Do You Mean What You Say?
The Effect of Uncertainty Avoidance on the Interpretation of Probability Expressions - A Comparative Study between Spanish and German

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Abstract

In times of globalization, differences between cultures and in the interpretation of linguistic terms can lead to misunderstanding in communication. The present study focuses on the influence of cultural dimensions, especially uncertainty avoidance, on the interpretation of verbal probability expressions. It is hypothesized that uncertainty avoidance has an effect on the interpretation of uncertainty expressions. Therefore, Spanish and German participants were asked (1) for uncertainty avoidance and (2) to estimate numerical equivalents for 12 verbal probability expressions (e.g., *possible*). The estimation data were modeled using fuzzy membership functions. Results neither show differences in uncertainty avoidance nor in the interpretation of the probability expressions between these two languages. Possible reasons and future research perspectives are discussed.

Keywords: Uncertainty Avoidance, Linguistic Terms, Probability Expressions, Fuzzy Membership Functions.

Introduction

In times of the most severe economic crisis the European Union ever experienced the following situation is likely to happen: Imagine economic experts from Spain and Germany discussing about the risk of a financial breakdown of Spain's banks in the near future: Expert 1 argues: "I am *sure* that we will have a crash next year." and expert 2 responds: "It's *possible* but I am still optimistic. *Probably* we can manage it." In many social interactions between persons or groups of different countries the language for communication might not be the native language of the speakers (e.g., Spanish or German) but a foreign one (such as English). Nevertheless, one is likely to "think" in terms of the own language, choose words that express the own intention best and then "translate" them into the foreign language. But given the vagueness of natural languages (e.g., Teigen & Brun, 2003; Budescu, Karelitz & Wallsten, 2003; Bocklisch, Bocklisch & Krems, 2010; 2012) and potential cultural differences (e.g., Hofstede, 1980; 2001; Hofstede, Hofstede, & Minkov, 2010) we can not necessarily be sure that the translation reflects the meaning precisely and therefore, communication partners may misunderstand each other. The example described above is prototypical for situations in which forecasts and decisions have to be done under uncertain circumstances. Often, the decision makers express their beliefs using verbal probabilities such as "*probable*" or "*possible*". There is a risk of miscommunication because of the considerable variation of people's interpretation of the meaning of linguistic terms (LTs) (e.g., Karelitz & Budescu, 2004). Further, misunderstandings may lead to wrong decisions with undesirable consequences. Therefore, avoiding misunderstandings and improving interpersonal communication is highly relevant in a globalized world.

The present paper highlights the questions (1) if LTs (probability expressions) of different languages (Spanish vs. German) are interpreted differently by native speakers and (2) whether there exists a cultural influence on the LTs interpretation, namely, concerning the dimension of uncertainty avoidance (Hofstede, 1980). Methodologically, we use fuzzy membership functions (MFs) to formalize and compare the vague meaning of the LTs (e.g., Bocklisch, Bocklisch & Krems, 2012).

Culture and Language

One influential paradigm in intercultural research is Hofstedes model of cultural differences. In its original form (Hofstede, 1980), he differentiated four cultural dimensions on which cultures vary and, therefore, may be compared: individualism/collectivism, power distance, uncertainty avoidance and masculinity/femininity. Concerning the investigation of probability expressions, we consider the third dimension "uncertainty avoidance" (UA) as especially interesting and, therefore, focus on UA in the following. In short, UA is determined by the extent to which members of a society become nervous or insecure about situations that seem to be unpredictable, unstructured and uncertain.

There are already evidences that culture and language are important concerning the interpretation of LTs, for instance, Doupnik and Richter (2003) already found differences in the interpretation of German and English uncertainty expressions between native speaking auditors in two cultural areas, namely, America and Germany. We will focus on two languages, Spanish and German, which developed in the same European cultural region. According to Hofestede (2001), Spain and Germany are both countries with high UA values and, at the same time, differ remarkably in UA ($UA_{Spain} > UA_{Germany}$). In our study we (1) expect to replicate Hofstedes results and find high UA scores for both languages as well as significant differences. Furthermore, we hypothesize that the probability expressions should be interpreted differently. We expect that because the context seems to influence the meaning of expressions (e.g., Weber & Hilton, 1990). We think that culture may be determined as a very global form of context. Therefore, if the scores of $UA_{Spain} \neq UA_{Germany}$ the LTs might also be interpreted differently.

Numerical Translation of Linguistic Terms

To determine the meaning of LTs researchers have developed procedures for the numerical translation of verbal expressions (e.g., Simpson, 1944; Beyth-Marom, 1982; Budescu, Karelitz & Wallsten, 2003; Bocklisch, Bocklisch & Krems, 2010; 2012). Generally, results of these studies show (1) that mean estimates for linguistic expressions are similar and that they have stable meaning (Simpson, 1944 and Hakel, 1968). At the same time there exists large inter-individual variability in the interpretation of verbal expressions (for reviews see Pepper, 1981; Teigen & Brun, 2003). Another important outcome is (2) that fuzzy set theory (Zadeh, 1965) proved especially useful for describing the vague meaning of LTs by modelling them using fuzzy MFs (e.g., Zimmer, 1984; Budescu & Wallsten, 1995; Budescu et al., 2003, Bocklisch et al., 2012).

We used the two-step translation procedure outlined in Bocklisch et al. (2012) for the numerical translation of the probability expressions. This procedure also uses fuzzy MFs to model the empirical estimates of participants. MFs are truth value functions. In this study, the membership value (μ) represents the degree of truth that a numerical estimate fulfils a specific criterion represented by a LT (e.g., the numerical probability “in 70 of 100 cases” belongs to the linguistic probability expression *probable*). We use a standardized μ ranging from 0 (no membership) to 1 (full membership). Furthermore, the procedure has been proven useful for the translation of LTs (e.g., probability expressions: Bocklisch et al., 2010; symptom intensities in medical contexts: Bocklisch, Stephan, Wulfken, Bocklisch & Krems, 2011; and frequency expressions: Bocklisch et al., 2012), and as basis for evaluating and choosing verbal response labels for questionnaire scales (e.g., for the State-Trait Anxiety Inventory (STAI-T) see Bocklisch, Bocklisch & Krems 2011). It includes (1) an empirical estimation method in which participants assign typical, minimum and maximum correspondence numbers to presented words, and (2) a fuzzy approach for the analysis of data and the generation of MFs – specifically, parametric MFs of the potential type. This procedure is very efficient as only three numerical values are estimated, and is easily understood because the semantic meaning of estimation points is implicitly clear to participants (e.g., minimum and maximum correspondence values = borders of LTs meanings). Semantic comprehensibility, as such, makes participants’ estimates understandable even if they have no theoretical knowledge of the concept of fuzzy membership.

Such intuitive understanding is also advantageous when an estimation method is used for participants not highly trained in estimation tasks. For more details concerning the theoretical justification or parameter estimation see Bocklisch (1987) or Bocklisch, Groß, Bocklisch and Krems (submitted).

Method

Participants

We collected data of 147 German participants (51 males) with an average age of 27.5 (*SD* = 9.9) and 21 Spanish participants (12 males) with a mean age of 34.8 (*SD* = 12.9). All subjects were native speakers. Four (German sample) vs. one (Spanish sample) persons were raised bilingual. Most of the participants were students and the German students received course credits for participation.

Design, Material and Procedure

The study was quasi-experimental employing an online questionnaire in two languages (Spanish vs. German). The material was carefully constructed to make sure that both questionnaire versions were equivalent in meaning, especially concerning the 12 probability expressions (see Table 1) that were presented in the questionnaire in a random order. The 12 LTs were chosen from a pool of 47 probability expressions gained from a literature review and dictionaries. These 12 words are rather unambiguous in meaning and are frequently used in both languages. The translation from German to Spanish was done independently by two Spanish that also speak German very well (international C1 and B2 level). The questionnaire had four main parts: (1) a short introduction, (2) the estimation part for the translation of the probability expressions (Bocklisch et al., 2012), (3) the uncertainty avoidance scale including ten items (e.g., “I would like to have more control about the future.”) (Mealy, Stephan, Abalakina-Paap, 2006; see also Fahmie, 2012) and (4) a few questions concerning demographic data.

Results

Uncertainty Avoidance

We found UA scores of M_{German} = 38.8 (SD_{German} = 7.0) and $M_{Spanish}$= 39.5 ($SD_{Spanish}$= 5.8) and, therefore, no significant differences ($t(166) = -.425$, $p = 0.67$).

Meaning of Linguistic Terms

The results for the meanings of LTs are structured starting with descriptive statistics of the data, and then the fuzzy MFs and discriminatory power values (*dp*) indicating how similar the MFs and, hence, the meaning of the LTs are. As outlined in Bocklisch et al. (2012, p.148), we present descriptive statistics and MFs for purposes of completeness and comparison, even though we believe that MFs are more suitable for describing the meaning of vague LTs. We have to emphasize that statistical and fuzzy analyses are two approaches that should be understood independently, because fuzzy MFs, by definition, do not refer to probability theory and statistics. Although some parameters of our MF type can be interpreted statistically (e.g., representative values (r) = the arithmetic mean), a MF is not a probability density function and conventional requirements (i.e., the integral of the variable's density is equal to 1) are not valid.

Descriptive Statistics. Table 1 shows a comparison of the descriptive statistics (i.e., means and standard deviations) for the Spanish and German LTs. The minimal and maximal estimates were used for modelling of the MFs and are not reported here.

The order of the means of the typical estimates (equals r of the MFs, see below) presented in Table 1 is the same for the Spanish and German LTs and even the numerical values are very similar. The largest difference is 12.5 for *probable*.

Table 1: Descriptive Statistics (Typical Estimates) and Discriminatory Power Values (*dp*)

Probability Expressions English Translation (Original in German / Spanish)		German *M*	 *SD*	Spanish *M*	 *SD*	*dp*
1	Impossible (Unmöglich / Imposible)	1.53	2.93	0.50	1.24	0.44
2	Very improbable (Sehr unwahrscheinlich / Muy improbable)	7.48	4.98	8.95	7.41	0.16
3	Improbable (Unwahrscheinlich / Improbable)	14.24	8.29	13.71	9.18	0.05
4	A small probability (Wenig wahrscheinlich / Poco probable)	19.79	10.14	18.38	11.63	0.08
5	Uncertain (Unsicher / Inseguro)	28.21	15.04	27.52	19.11	0.04
6	Maybe possible (Vielleicht möglich / Tal vez posible)	36.69	16.54	35.24	15.53	0.10
7	Possible (Möglich / Posible)	52.04	13.49	52.86	9.43	0.05
8	Probable (Wahrscheinlich / Probable)	71.64	13.62	59.14	15.26	0.35
9	Rather certain (Ziemlich sicher / Bastante seguro)	82.89	10.99	82.86	9.43	0.09
10	Very probable (Sehr wahrscheinlich /Muy probable)	85.96	8.76	85.60	9.42	0.17
11	Highly probable (Höchstwahrscheinlich / Altamente probable)	87.16	10.66	85.75	7.48	0.27
12	Certain (Sicher / Seguro)	94.22	8.93	98.30	3.23	0.71

Fuzzy Membership Functions. Figure 1 shows the potential MF for both the German and Spanish probability expressions. The MFs' peaks (marked with a vertical line), indicating the highest membership (r), are identical to the means shown in Table 1. *Dp*s of the MFs are shown in Table 1. According to Bocklisch et al. (2012; p.149), *dp* values are defined by the overlapping area of two MFs and is standardized by taking values between 0 (MFs are identical) and 1 (no overlap at all). By definition, the larger the overlap, the smaller the *dp*, and the more similar the meanings of the verbal expressions are. Concerning the interpretation of *dp*, values ≥ 0.7 suggest that the MFs are considerably different (because overlap is <30%).

For reasons of clarity and comprehensibility, the LTs with odd numbers are shown in the upper part and even numbers in the lower part of Figure 1. The MFs positions and shapes show that the meaning of a certain LT is highly similar regarding its typical meaning (rs) as well as vagueness (MFs shapes) in both languages. For instance, the MFs for *possible* (MF 7) are almost congruent.

Furthermore, we find the same pattern as reported in Bocklisch et al. (2010 and 2012) that MFs of LTs at the scales borders (e.g., *impossible*) are smaller in extent and, therefore, more precise in meaning compared to mid-scale LTs (e.g., possible). MFs 8 and 12 (*probable* and *certain*) show the largest differences. This is also confirmed by the *dp*s (see Table 1). For MFs 12 (*certain*) *dp* = 0.71 reaches the threshold of a remarkable difference while all other *dp*s are smaller than 0.5.

Discussion

The results show that there is (1) no significant difference in the UA between Spanish and German participants. Hence, we could replicate only parts of Hofstedes results (Hofstede, 2001): Spain and Germany are both countries with high UA. But our results do not show remarkable differences between Spain and Germany in UA as we hypothesized according to Hofstede (2001). Concerning (2) the interpretation of probability expressions we did not find differences in the MFs between the Spanish and German sample except for LT *certain* and, by tendency, for *probable*. This is a surprise because we did not expect that the MFs of the Spanish and German LTs are so similar because the languages do not origin from the same language family. But in regard to the cultural background it seems reasonable and goes along with the idea that UA and interpretation of probability LTs may be connected. For future studies we suggest to collect data from a more representative sample. Especially the Spanish sample of this study was rather small.

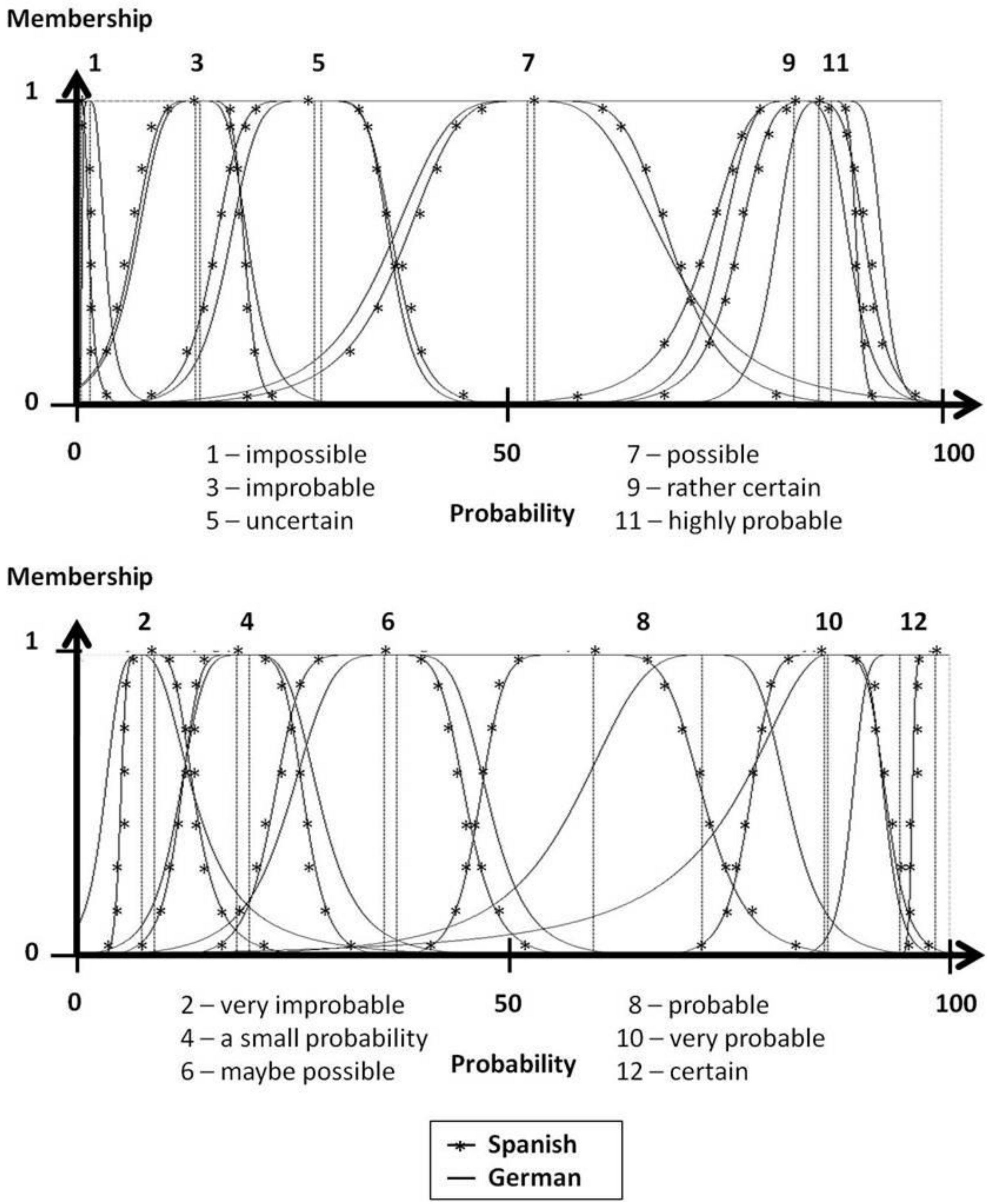

Figure 1: Fuzzy MFs of Spanish and German LTs

Furthermore, a comparison of languages from cultures with larger differences in UA (e.g., Asian vs. European cultures) would be interesting to test the hypothesis whether UA influences the interpretation of LTs because the larger the differences in UA the more differences in LTs MFs should be.

As an additional result it was possible to compare the data of Bocklisch et al. (2010) that used the same translation procedure and the results of the German sample for seven LTs (see Table 2). The *r*s (means of the typical values) are almost identical (largest difference is 3.96 for *probable*) meaning that we could replicate their findings very good using the fuzzy MF approach.

Table 2: Comparison of Representative Values of German Sample and Bocklisch et al. (2010)

Probability Expressions (Original German)	German Sample	Bocklisch, et al. (2010)
Impossible	1.53	1.44
Very Improbable	7.48	5.53
Improbable	14.24	11.68
Possible	52.04	51.49
Probable	71.64	67.68
Very Probable	85.96	83.95
Certain	94.22	96.28

The results encourage the application of fuzzy MFs in technical, cognitive and language interaction systems. Concerning the methodological possibilities of MFs the implementation in technical systems can easily be done by implementing the parametric description that underlies the MFs. We see a high potential for this methodology for future research and application, for instance, in the field of intercultural communication.

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