medium, and high) of the first attribute by the 3 levels of the second attribute.

Summarizing, the experimental design was compounded by the four attributes (competence, benevolence, honesty, and predictability), each of them described by one of three levels (low, medium, high). In order to study the integration process, we varied the pairs of attributes: i.e., we produced a design with six two-way sub-designs obtained by the combination of the four attributes. This procedure was the same as the one discussed by Anderson (1982, p. 92).¹

The thirty-six participants involved in this study (18 males and 18 females ranging from 20 to 28 in age) were students of the University of Padua and they were randomly assigned to one of the three different experimental conditions (i.e., an interpersonal, institutional, or an organizational condition). Moreover 4 participants joined in only for a pre-experimental preparatory phase.

All statistical and graphical analysis was carried out by means of R language (*base*: R Development Core Team, 2011; *cluster*: Maechler, Rousseeuw, Struyf, & Hubert, 2005; *rAverage*: Vidotto, Noventa,

¹ It is worth noting that this is a special case with four stimulus variables where there are six two-factor designs and the initial state term is eliminated from the model. The level of uniqueness depends on the experimental design so that the value of the initial state term can be estimated only when all designs in the family do not have the same size (Anderson, 1982; Noventa, Massidda, & Vidotto, 2010).

Massidda, & Vicentini, 2012). For the 36 participants, at first, data analysis was conducted separately for each single subject, using a procedure to estimate parameters (i.e., scale values and weights) for the differential-weight averaging models based upon parsimony principle and information criteria (Vidotto, Massidda, & Noventa, 2010; Vidotto & Vicentini, 2007).²

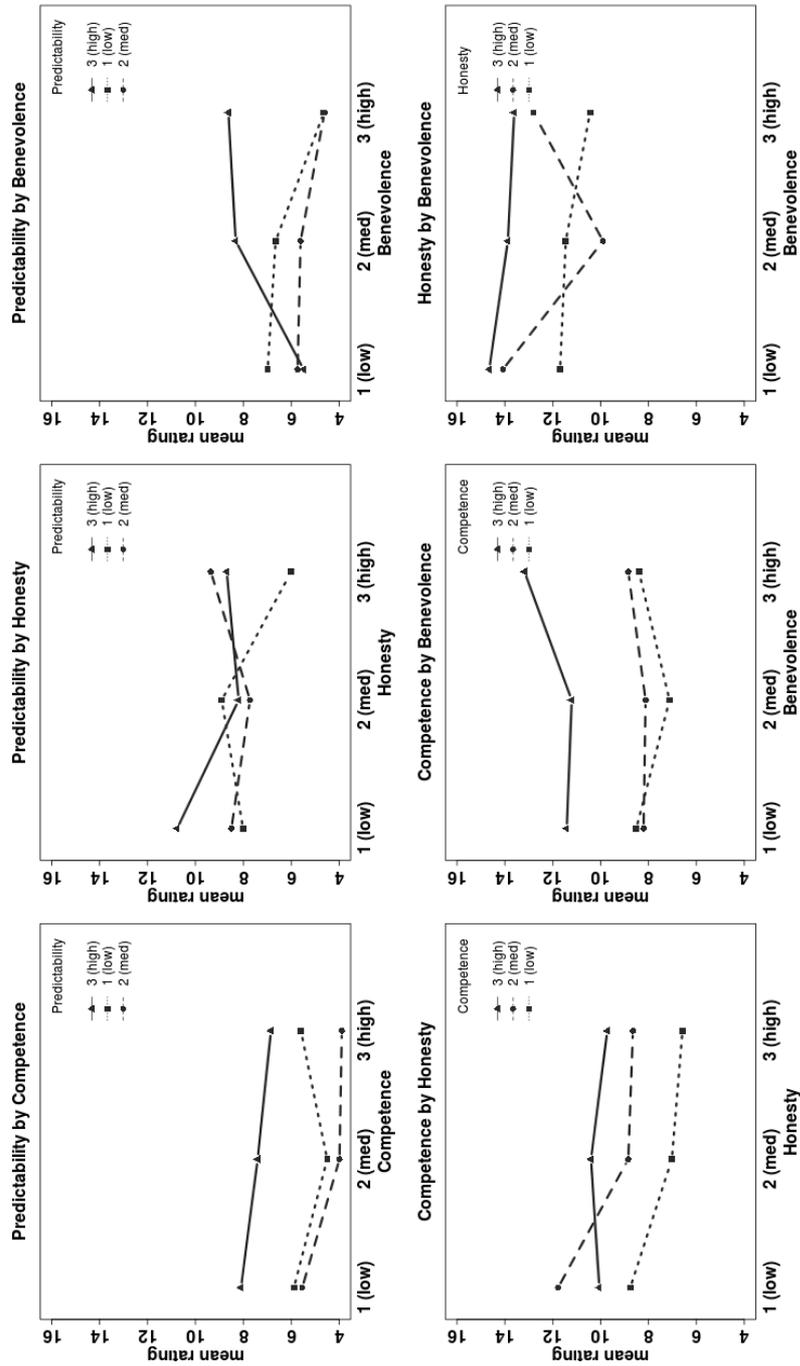
We estimated the logarithm of the weights instead of the weights themselves to improve unbiased estimations when a differential-weight averaging model is assumed (Vidotto, in press). Moreover, we eliminated the initial state term from the model so that the parameters for the manipulated stimulus variables could achieve maximal uniqueness (Anderson, 1982; Noventa, Massidda, & Vidotto, 2010).

One participant in the organizational condition was excluded because of a set of erratic responses. The remaining 35 participants showed a coherent set of responses and therefore we kept all 54 responses in the 6 situational context descriptions for each individual.

RESULTS

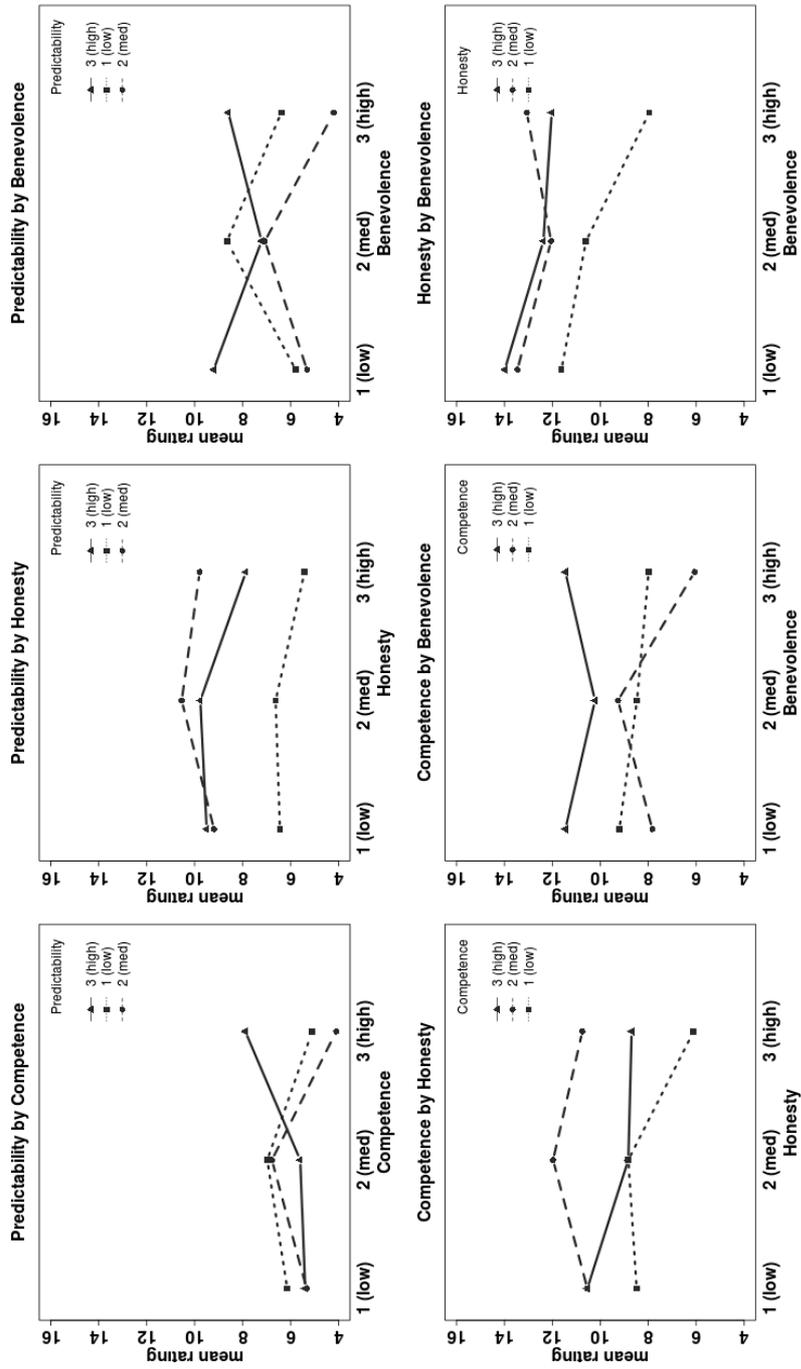
Figure 1 shows the response configuration for the three groups of participants evaluating a person in the three different types of social contexts. Participants show patterns of response that are consistent with an averaging model. Moreover, deviations from parallelism suggest a reasonable presence of different weights for some levels of the attributes (Anderson, 1982).

² In a pre-experimental phase of the study, we analyzed the responses of four participants to evaluate the plausibility of the different integration models. All four participants followed an averaging model.



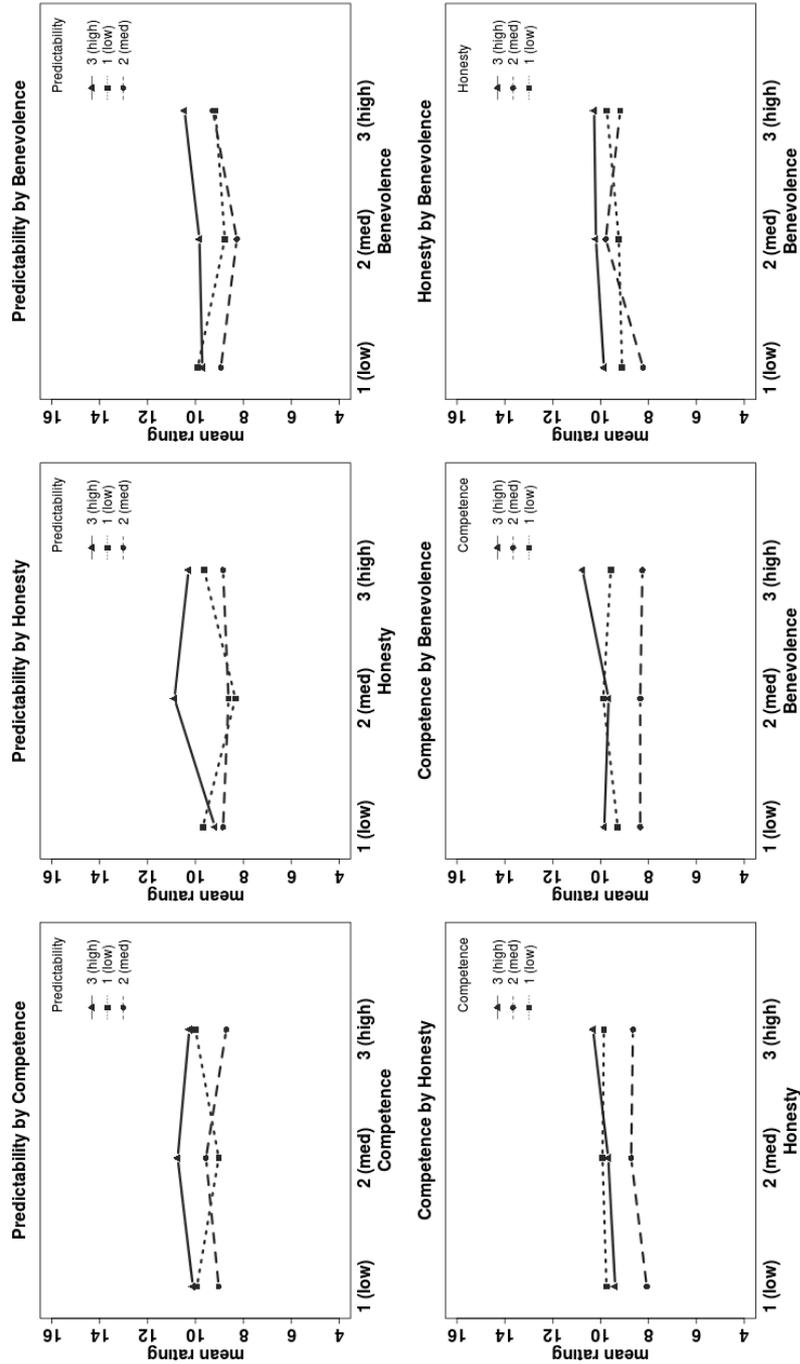
INSTITUTIONAL SCENARIOS

Figure 1a: Means of raw judgments of 12 participants evaluating 6 institutional scenarios for 6 different pairs of attributes.



INTERPERSONAL SCENARIOS

Figure 1b: Means of raw judgments of 12 participants evaluating 6 interpersonal scenarios for 6 different pairs of attributes.



ORGANIZATIONAL SCENARIOS

Figure 1c: Means of raw judgments of 11 participants evaluating 6 organizational scenarios for 6 different pairs of attributes.

Table 1: Individual Indexes of Fit (R squared, AIC, and BIC) for the Participants (Identified by a Number) in the Three Different Situational Contexts.

Institutional Scenarios												
ID	1	2	3	4	5	6	7	8	9	10	11	12
R ²	0.82	0.82	0.85	0.86	0.85	0.83	0.91	0.92	0.77	0.60	0.52	0.83
AIC	712	644	193	506	360	674	435	373	651	895	428	613
BIC	780	708	261	578	437	742	503	446	719	950	504	672

Interpersonal Scenarios												
ID	1	2	3	4	5	6	7	8	9	10	11	12
R ²	0.76	0.85	0.86	0.85	0.81	0.82	0.80	0.72	0.73	0.88	0.85	0.79
AIC	655	499	386	501	459	553	649	506	579	463	542	545
BIC	723	559	442	573	526	613	721	561	638	522	605	609

Organizational Scenarios											
ID	1	2	3	4	5	6	7	8	9	10	11
R ²	0.86	0.75	0.73	0.91	0.92	0.91	0.89	0.91	0.88	0.55	0.92
AIC	534	548	689	447	334	357	367	415	347	863	288
BIC	602	595	757	520	406	434	439	478	406	923	347

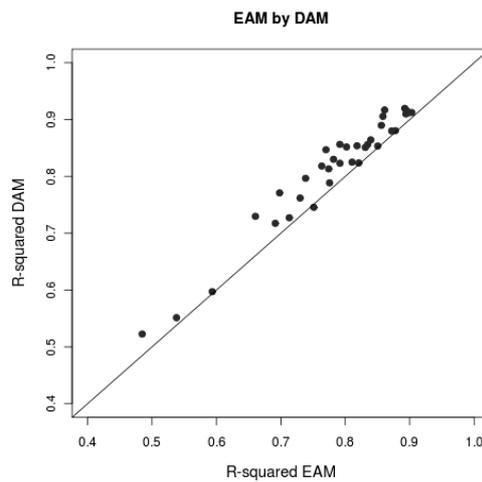


Figure 2. R-squared comparison for equal (x-axis) and differential (y-axis) weight cases.

Cluster analysis was used to analyze subject proximity (Hofmans, & Mullet, in press; Struyf, Hubert, & Rousseeuw, 1997). Due to the results of the cluster analysis, which show consistent profile similarities for the majority of the participants, we pooled them all together and applied two separate analyses of variance, using as a dependent variable one of the two estimated parameters (estimated scale values or estimated weights) with the following factors as independent variables: context (interpersonal, institutional, organizational), attribute (benevolence, competence, honesty, predictability), and level (low, medium, high).

As expected, with respect to the scale values, we found statistically significant differences in the main effects for level ($F(2,64)=677.22$, $p<.001$) and attribute ($F(3,96)=11.04$, $p<.001$). Moreover, there were two significant interactions: level by attribute ($F(6,192)=19.33$; $p<.001$) and level by attribute by context ($F(12,192)=1.94$, $p=0.03$). The same statistically significant differences were found for the main effects (level, $F(2,64)=39.40$, $p<.001$; attribute, $F(3,96)=31.16$, $p<.001$) and one interaction (level by attribute, $F(6,192)=2.52$, $p=0.02$) considering the estimated weights. No other significant results were found.

Figure 3 shows the graphs for the interaction level by attribute relating to scale values, and Figure 4 shows the same for the weights. Figure 5 shows the interaction level by attribute by context for the scale values.

DISCUSSION

The results have important implications. First, the four main beliefs advanced by McKnight et al. (1998) indeed appear to play a fundamental role in judging trust. Second, in agreement with information integration theory and functional measurement, an averaging model seems to explain individual responses. While the great majority of the participants (34) could be referred to the differential-weight case, only one participant showed a pattern that is clearly consistent with equal-weight averaging.

While the scale values show a neat linear trend with higher slopes for honesty and competence (Figure 3), weights also show higher mean values for honesty and competence (Figure 4). These results are consistent with the idea that different attributes play different roles in the trust judgments: indeed, honesty and competence seem to play major roles, while predictability seems less relevant.

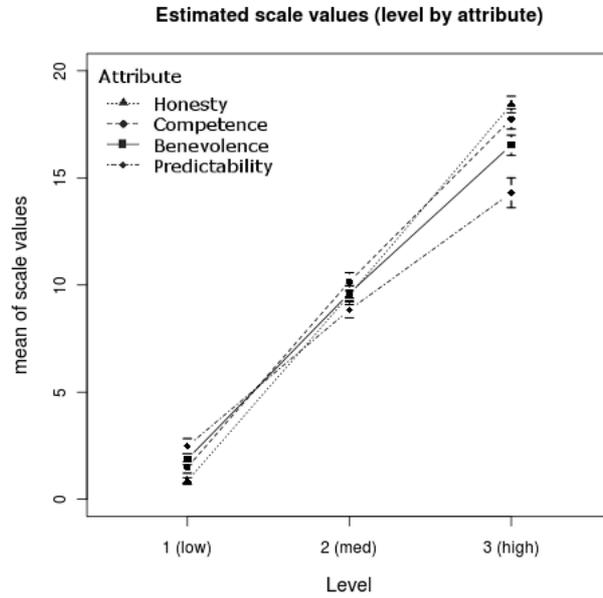


Figure 3. Mean of the estimated scale values as a function of the three levels (Low, Medium, and High) and the four attributes (Honesty, Competence, Benevolence, and Predictability).

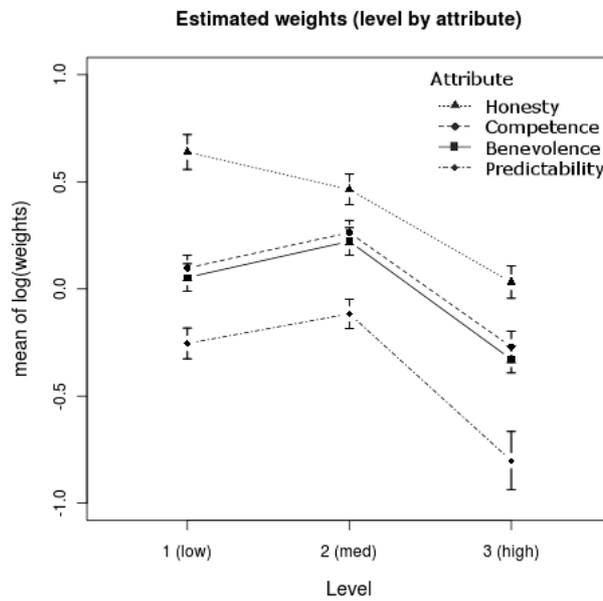


Figure 4. Mean logarithm of the estimated weights as a function of the three levels (Low, Medium, and High) and the four attributes (Honesty, Competence, Benevolence, and Predictability).

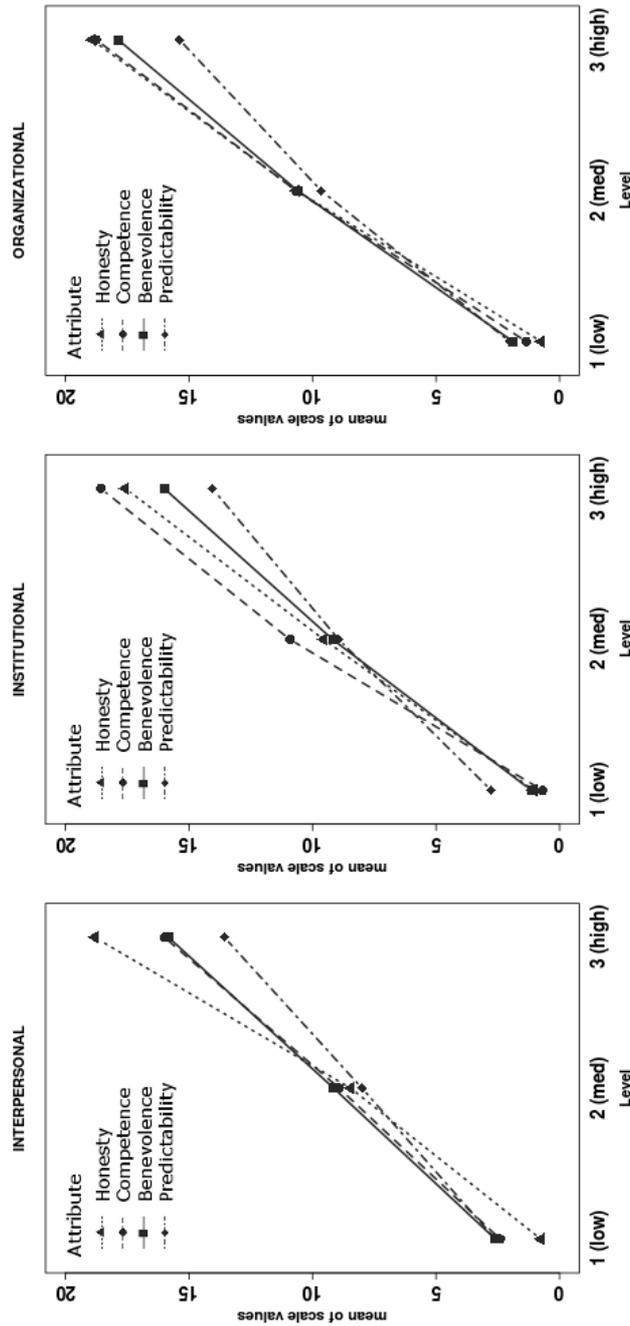


Figure 5. Mean of the estimated scale values as a function of the three levels (Low, Medium, and High) of the four attributes (Honesty, Competence, Benevolence, and Predictability) in the three different situational contexts (Interpersonal, Institutional, and Organizational).

Another interesting conclusion refers to the high weight of the low level of honesty; it seems to show how a belief related to low integrity plays the most significant role for a final negative judgment.

Finally, the different slopes for the levels of the attributes in the three situational contexts (see Figure 5) suggest the prominent roles of honesty in the interpersonal contexts and competence in the institutional contexts.

In conclusion, information integration theory and functional measurement seem to represent an interesting approach to comprehending the role of trusting beliefs to explain trust judgments. Differential-weight averaging models constitute a keystone to study this kind of phenomenon. While these models appear in the literature (Anderson, 1991) less often than other models (i.e., adding, multiplying, and equal-weight models), they hold great potential to be used in future studies to analyze critical variables that could not be referred to in the other, simpler models.

This study has some limitations, and caution is required to prevent over-generalizing the findings. The results refer to a group of Italian university students, so it would be important to confirm whether these integration processes and the related importance of the attributes correspond to a generalizable model with cross-cultural validity. Moreover, the results suffer from the fact that participants had to cope with artificial, non-ecological scenarios; in real life, they could have responded differently (e.g., predictability could have greater importance). These criticisms have only partial responses, and new data are essential in order to overcome these open questions.

REFERENCES

- Anderson, N. H. (1981). *Foundations of information integration theory*. New York: Academic Press.
- Anderson, N. H. (1982). *Methods of information integration theory*. New York: Academic Press.
- Anderson, N. H. (ed.) (1991). *Contributions to information integration theory (Vol. 1: Cognition; Vol. 2: Social; Vol. 3: Developmental)*. New Jersey: Lawrence Erlbaum Associates.
- Anderson, N. H. (2001). *Empirical direction in design and analysis*. New Jersey: Lawrence Erlbaum Associates.
- Bromiley, P., & Cummings, L. L. (1995). Transaction costs in organizations with trust. In R. Bies, R. Lewicki, & B. Sheppard (Eds.), *Research on Negotiations in Organizations* (pp. 219–247). Greenwich: JAI Press.

- Cummings, L. L., & Bromiley, P. (1996). The Organizational Trust Inventory (OTI): Development and validation. In R. Kramer & T. Tyler (Eds.), *Trust in Organizations* (pp. 302–330). Thousand Oaks, CA: Sage.
- Hofmans, J., & Mullet, E. (in press). Towards unveiling individual differences in different stages of information processing: a clustering-based approach. *Quality & Quantity*, on line first, DOI 10.1007/s11135-011-9529-7.
- Maechler, M., Rousseeuw, P., Struyf, A., Hubert, M. (2005). *Cluster Analysis Basics and Extensions*. <http://cran.r-project.org/web/packages/cluster/>
- McEvily, B., & Tortoriello M. (2012). Measuring trust in organizational research: Review and recommendations. *Journal of Trust Research*, 1, 23-63.
- McKnight, D. H., & Chervany, N. L. (2000). What is trust? A conceptual analysis and an interdisciplinary model. *AMCIS 2000 Proceedings, Paper 382*. <http://aisel.aisnet.org/amcis2000/382>.
- Mcknight, D. H., Cummings, L. L., & Chervany, N. L. (1998). Initial trust formation in new organizational relationships. *Academy of Management Review*, 23, 473–490.
- Noventa, S., Massidda, D., & Vidotto, G. (2010). Initial conditions in the averaging cognitive model. *Psicologica*, 31, 477–489.
- R Development Core Team (2011). R: A language and environment for statistical computing. *Vienna, Austria: R Foundation for Statistical Computing*. <http://www.R-project.org/>
- Rotter, J. B. (1967). A new scale for the measurement of interpersonal trust. *Journal of Personality*, 35, 615–665.
- Schwarz, G. (1978). Estimating the dimension of a model. *The Annals of Statistics*, 6, 461–464.
- Stack, L.C. (1978). Trust. In H. London and J.E. Exner, Jr (Eds.), *Dimensions of personality*, (pp. 373–412). New York: Wiley.
- Struyf, A., Hubert, M., & Rousseeuw, P. J. (1997). Integrating robust clustering techniques in S-PLUS. *Computational Statistics and Data Analysis*, 26, 17–37.
- Vidotto, G. (in press). Note on differential weight averaging models in functional measurement. *Quality & Quantity*, on line first, DOI 10.1007/s11135-011-9567-1.
- Vidotto, G., Massidda, D., & Noventa, S. (2010). Averaging models: Parameters estimation with the R-average procedure. *Psicologica*, 31, 461–475.
- Vidotto, G., Noventa, S., Massidda, D., & Vicentini M. (2012). *rAverage: Parameter estimation for the Averaging model of Information Integration Theory*. <http://cran.r-project.org/web/packages/rAverage/>
- Vidotto, G., & Vicentini, M. (2007). A general method for parameter estimation of averaging models. *Teorie & Modelli*, 12, 211–221.
- Wrightsman, L.S. (1991). Interpersonal trust and attitudes toward human nature. J.P. Robinson, P.R. Shaver, & L.S. Wrightsman (Eds.), *Measures of personality and social psychological attitudes*, (pp. 373–412). San Diego CA: Academic Press.

APPENDIX

Preliminary context

1. You report to the Police that in the school attended by your son there is a running drug ring, they assure you the school will be regularly patrolled.

Institutional context

1. You are asking information at the station counter about a journey that needs some line changes. The travel takes also an entire night so that you will have to sleep in a wagon-lit or a bunk. It is the first time you have taken this trip. You fear the counter operator could have the connections wrong.
2. You reach the county offices because you want to know if the modifications to your heating system will benefit from a grant aid.
3. The election for the mayor of your city is approaching.
4. You've just obtained your high-school diploma and one of your teachers suggests to you a university for which he thinks you have a genius.
5. You have a persistent pain in your knee. The specialist who visits you thinks surgery is necessary.
6. Your church has organized a fundraising event to provide drugs and medications to a foreign country struck by famine.

Interpersonal context

1. Your mother is remarrying after a divorce. Her new husband is coming to live at your house. You're wondering how living together will be.
2. Your teenage son asks you to buy him a moped. Since he knows that you consider it dangerous, he ensures that he will be cautious.
3. You have confided something to a friend. You hope the confidence will remain so.
4. You are leaving on vacations. You always took accurate care of the plants in your apartment. You think your neighbor could be willing to water them, but you have to leave him your apartment's keys.
5. You are searching for somebody to share your apartment's costs with. Someone replies to your announcement.
6. You are searching for a woman who could weekly spend some housekeeping hours at your place. It comes down to a lady you don't know personally.

Organizational context

1. The market of your company business is diminishing. Some companies have already closed. You are wondering about your future. Your employer assures that the company will get through the crisis.
2. You have been asked to work on a project with a person you have never worked with before.
3. Your employer says that if you are willing to be away and to do extra hours for some time (2 or 3 years), you will get an important promotion.
4. You are picking up a computer you brought to be fixed. You are told that some expensive components have been changed. You wonder whether those substitutions have really been done or were really necessary.
5. You cannot decide between two stereos with the same features but of different brands. The clerk suggests one of the two, stating that it has better performance.
6. You've met for the first time with a salesman of a company whose products you are interested in.

(Manuscript received: 16 October 2011; accepted: 26 March 2012)