BEM'S "FEELING THE FUTURE" (2011) FIVE YEARS LATER: ITS IMPACT ON SCIENTIFIC LITERATURE

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ABSTRACT: The study analyses the impact on scientific literature of the controversial 2011 article by Bem, "Feeling the Future." Texts that cite Bem´s article (*N* = 162) were identified from the Elsevier Scopus database for the years 2011 to 2015. Their summaries were analyzed using the Iramuteq program for textual data. The analysis suggested that the impact can be grouped into four classes: (a) The Replication class is characterized by a vocabulary addressing the role of replication in psychology research; (b) the Bayesian class reflects the perceived merits of this approach when compared with more traditional inferential statistics, namely statistics relying on *p* values; (c) the Experimental Studies of Anomalous Experiences (AE) class includes terms related to classical empirical research, applied in AE studies, and concepts, methodologies and theories specific to parapsychological research; (d) the Quantum Phenomena and Theories class vocabulary suggests that quantum theories of brain/consciousness function may leave the door open to the possibility of the existence of psi phenomena. The Replication and Bayesian classes are represented more in psychology literature, confirming our hypothesis that psychology sources have a more critical position. Data moreover suggest that replication is currently the most referred path in the attempt to reach closure on this controversy.

Even before its publication, in March 2011, in the highly influential *Journal of Personality and Social Psychology (JPSP)*, Daryl Bem´s (2011) article "Feeling the Future: Experimental Evidence for Anomalous Retroactive Influences on Cognition and Affect" had already initiated an intense debate in the (social) media, establishing a remarkable controversy (e.g., Gad-el-Hak, 2011; MSNBC, 2011). The main reason for this was the message conveyed by its findings: "Precognition is scientifically supported" (Duggan, 2015). Although there is great public interest in parapsychological (psi) research, controversy has always been an integral part of this field of study, such that Richard Broughton (1991) titled his book *Parapsychology: The Controversial Science*. Evidence for psi was reported in the extensive parapsychological literature of recent and past years. What, then, made the article by Bem so unique and interesting? According to Palmer (2015), its particular importance lies in the scientific status of Bem as a social psychologist at the prestigious Cornell University, where he works, and in the fact that in this article he adapted experiments from methodological paradigms that are common in psychology, although reversing the order in which the task stimuli were presented.

Although controversies in science are common and scientists often argue among themselves, this does not mean that scientists must argue or that controversies are essential to the development of science. The history of science shows that some important theoretical changes have been controversial (e.g., Darwinism), whereas other achievements (e.g., electricity-magnetism unification) have not (Machamer, 2000). There are also controversies that are explicitly avoided. By publishing in a highly regarded journal, and using well established methodological paradigms of mainstream psychology that were reversed, Bem also gave rise to controversy within the scientific community.

In parapsychology, some controversies have been documented and studied. Zingrone (2006) presents an impressive amount of data and an in-depth analysis of controversies throughout its history. Palmer (2015) analyzed Bem´s (2011) controversy in some depth, namely the specific criticisms levelled at his studies, and the meta-analysis conducted by Tressoldi, Rabeyron, Duggan, and Bem (2014; see also Bem, Tressoldi, Rabeyron, and Duggan, 2015), which supports the early findings of Bem.

The present study aims to complement this more in-depth approach to the controversies in parapsychology through an analysis of texts indexed in a scientific database that cited Bem´s (2011) article, using the Iramuteq program for textual data analysis (Ratinaud, 2009). Using exploratory means,

Iramuteq employs a quantitative approach that we used in order to understand the impact of this article on the scientific community.

We analyzed three supplementary variables representing the year of publication and subject area. The choice of the supplementary variables resulted from our expectations. Indeed, we did not have any particular predictions regarding the year of publication, but we had some hypotheses with respect to the subject areas in which the sources were indexed: We expected that a more critical point of view on Bem's article would be demonstrated by papers published in sources indexed in the subject area Psychology, and a more positive point of view would be found in texts published in sources indexed in other subject areas (see, e.g., McClenon, 1982; McClenon, Roig, Smith & Ferrier, 2003; McConnell & Clark, 1991; Roe, 2016).

Method

Data Collection

The texts that cite Bem´s (2011) Feeling the Future were identified from the Elsevier Scopus database for the years 2011 to 2015. The export procedure was performed on August 24, 2015, resulting in the collection of 163 texts, but one that was duplicated was excluded from further analysis. The following information was registered for the 162 remaining texts: (a) title, (b) abstract (when available), (c) authors' keywords (when available), (d) year of publication, (e) authors' names, (f) source, and (g) subject area. A source could be indexed in more than one subject area. Very few errors were detected in the downloaded texts (eight words misspelled, two authors' keywords missing and one incomplete). These errors were manually corrected after consulting the original texts, and one title was translated from Italian to English in order to run the automatic data analysis on a reliable document. Titles, abstracts, authors' keywords, years of publication, and authors' names were then compiled into a single textual *corpus,* which constituted the material to be analyzed.

Summaries were separated by the supplementary variables necessary for the association of the lexical productions with the years and subject areas of publication. Three supplementary variables were added: first, the year of publication [variable with five modalities (or categories): from 2011 to 2015], and then two different (but complementary) variables for the definition of the subject areas (e.g., Psychology, Medicine) in which the sources (academic journals, books, conference proceedings) were indexed: (a) a variable with two modalities: in the subject area Psychology, indexation (i) or not (ii), and (b) a variable with three modalities: indexation only in the subject area Psychology (i), or indexation in the subject area Psychology as well as in other subject areas, namely, Arts and Humanities, Medicine, Social Sciences, Mathematics, Neuroscience, Business, Management and Accounting, Decision Sciences, Economics, Econometrics and Finance (ii), or indexation *not* in subject area Psychology but in other subject areas, which were, in addition to the above-mentioned ones, Physics and Astronomy, Multidisciplinary, Nursing, Agricultural and Biological Sciences, Computer Science, Engineering, Materials Science, and Health Professions (iii). The introduction of this second variable for the subject areas in which the sources were indexed was meant to assess whether the lexical production of the texts included in sources indexed in subject area Psychology and also in other subject areas would modulate the broad difference expected between the texts indexed or not indexed in subject area Psychology.

Data Analysis

To analyze the very large corpus extracted from the database, we used the Iramuteq program (Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires). This program, anchored in R software, enables several different statistical analyses and processing of text (Ratinaud, 2009). In particular, Iramuteq enables the analysis of a corpus using a method developed by Reinert (e.g., 1993), named Alceste (Analyse des Lexèmes Cooccurrents dans les Énoncés Simples d'un Texte), which

has been available for a long time in the software ALCESTE®. The method enables the study of the formal structure of the co-occurrence of the words ("*the lexical worlds*") in a given text or set of texts: classes of words are created and associated with supplementary variables likely to explain the conditions of their production. More precisely, the program performs a downward hierarchical classification, extracting (creating) classes of words that co-occur and that are most dissimilar from other classes of co-occurring words; it presents the resulting clustering tree (*dendrogram*) showing the proximity relationships between the classes; it also provides a list of the most representative words in each class, a list of text segments in which the representative words are included, and the modalities (i.e. the categories) of the supplementary variables associated with the classes. Iramuteq also performs an analysis of correspondence (Benzécri, 1973), which provides a schematic spatial representation of the relationships between the extracted classes, represented by their most representative words. Data analysis was performed using Iramuteq version 07.2, released on December 23, 2014.

Concretely, three steps are taken to perform the analyses. In Step 1 the different parts of a text or, in the case of a questionnaire, respondents' answers to an open-ended question (see, e.g., Poeschl, Valentim, & Silva, 2015), are divided into text segments. The text segments correspond, usually, to a sentence and they are the basis of all computed statistics. At that time, all words are registered to create a dictionary, as well as a dictionary of their lemmatized *forms* (words reduced to their roots), intended to avoid irrelevant differences (words written in singular or plural, verbs conjugated in different tenses, etc.; Chabchoub, 2008). The text segments are congregated in larger groups of text segments which form the rows of a table. The lemmatized forms form the columns of the table. The intersection of the rows and the columns registers either 1 if the form is present in the text segments, or 0 if it is not.

In Step 2, the table is submitted to a downward hierarchical classification, which iteratively separates the text segments into classes in which specific lemmatized forms co-occur and classes in which they do not (Reinert, 1986). This procedure was developed to analyze large logical tables (codified 0 or 1) of scarce frequencies. The first iteration decomposes the original table, made up of all the text segments, into two subtables, one including text segments with mostly "0" in the cells in the original table, and the other including text segments with mostly "1" in the cells. Each of the subtables thus constitutes a class made up of a distinct vocabulary with the overlap of classes as small as possible. The following iterations further decompose the subclasses, increasing the intraclass homogeneity and the interclass differences until the iterations fails to improve the sorting (Reinert, 1986; for more details about the procedure, see also Reinert, 1983, 1985). The procedure results in a tree diagram.

In Step 3, the results that may be interpreted are displayed. The classes presented in the clustering tree are described by the list of their associated forms, which constitutes the classes' *profiles*. The profile of a class is the list of the words associated with the class. The degree of association of a form with a class is assessed by applying the chi-square formula on the observed data. An illustration of the relation of Form 1 (replication) with Class 1 (the role of replication in psychology research) is presented in Table 1 (see Pélissier, 2016, for further examples; Reinert, 1993). In this example, the chi square of association is significant: $\chi^2(1, N = 622) = 105.27, p < .0001$.

Insert here Table 1

To indicate the direction of the relation between a form and a class (in Table 1, e.g, whether there were, or not, more "Form 1" present in Class 1 than in the other classes, or vice versa), the sign of the difference between the observed and the expected frequencies is added to the chi square value, which is then denominated *chi square of association*. The significance of the chi square value, with one degree of freedom, is assessed and the classes are described by their most representative forms. The larger the chi square value, the stronger the association of the form with the class, and each class is thus characterized by a set of forms (words) more representative of that class than the others (Viaud, Uribe, & Acosta, 2007).

A chi-square of association is also computed to assess the degree of association of the supplementary variables introduced in the corpus with the classes extracted by the program. An illustration of the relation of Modality 2 (year 2012) of Supplementary Variable 1 (year of publication) with Class 2 (experimental studies in anomalous experiences) is presented in Table 2. The chi square of association is significant: $\chi^2(1, N = 622) = 22.34, p < .0001$.

Insert here Table 2

We present hereafter the results obtained from the procedure. More specifically, we describe the profiles of the classes extracted by the downward hierarchical classification performed on the corpus, and their association with the modalities of the supplementary variables. Then we present the results of the correspondence analysis.

Results

The analysis of the *corpus* with the Iramuteq program was performed on the 162 texts that cited Bem´s (2011) "Feeling the future". In step 1, the corpus was subdivided by the program into 721 text segments containing, altogether, 4438 lemmatized forms. In step 2, the downward hierarchical classification sorted 622 text segments into four classes, classifying 86.27% of the 721 total text segments. The excluded segments were containing forms (i.e., words) that were too rare to be taken into consideration (i.e., total frequency less than 3). The analyzed text segments were first divided into two main *branches* of the clustering tree (or tree diagram) on the basis of the dissimilarity of their vocabulary. Each one was subsequently decomposed further into two *classes* of words that did not require any further division (see Figure 1).

Insert here Figure 1

Figure 1. Dendrogram and relative weight of the classes based on the percentage of text segments.

First Branch of the Dendrogram

We begin by describing the two classes of the first branch of the dendrogram presented in Figure 1, which includes 58.3% of the total text segments: the large Class 1 and the smaller Class 4. Table 3 presents a summary of the forms included in these two classes, that is, their 35 most representative forms, showing the frequency of each form in the class, its total frequency in the analyzed segments, the percentage of the form in the class, and the value of its chi square of association, calculated from a table such as Table 1 (for each value, $df = 1$; $N = 622$, $p < .001$). To make the reading easier, we substituted for each lemmatized form the word most frequently used in the corpus.

Insert here Table 3

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Class 1—The Role of Replication in Psychology Research. Class 1, one of the two largest classes, is composed of 195 text segments, that is, 31.4% of the corpus, organized around "replication": $\chi^2 = 105.27$. As may be seen in Table 3, it also includes significant chi squares for the words "psychology," ($\chi^2 = 88.38$) "science," ($\chi^2 = 76.15$) and "research" ($\chi^2 = 72.64$), "article," ($\chi^2 = 37.84$) "publication bias,"

(χ^2 = 31.99) and "practice," (χ^2 = 31.76) "psychological," (χ^2 = 27.72) "important," (χ^2 = 27.44) "method," (χ^2 = 26.28) "empirical," (χ^2 = 25.96) "education," (χ^2 = 25.18) "field," (χ^2 = 22.72) "publication" (χ^2 = 20.68) and "methodological," (χ^2 = 19.67) "recommendation," (χ^2 = 18.46) "improve," (χ^2 = 16.90) "credibility," (χ^2 = 15.50) "validity," (χ^2 = 13.27) "crisis," (χ^2 = 13.25) and "error" (χ^2 = 11.87). This class is characterized by a vocabulary that addresses the role of replication in psychology research. The lack of replication of some studies, along with questionable research practices, may have contributed to a crisis of credibility regarding psychological science. Publication bias is a major concern, and the perceived crisis is also viewed as an opportunity to improve research practices through implementation of recommendations that can increase the credibility of scientific evidence in psychology journals. Issues of validity of empirical findings and errors also characterize the vocabulary of this class.

This first class groups vocabulary that was referred to mostly in texts whose sources are indexed in subject area Psychology, f = 147; χ^2 = 36.96. Significant chi squares were found for only subject area Psychology, f = 68; χ^2 = 13.44; Psychology and other subject areas, f = 79; χ^2 = 9.1; and texts published in 2015, f = 20; χ^2= 11.46. The other chi squares are nonsignificant. With regard to the subject areas, we note that, although globally the vocabulary stems from texts whose sources are indexed in subject area Psychology, it is more specifically characteristic of the texts whose sources are indexed only in this area than of the texts whose sources are indexed in the modality Psychology and also other subject areas.

Class 4—Bayesian Statistical Inference. Close to Class 1 in term of vocabulary, Class 4, the second largest class, includes 167 text segments which correspond to 26.9% of the total segments. This class is structured around "Bayes": χ^2 = 88.89. As shown in Table 3, it also comprises significant chi squares for the words "factor," (χ^2 = 73.17) "Bayesian," (χ^2 = 64.56) "test," (χ^2 = 56.11) "null," (χ^2 = 54.57) "Bayes factor," (χ^2 = 45.99) "statistical," (χ^2 = 45.11) "hypothesis," (χ^2 = 43.40) "data" (χ^2 = 42.59) and "*p* values," (χ^2 = 40.27), "inference," (χ^2 = 27.41) "default," (χ^2 = 24.88) "set" (χ^2 = 22.46) and "analyse," (χ^2 > = 21.91) "significance," (χ^2 = 19.88) "frequentist," (χ^2 = 19.29) "assessment," (χ^2 = 16.91) "effect size," (χ^2 = 16.91) "probability," (χ^2 = 16.91) "exploratory," (χ^2 = 13.73) and "one-sided" (χ^2 = 13.73). The vocabulary of this class points mainly to concepts related with the Bayesian approach. The segments of text mostly reflect the perceived merits of this approach when compared with the more traditional inferential statistics, namely those relying on *p* values. The words "Bayes" and "Bayesian" are used to express an inferential statistical method used to test hypotheses (null and alternative) in which the notion of probability is different from the frequentist approach. On the other hand, the specific term "Bayes factor" is a value that results from one Bayesian approach to assessing null values, and it is used to infer which model (null or alternative) is more accurate given the data. With regard to effect size, it relates with both approaches.

Class 4 groups vocabulary that was referred to more in texts whose sources are indexed in subject area Psychology, f = 121; χ^2 = 20.74; Psychology and other subject areas, f = 78; χ^2 = 22.16; and texts published in 2011, f = 51; χ^2 = 14.39.

Second Branch of the Dendrogram

The second branch of the dendrogram presented in Figure 1 includes 41.8% of the text segments, also divided into two classes of unequal weight, Class 2 and the small Class 3. Table 4 presents a summary of the forms included in these two classes, that is, their 35 most representative forms, indicating for each form its frequency in the class, its total frequency in the analyzed text segments, its percentage in the class, and the value of its chi square of association (df = 1, N = 622, p < .001). We also substituted for each lemmatized form the word most frequently used in the corpus, to make the reading easier.

Insert here Table 4

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Class 2—Experimental Studies of Anomalous Experience. Class 2 includes 153 text segments, that is, 24.6% of the segments. It is organized around "participant" and "task": χ^2= 43.10. It significantly comprises the words "experience" (χ^2 = 34.67) and "target," (χ^2 = 31.15), "response," (χ^2 = 29.14) "predict," (χ^2 = 28.44) "learn," (χ^2 = 27.99) "anomalous," (χ^2 = 26.55) "nonintentional," (χ^2 = 24.84) "spontaneous," (χ^2 = 24.84) "stimulus," (χ^2 = 22.40) "performance" (χ^2 = 21.70) and "precognition" (χ^2 = 20.43), as well as "subject," (χ^2 = 19.68) "emotional," (χ^2 = 18.57) "prestimulus," (χ^2 = 18.57) "mind," (χ^2 = 18.19) "control," (χ^2 = 17.69) "randomly," (χ^2 = 17.29) "go/nogo," (χ^2 = 15.45) "PMIR," (χ^2 = 15.45) and "remote viewing" (χ^2 = 15.45). This class includes terms from classical empirical research, applied in anomalous experiences studies, and also concepts, methodologies, and theories specific to parapsychological research (e.g., nonintentional, precognition, task, prestimulus, go/nogo task, remote viewing, and psi-mediated instrumental response—PMIR).

Class 2 groups vocabulary that was referred to mostly in texts whose sources are not indexed in subject area Psychology, $f = 88$; χ^2= 18.87, $p < .0001$; and in texts published in 2012, $f = 63$; $\chi^2 = 22.34$.

Class 3—Quantum Phenomena and Theories. Class 3, with 107 text segments which correspond to 17.20% of the total analyzed segments, is the smallest of the extracted classes. It is strongly structured around "quantum": χ^2 = 143.46, to which the words "brain" (χ^2 = 73.98) and "consciousness" (χ^2 = 57.21) were significantly associated, as well as "Orch Or," ([Penrose–Hameroff theory of] orchestrated objective reduction; χ^2 = 39.01) "entanglement," (χ^2 = 37.81) "moment," (χ^2 = 37.81) "system," (χ^2 = 34.52) "retrocausality," (χ^2 = 34.08) and "space time," (χ^2 = 34.08), "microtubule," (χ^2 = 29.16) "nonlocality," (χ^2 = 29.16) "superposition," (χ^2 = 29.16) "reality," (χ^2 = 28.12) "mechanic," (χ^2 = 24.26) "paa" (predictive anticipatory activity; χ^2 = 24.26) "causality," (χ^2 = 23.53) "principle" (χ^2 = 23.33) and "anticipatory," (χ^2 = 19.38) "EKT" ([analysis of] Echeverria, Klinkhammer, and Thorne; χ^2 = 19.38) "paradox," (χ^2 = 19.38) "backward" (χ^2 = 18.60) and "bilk" (χ^2 = 18.60).

This last class grouped vocabulary that was mainly mentioned in texts whose sources are not indexed in subject area Psychology, $f = 82$; $\chi^2 = 61.84$; and in texts published in 2011, $f = 34$; $\chi^2 = 10.26$.

Relationships Between Classes

The relationships of proximity and opposition between the classes may also be observed in the graphic provided by the correspondence analysis performed by the Iramuteq program. As may be seen in Figure 2, the most representative words of the four classes are positioned on two axes: the horizontal axis explains 40.75% of the inertia (i.e., variance) and the vertical axis 30.49%.

Insert here Figure 2

Figure 2. Correspondence analysis

Figure 2 confirms, on the horizontal axis, the strong contrast between Classes 1 and 4 (The Role of Replication in Psychology Research, Bayesian Statistical Inference), and Classes 2 and 3 (Experimental Studies of Anomalous Experiences, Quantum Phenomena and Theories). If we take also into consideration the position of the words on the vertical axis, we may further note that the texts on Replication issues are the most closely related, in terms of vocabulary, with the texts on Bayesian Statistical Inference, and most distant from the texts on Experimental Studies of Anomalous Experiences. On the other hand, the texts on Quantum Phenomena and Theories are the most closely related, in terms of vocabulary, with the texts on Experimental Studies of Anomalous Experiences and most distant from the texts on Bayesian Statistical Inference.

Discussion

The analysis performed on the summaries of published texts with regard to Bem's controversy extracted four classes, which enabled us to identify four types of impact on the scientific literature of Bem´s (2011) article "Feeling the Future." If Classes 1 and 4 (The Role of Replication in Psychology Research and Bayesian Statistical Inference) might be considered as coming from a more critical point of view, the data also show that they are close to each other and both are related with the identification of methodological problems and questionable research practices, including proposals for solving the problems. Classes 2 and 3 (Experimental Studies of Anomalous Experiences and Quantum Phenomena and Theories), on the other hand, do not share the same point of view, inasmuch as they are characterized by a specific vocabulary which indicates different approaches to Bem´s article.

Data suggest that, subjacent to the Replication class, and to some extent also the Bayesian class, it is possible to consider the question of the authenticity or ontological reality of psi phenomena. Is there evidence or strong evidence that psi is real? The lack of replication of some studies (not only in psi research, but, for example, also in mainstream psychology and medicine), questionable research practices, and the debate around some statistical inference methods, fomented criticisms and negative reactions to Bem´s findings. The Bayesian vocabulary was present more in 2011, when the debate began—for instance, in the same issue of *JPSP* in which the article by Bem appeared, Wagenmakers, Wetzels, Borsboom, and van der Maas (2011) published a paper on Bayesian statistics as a comment on Bem. On the contrary, 2015 was the year in which the question of replication seemed to be most prominent. In that same year, the journal *Science* listed the transformations made by psychologists in their research efforts (i.e., replications of key studies; creation of new models of scholarly publication and peer review, such as preregistration) as one of the notable scientific breakthroughs of 2015 (Bohannon, 2015)

The technical and complex replication topic, and subtopics such as meta-analysis, have been addressed by some parapsychologists over the years (e.g., Honorton & Ferrari, 1989; Watt & Kennedy, 2015, 2016). On the other hand, controversies between the supporters of frequentist and Bayesian forms of interpreting probability have a long history in science, with the former seeing probability as a limiting ratio in a sequence of repeatable events, and the latter as a mental construct that represents uncertainty and which applies not directly to events but to our knowledge about them. As argued by Howey (2002), ". . . a choice between the two interpretations of probability is not forced by pure logic or the mathematics of the situation, but rather depends on the experiences and aims of the individuals involved and their views of the correct form of scientific inquiry" (p. i).

The fact that the Replication and Bayesian classes were represented more in psychology texts confirms our hypothesis that psychology sources have a more critical position concerning Bem´s (2011) article. Firstly, it was published in one of the most influential journals in social psychology, using common methodological paradigms of mainstream psychology, which were reversed; secondly, it is well established that psychologists in general have had a strong critical position about the existence of psi phenomena; thus, it was expected that the most critical reaction would come from psychology sources. (Although the *Journal of Parapsychology* is also indexed in the subject area Psychology, the relatively small number of articles it published on this topic reduced its impact in the scientific literature indexed in the selected database). When the sources indexed in the subject area Psychology were divided into Only Subject Area Psychology and Psychology and Other Subject Areas, the Bayesian class was represented more in the latter, which is consistent with our technical argumentation, particularly in mathematical terms.

Classes 2, Experimental Studies of Anomalous Experiences, and 3, Quantum Phenomena and Theories, underlie two other types of impact of Bem´s (2011) article. As pointed out before, the class Experimental Studies of Anomalous Experiences includes terms from classical empirical research, applied in anomalous experiences studies, and also concepts, methodologies, and theories specific to parapsychological research. The data suggest that, for the authors of these texts, the citation of Bem´s article was applied in a context of process-oriented research on anomalous experiences (experimental work designed to find evidence about the characteristics of processes that underlie anomalous experiences), as opposed to proof-oriented research, that is, research that aims to find evidence for the

existence of psi. This class is represented more in 2012 and in texts whose sources are indexed in subject areas other than psychology, thus confirming the hypothesis that sources from other areas of knowledge might have a more positive position concerning Bem's article.

The Quantum Phenomena and Theories class gives the same result, being more represented in texts whose sources are indexed in other areas of knowledge. In this case, data indicate that quantum theories of brain/consciousness function may leave the door open to the possibility of the existence of psi phenomena. For instance, retrocausality and predictive anticipatory activity (PAA) can be addressed in terms of quantum phenomena. This class, like the Bayesian Statistical Inference class, is represented more in the beginning of the debate (i.e., 2011). Scientists with a favorable position integrated the evidence of retrocausality phenomena as deserving further explanation, whereas the scientists with a more critical position pointed to the necessity for a new method of statistical inference to demonstrate that Bem's (2011) analysis had weaknesses and was not valid. The data trends in the present study suggest that the replication path is currently the most referred to in the attempt to reach closure in this controversy.

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Table 1

Presence vs. Absence of Form 1 in the Text Segments of Class 1 vs. Other Classes in the Observed Data

	Number of text segments with Form 1 present	Number of text segments with Form 1absent	Total
Class 1	55	140	195
Other classes	7	420	427
Total	62	560	622

Table 2

Presence vs. Absence of Modality 2 of Supplementary Variable 1 in the Text Segments of Class 2 vs. Other Classes in the Observed Data

	Number of text segments with Modality 2 present	Number of text segments with Modality 2 absent	Total
Class2	63	90	153
Other classes	102	367	469
Total	165	457	622

Table 3

Class profiles: 35 Most Representative Words associated With Class 1 and Class 4

Class1					Class 4				
Form	*N* in class	Total *N*	% in class	χ^2	Form	*N* in class	Total *N*	% in class	χ^2
Replication	55	62	88.71	105.27	Bayes	31	31	100.00	88.89
Psychology	62	81	76.54	88.38	Factor	35	42	83.33	73.17
Science	47	57	82.46	76.15	Bayesian	32	39	82.05	64.56
Research	61	86	70.93	72.64	Test	41	61	67.21	56.11
Scientific	31	40	77.50	42.30	Null	25	29	86.21	54.57
Article	30	40	75.00	37.84	Bayes factor	18	19	94.74	45.99
Publication bias	16	17	94.12	31.99	Statistical	27	36	75.00	45.11
Practice	31	45	68.89	31.76	Hypothesis	35	54	64.81	43.40
Psychological	24	33	72.73	27.72	Datum	42	71	59.15	42.59
Important	14	15	93.33	27.44	*p* values	16	17	94.12	40.27
Method	29	44	65.91	26.28	Inference	14	17	82.35	27.41
Empirical	21	28	75.00	25.96	Default	9	9	100.00	24.88
Education	13	14	92.86	25.18	Set	17	25	68.00	22.46
Field	16	20	80.00	22.72	Analyse	13	17	76.47	21.91
Publication	11	12	91.67	20.68	Provide	14	19	73.68	21.89
Methodological	12	14	85.71	19.67	Significance	10	12	83.33	19.88
Recommendation	10	11	90.91	18.46	Calorie	7	7	100.00	19.29
Core	8	8	100.00	17.75	Frequentist	7	7	100.00	19.29
Fact	8	8	100.00	17.75	Food	7	7	100.00	19.29
Improve	12	15	80.00	16.90	Analyze	8	9	88.89	17.90
Movement	9	10	90.00	16.24	Effect	31	63	49.21	17.84
Credibility	7	7	100.00	15.50	Obtain	9	11	81.82	17.23
Issue	12	16	75.00	14.54	Evidence	34	72	47.22	17.21
Replicability	11	14	78.57	14.84	Assessment	11	15	73.33	16.91
Journal	14	20	70.00	14.34	Effect size	11	15	73.33	16.91
Developmental	6	6	100.00	13.27	Probability	11	15	73.33	16.91
Guide	6	6	100.00	13.27	Stop	6	6	100.00	16.51
Validity	6	6	100.00	13.27	Yield	6	6	100.00	16.51
Crisis	9	11	81.82	13.25	Estimate	8	10	80.00	14.62
Investigation	9	11	81.82	13.25	Favor	8	10	80.00	14.62
Argue	16	25	64.00	12.90	Confirmatory	5	5	100.00	13.73
Error	7	8	87.50	11.87	Exploratory	5	5	100.00	13.73
Similar	7	8	87.50	11.87	One-sided	5	5	100.00	13.73
Finding	17	28	60.71	11.75	Small	5	5	100.00	13.73
Experimental	26	49	53.06	11.65	Value	12	19	63.13	13.16

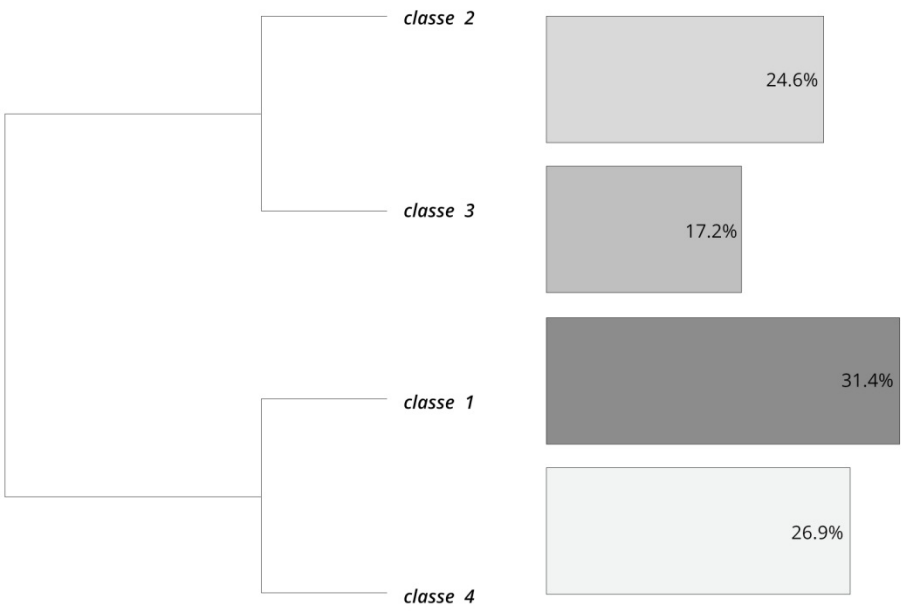
Note. *N* = number. Critical values of χ^2 with 1 df: 19.51 for $p < .00001$: 15.14 for $p < .0001$; 10.83 for $p < .001$.

Table 4

Class profiles: 35 Most Representative Words Associated With Class 2 and Class 3

Class 2					Class 3				
Form	*N* in class	Total *N*	% in class	χ^2	Form	*N* in class	Total *N*	% in class	χ^2
Participant	22	29	75.86	43.10	Quantum	32	35	91.43	143.46
Task	22	29	75.86	43.10	Brain	15	15	100.00	73.98
Experience	20	28	71.43	34.67	Consciousness	16	20	80.00	57.21
Target	10	10	100.00	31.15	Conscious	12	15	80.00	42.56
Response	18	26	69.23	29.14	Orch or	8	8	100.00	39.01
Predict	12	14	85.71	28.84	Entanglement	9	10	90.00	37.81
Learn	9	9	100.00	27.99	Moment	9	10	90.00	37.81
Anomalous	10	11	90.91	26.55	System	14	22	63.64	34.52
Person	14	19	73.68	25.46	Retrocausality	7	7	100.00	34.08
Time	21	35	60.00	25.06	Space time	7	7	100.00	34.08
Nonintentional	8	8	100.00	24.84	Microtubule	6	6	100.00	29.16
Spontaneous	8	8	100.00	24.84	Nonlocality	6	6	100.00	29.16
Investigate	10	12	83.33	22.76	Superposition	6	6	100.00	29.16
Stimulus	17	27	62.96	22.40	Reality	7	8	87.50	28.12
Performance	7	7	100.00	21.70	Imply	5	5	100.00	24.26
Precognition	19	33	57.58	20.43	Macroscopic	5	5	100.00	24.26
Subject	11	15	73.33	19.68	Mechanic	5	5	100.00	24.26
Emotional	6	6	100.00	18.57	Paa	5	5	100.00	24.26
Prestimulus	6	6	100.00	18.57	Universe	5	5	100.00	24.26
Mind	13	20	65.00	18.19	Basic	6	7	85.71	23.33
Control	12	18	66.67	17.69	Causality	7	9	77.78	23.53
Feel	7	8	87.50	17.29	Framework	7	9	77.78	23.53
Randomly	7	8	87.50	17.29	Fundamental	7	9	77.78	23.53
Read	7	8	87.50	17.29	Principle	6	7	85.71	23.33
Word	7	8	87.50	17.29	Paper	10	17	58.82	21.26
Reward	8	10	80.00	16.82	Anticipatory	4	4	100.00	19.38
Belief	13	21	61.90	16.31	Biology	4	4	100.00	19.38
Human	12	19	63.16	15.71	Ekt	4	4	100.00	19.38
Go nogo	5	5	100.00	15.45	Paradox	4	4	100.00	19.38
Hit	5	5	100.00	15.45	Nature	10	18	55.56	19.14
Trust	5	5	100.00	15.45	Physical	6	8	75.00	19.01
Twin	5	5	100.00	15.45	Backward	5	6	83.33	18.60
Wander	5	5	100.00	15.45	Bilk	5	6	83.33	18.60
PMIR	5	5	100.00	15.45	Usual	5	6	83.33	18.60
Remote viewing	5	5	100.00	15.45	Causal	8	13	61.64	18.32

Note. *N* = number. Critical values of χ^2 with 1 df: 19.51 for $p < .00001$: 15.14 for $p < .0001$; 10.83 for $p < .001$.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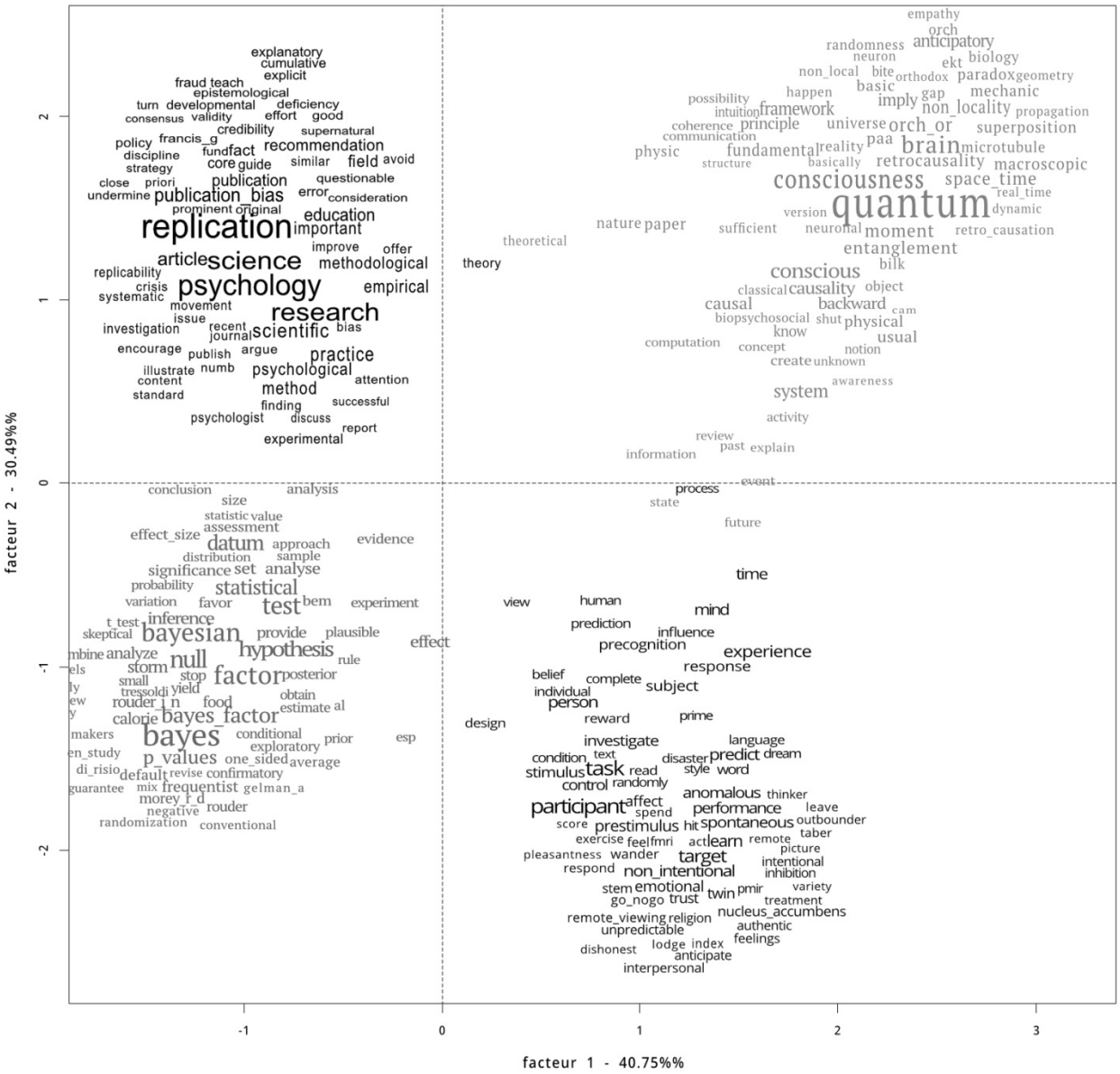
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