



Science and language: integrating discourse and context in the analysis of the Conclusions of experimental scientific articles “Memories of the Oswaldo Cruz Institute” (1909-1919 and 1980-1989)

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Abstract

The Conclusions of the experimental scientific articles from a traditional Brazilian journal were analyzed considering the 1909-1919 and 1980-1989 periods. The analysis integrated language and context by revealing types of arguments, rhetorical moves and linguistic traits. The findings were the change from a linear and less rhetorically elaborated discourse in the first period to a highly rhetorical density and ciclicity in the second period. They were correlated with the change from a cohesive, small and prestigious community to a big community pressured to adapt to the parameters of the big science, with no governmental support. The contributions to genre analysis, studies of science and teaching for academic purposes are discussed.

1 Introduction

Studies of genre have been traditionally associated with pedagogical purposes. The motivation for that is the belief that mastering the comprehension and the production of specific genres grant a faster and smoother access to specific social groups. A training/educational plan that considers genres is believed to be strategic for the “student success in all rhetorical situations” (Johns et al., 2006: 248). Therefore, a meta-awareness of the aspects of genres is expected to empower students and democratize their social participation (Ramanathan and Kaplan, 2000).



Extrapolating that application, some authors have studied genres to portray scientific communities, considering their typical social practices, beliefs and objectives (Salager-Meyer, 1999; Peacock, 2002; Samraj, 2002; Ayers, 2008; Bruce, 2008). In general, these studies analyze communities of different disciplines or of different areas of knowledge (i.e. social sciences vs. physical sciences).

For both applications, a model of a certain genre that achieves comprehensiveness and flexibility at the same time is an invaluable gain. In pedagogical terms, it would offer teachers/trainers the opportunity of competently emulating the discourse reality students will experience in the future. In studies of discourse communities, it would favor deeper and more critical analyses – triangulating different angles without losing sight of the aspects that push change in discourse habits.

Frequently, however, genre analyses consider few discourse elements and usually approach them with unequal focus: some researchers give more attention to linguistic aspects and others highlight the rhetorical structure. To illustrate how this practice is misleading, Coracini (1990) demonstrated that the sole consideration of linguistic aspects in research articles lead to the naïve idea that the scientific discourse is essentially objective. Indeed, the impression of objectivity is an argumentative resource itself, sustaining the “illusion of empirical evidence” – a conclusion that is only possible when pragmatic aspects are considered.

Some authors have already claimed for an integrated analysis. Swales (1990, 2004) used linguistic evidences to support the characterization of rhetorical moves. Atkinson (1999) was particularly fortunate in crossing the linguistic analysis, the rhetorical analysis and the historical context analysis in his study. Bruce (2008) claimed for the inclusion of types of procedural knowledge (what he called “cognitive genres”) in the analysis. Yet, a systematization of an integrated model for genre analysis remains a challenge.

The purpose of this article is to respond to this challenge by proposing an integrated model, specifically focusing on the Conclusions of experimental scientific articles. The model draws on the Theory of Speech Acts, considering its application extended to discourse (the “pragmatic macrostructure”, van Dijk, 1977). In addition, it is particularly inspired by Atkinson’s practice of Discourse Analysis, which adopts two complimentary descriptive procedures: “the analytical reading of texts as deeply embedded in their sociohistorical contexts (...) and the “reading-off” of such contexts from the texts themselves” (1999: 60).

2 The Study

The object of this study is a collection of experimental scientific articles from a renowned Brazilian Journal, “Memories of the Oswaldo Cruz Institute” (MOCI), in two different moments, 1909-1919 and 1980-1989. This is the oldest journal in Brazil still publishing today and it belongs to the area of Life Sciences.

2.1 The journal and the chosen periods of time

The MOCI is a relevant vehicle for the scientific production in Brazil since it started (1909). In its beginnings, it registered the arrival of the new microbiologic paradigm, brought by Oswaldo Cruz from France. In the present days, the journal is internationally recognized by its excellence.



The two chosen periods, 1909-1919 and 1980-1989, represent two key moments in history that are practically opposing in terms of opportunity for scientists (Schwartzman, 1991 and 1982). The first one is characterized as the Brazilian Illustration phase, a favorable moment for Brazilian scientists who were internationally acknowledged.

The other period is characterized as a crisis time which was marked by the lack of funding and support to scientists and the fast internationalization of science. The scientists at this time are considered a “group of pressure” (Schwartzman, 1991 and 1994), as they have to fight for resources and struggle for a place in the scenario of the “big science”.

2.2 Selection of the *corpus*

A preliminary *corpus* included five samples of Conclusions for each of the two periods. The preliminary analysis helped determine the extent of a discursive pattern (Nwogu, 1997: 121) and enabled training for the definitive analysis. This analysis was subjected to the validation criterion of intra-rater agreement (Peacock, 2002: 485) six months after the first analysis.

The definitive *corpus* included 12 Conclusions of each period, randomly selected. The definitive analysis was submitted to two validation criteria: intra-rater agreement four months after the first analysis and inter-rater agreement. A graduate student of Linguistics, whose doctorate thesis included the analysis of rhetorical moves, evaluated 25% of the *corpus*. Particularly, the inter-rater agreement was performed for the analysis of rhetorical moves only, as the analysis of types of arguments is a novelty and would require long training of other evaluators. The agreement rates were 92.79% (intra) and 89.61% (inter). A high degree of agreement suggests that the interpretation has a “psychological reality”, that is, the results are reliable (Kanoksilapatham, 2005: 273).

2.3 Procedures of analysis

The analysis included two complimentary procedures: the reading of the texts after the study of social and historical data (contextual reading) and the reading of the texts as symbolic indicators of the social and historical aspects (interpretative reading).

For the contextual reading, the general historical context of both periods was studied, considering local aspects relative to the journal and its discursive community. The source of data was texts of historians and texts published in the MOCI, such as editorials and homage notes. The organization of these data followed the criteria put forward by Swales (1990: 24-27) to characterize discursive communities: public objectives, intercommunication mechanisms, shared genres, and shared epistemological position. The only criterion that was not considered was the specialized lexicon, which would demand more attention and time of research.

For the interpretative reading, the analysis happened in three phases: 1) checking the presence of argumentation; 2) assessing the rhetorical moves; 3) assessing the types of arguments and the argumentative structure.

In addition, the linguistic aspects were subjected to a computerized analysis, helping evidence the contextual and the interpretative readings. For Upton and Connor (2001: 318), the analysis in multiple levels, combining the analysis of the manually categorized rhetorical moves and the computerized analysis of the lexical-grammatical aspects, is effective and invaluable.

In general, the model of analysis integrated the three levels of language, locutionary, illocutionary and perlocutionary, corresponding, respectively, to the linguistic aspects, rhetorical moves and types of arguments. Those three levels of language combined were confronted with the contextual data. Figure 1 demonstrates the intricate relation of these elements.

The picture shows the double possibility to start the analysis. Observing the picture carefully, it is possible to look through it from the contextual conditions to the locutionary level and vice-versa. That representation emphasizes the fact that when discursive phenomena is considered, there is no privileged start point in the analysis.

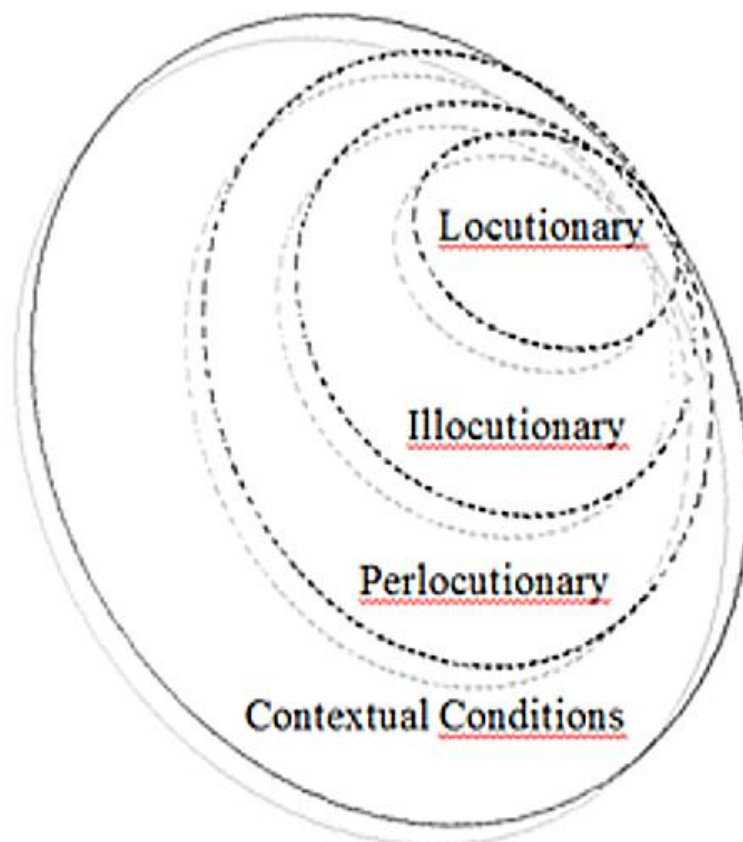


Figure 1- Model of Analysis

2.3.1 Analysis of the linguistic aspects (locutionary level)

For the analysis of the linguistics aspects, the *corpus* was analyzed using the Wordlist and Concordance tools of *Wordsmith tools 5.0*. The concordance tool was specifically used for refined searches, such as those for adverbs, by filtering the search with typical adverb endings. The other tool provided information about specific words or types of word, such as the modal verb “can”¹. The program provides information about the frequency of the items and about the distribution of the items in the *corpus*.

¹ The linguistic elements and categories were originally in Portuguese. The translation into English should be considered an approximate correspondence.



The choice of the items was mainly guided by the search for marks of argumentation and subjectivity. Particularly, the search was inspired by studies of the relation between modalization and argumentation (Koch, 2006; Guimarães, 2001; Neves, 2007); hypotheses raised with the use of the program Unitex; and hypotheses originated from the experience with the scientific discourse.

Elements/categories	Results of the search
Verb to be	is; are; was; were
Modal verbs	can and should (in different inflected forms in Portuguese)
Adverbs in -ly	possibly; perfectly; mainly; probably; easily; absolutely; really; partially; extremely; determinedly; meticulously; detailedly; frequently; usually; difficultly; only; totally; normally; substantially; visibly; potentially; deeply; essentially; preferably; relatively; properly; enormously; favorably; strongly; extraordinarily; classically; clearly; apparently; predominantly; notoriously
Use of the 1st person and passive voice	verbs in 1st person plural; the pronoun 'us'; passive voice
Verb tenses and moods	subjunctive; verbs with would (in Portuguese there is a verb tense corresponding to would) ; verbs with will (in Portuguese there is a verb tense corresponding to will)
Contrast connectors	but; however; on the other hand; on contrary; nevertheless; while; yet; nonetheless; although
Cause and effect connectors	given that; due to; so; for; because; since
Addition and emphasis connectors and expressions	also; even; really; too; in fact; moreover; including
Intensity expressions	very; all; few; only; just; almost; partial
Adjectives	possible; necessary; difficult; important; easy; probable; right; convenient; surprisingly
Cognition verbs	find; judge; think; conclude; see (understand); verify; know
Volition verbs	want, need
Verbs representing the speaker's relation with the object of knowledge	verify; obtain; identify; observe; seem; note; deserve; detect; suggest

Table 1: Linguistic elements and categories

The Unitex 2.0 program worked as the first identifier of some classes of speech. That is possible because the program has tagged dictionaries (though the tagger is not perfect). One major fault of this program, however, is the fact that texts cannot be treated separately – what explains the use of WordSmith as the definitive search program.



2.3.2 Analysis of rhetorical moves (illocutionary level)

To identify the rhetorical moves, a combination of textual and linguistic evidences (Peacock, 2002: 485) was used. The evidences were verbs, discursive markers, metadiscursive markers (Moraes, 2005) or textual structures such as narratives (Table 2).

Textual/linguistic evidences	Examples ²	Interpretation
Verbs	The parasitism of the anal glands by <i>T.cruzi</i> in skunks <u>suggests</u> a high degree of host-parasite adaptation...	The verb points to a conclusion of the previous fact, with a degree of uncertainty, though: ‘deduction and hypotheses’.
Discursive Markers	... a high degree of host-parasite adaptation, <u>given that</u> the parasites are protected against the immune response in the lumen of the glands ...	The marker points to an explanation of the previous conclusion: ‘Explanation’.
Textual elements	After the continuous use of insecticide with residual action, the <i>T. infestans</i> was eradicated, interrupting the domestic transmission of the Chagas disease. The <i>O. P. megistus</i> , native species with great mobility, moving actively from the wild to the domestic environment, was the only captured triatominae of which domestic colonization was hampered by the insecticide used in the Epidemiologic Surveillance, implemented in the region in 1974 (Dias, 1982).	All the passage is a narrative passage, with verbs in the past and time expressions: “Phenomenon Narrative”.
Other evidences	<u>The facts</u> , <u>altogether</u> , <u>corroborate</u> the possibility of “pêros” transmission of the Chagas disease ...	In this case, the underlined words suggest a metalanguage about the text. The phrase, “the facts”, prints an objective character to everything that was previously said. This passage illustrates the “ideation markers” (Moraes, 2005: 81), that is, organizers of blocks of ideas. The verb ‘corroborate’ contributes to the overall movement of

² All the passages from the MOCI were originally in Portuguese.



		deduction. Then, this an example of “Deduction And Hypothesis”.
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Table 2: Examples of rhetorical moves

The rhetorical moves used in this work (Table 3) were a combination of the rhetorical moves proposed by Swales (1990) and the new moves identified in the texts of the preliminary corpus.

Rhetorical moves	Reference	Examples
Statement of Results	Swales, 1990	These granulations are gram-positive in relation to the remainder of the bacillus. (XB ³)
Background Information	Swales, 1990	When using sorology as a routine to aid diagnosis, it is convenient that the techniques be easily operated and interpreted, not involving high-cost equipment or reagents. (YG)
Unexpected Result	Swales, 1990	... it was not possible to note any significant difference between the mice infected with a hundred cercariae of the Porto Rico strain of the <i>S. mansoni</i> and those with the same infection from the Feira de Santana strain. (YE)
Reference to Previous Research (comparison)	Swales, 1990	Quay and Levine, 1959, using the colchichine in the newly-born rats, showed that the cells in a certain lobule kept the same mitotic activity and cytologic development, but that those parameters were different from those found in other lobules. (<i>corpus</i> XA)
Reference to Previous Research (support)	Swales, 1990	The successive injections in mice can frequently modify the virulence of the strains of toxoplasma, as demonstrated by Coutinho e Mendonça, 1975...(YC)
Explanation	Swales, 1990	... given that the parasites are protected against the immune response in the lumen of the glands, the parasites can be disseminated to tissues via blood flow. (YH)
Deduction and Hypothesis	Swales, 1990	The estradiol is possibly secreted by the Leydig cells ...(YB)
Recommendation	Swales, 1990	The possibility of similar cellular alterations in other structures of the Central Nervous System also deserves examination using similar methodology. (YA)
Phenomenon Narrative	Our <i>corpus</i>	The epidemiology of the Chagas disease in this municipality is characterized by a first phase in which the prevailing vector was <i>T. infestans</i> , [...] of which domestic colonization was hampered by the

³ Those letters represent the different preliminar corpora. The letter X represents the 1909-1919 corpus, Y, the 1980-1989 corpus.



		insecticide used in the Epidemiologic Surveillance, implemented in the region in 1974 (Dias, 1982). (YH)
Statement of Limitation	Our <i>corpus</i>	The question is to know if it is possible to continue in this path. Our opinion would be premature, given the small number of experiences... (XA)
Reason of Limitation	Our <i>corpus</i>	The researches were not continued due to the high environmental temperature, which made it difficult to avoid the fluidification of the gelatin membrane during the experience. (XA)
Recovery of Method	Our <i>corpus</i>	In this work, four antigens of different origins were used, the preparation technique of the antigens and all the reaction phases were kept constant. (YC)
Statement of Continuation	Our <i>corpus</i>	We intend to return to this point when we have more material. (XC)
Practical Implication	Our <i>corpus</i>	This way, besides the standardization of the reaction technique, optical equipment and reagents, the standardization of the antigens is also necessary. (2C)
Statement of novelty	Our <i>corpus</i>	In the hen pest, we believe ours are the first tests of complement fixation. (XC)
Acknowledgement of Collaborators	Our <i>corpus</i>	Now, to finish, it is our duty to express one more time our sincere thanks to the Doctor Professors Domingos de Góes and Fernando Terra. (XE)
Reason for Acknowledgement	Our <i>corpus</i>	...for lending their patients for all the studies and researches we wanted to conduct, making our work by all means easier and following with great interest our results. (XE)

Table 3: Rhetorical moves in the Conclusion sessions

2.3.3 Analysis of arguments (*perlocutionary level*)

To verify the presence of argumentation in the sessions of Conclusion, we used the modalization as a general clue. The modalization is the manifestation of the subjectivity of the speaker and of his/her relationship with the listener. The connection between the modalization and the argumentation seems to occur through three bonds. The first bond is about debate, the negotiation between the parties. Through modalization, the speaker marks the “types of acts he/she desires to perform and provides clues to the listener about his/her intentions” (Koch, 2006: 86). Neves (2007: 200) argues that

...in a modalized statement, the interpersonal function is also marked, exactly because of the evident presence of the speaker and of the listener, both in the epistemic commitment (which is associated with a semantic role of experimenter for the speaker) and in the deontic involvement (including the several discourse persons, focused on the listener). (Neves, 2007: 200)



The second bond is about doubt, the uncertainty of argumentation, which particularly favors the debate. That aspect is expressed by the distance or proximity of the speaker in relation to what he says (Koch, 2006: 86). The epistemic modalization, particularly, materializes the degrees of uncertainty in terms of the speaker’s knowledge and world perceptions. This type of modalization is especially found in technical and scientific discourses (Neves, 2007).

Finally, the third bound is about consensus, the object of negotiation in the argumentation, which is usually expressed by means of values. Specifically, the axiological axis includes moral, affective and technical values and the speaker’s feelings and will, as well (Koch, 2006: 85). Another form of expression is through speculation, which anticipates the reality that the speaker wants to have accepted by his/her interlocutor so as to reach an agreement. Some of the marks of speculation are the verbal tenses and moods of the imaginary domain (*irrealis*).

As a result, the perlocutionary analysis was based on those three notions: doubt, debate and pursuit of consensus. The evidences for doubt were “argumentative operators” (Koch, 2006: 85) and all the other general modalization elements such as verbs, adverbs, adjectives and nouns. The evidences for the relationships between interlocutors were the types of assertion (Guimarães (2001: 70-71) the unipersonalization processes (Neves, 2007: 167-168) and the use of the first person singular, the verb moods and the evidentiality (Neves, 2007: 200). The evidences for the search of consensus were judgement values expressed by adjectives, adverbs, nouns; speculation, expressed by *irrealis* tenses and moods; thematization/focus and emphasis (Guimarães, 2001). Those clues are organized, with examples, on Table 4.

Argumentative notions	Linguistic evidences	Examples
Doubt	Verbs	... the same isogenic lineage <u>can</u> present different degrees of resistance ... (YF)
	Argumentative operators	It has been <u>little</u> studied ... (YC)
	Nouns	The <u>possibility</u> of existence ... (YA)
	Adverbs	<u>Probably</u> this is due to the fact that ... (YD)
	Adjectives in predicative position	<u>It is also possible</u> that the intoxication happens ... (XF)
Debate	Type of assertion	No example found.
	Unipersonalization or uses of the first person	From <u>our</u> point of view, <u>we</u> <u>judge</u> that ... (YD)
	Evidentiality	... what is <u>in alignment with Chagas’s works</u> (1982). (YG)
Pursuit of consensus	Judgement values	Our apparatus is extraordinarily <u>cheap</u> and <u>easy</u> ... (X A)

	Speculation (<i>irrealis</i> tenses and moods)	...yet those differences <u>could</u> be related with possible antigenic differences. (YC) ... <u>in case</u> the surveillance and sprinkling activities <u>are suspended</u> . (YH)
	Thematization/focalization and emphasis	<u>It draws one's attention the observation</u> that the same isogenic lineage... (YF)

Table 4: Examples of linguistic evidences of argumentation: the case of modalization.

Finally, the types and structure of the arguments were analyzed based on Perelman and Olbrechts-Tyteca's work (2005). The type of argumentative structure typically found was that on the structure of reality. Indeed, the nature of Conclusions, structured from specific to general facts, representing a movement from inside to outside, favors the predominance of the relation of cause and effect.

For the interpretation of the arguments, the rhetorical moves and the linguistic evidences were combined. In some cases, the order of the rhetorical moves was determining (see Table 5, example of 'unlimited development').

Type of argument	Example	Analysis
Pragmatic	The successive injections in mice can frequently modify the virulence of the strains of toxoplasma, as demonstrated by Coutinho e Mendonça, 1975, yet those differences could be related with possible antigenic differences. All these data demonstrate that the toxoplasmosis serum antibody titres using indirect immunofluorescence can change according to the used antigens. Thus, besides the standardization of the technique of the reaction, of the optical equipment and of the reagents, the standardization of the antigen is also necessary. (YC)	In this case, the "antigenic differences" is identified as the only cause for the change of the results in the strains. The researchers seem to do this through the "reference to previous research" move. Even when they cite diverging literature, they corroborate the privileged cause through the moves of "statement of results" and "reference to previous research by support". The "deduction and hypothesis" and "practical implication" moves reinforce the privileged cause and effect relation. Linguistically, that support is materialized by the connector "yet", which expresses contrast and, above all, a shift of focus, which leads the reader to concentrate on the subsequent idea (i.e. the privileged cause). The "hypothesis and deduction" move (introduced by "All these data...") continue the text with an apparent consolidation of the cause highlighted.



Waste	This modification greatly simplifies the technique of injections and enables its use requiring very few resources, available everywhere. (XE)	The values of “facility” and “economy” in the “practical implication” move suggest that the methodology (represented by “the modification”) should be profited from.
Direction	The comparison between the figures points to an increase of the destruction of the cellular parenchyma of the pineal gland, when the number of stimulations were increased, suggesting the existence of a relation between the sound stimulus and the emergence of such intensive destructive aspects in the pineal glands of these animals. The possibility of the existence of similar cellular alterations in other structures of the Central Nervous System also deserves to be examined using similar methodology. (YA)	There is an idea of contagious spread subsumed for the other structures of the Central Nervous System. The idea is a propagation of the effect. The argument is founded on the idea that there is a natural flux of spread, and that is why it is necessary to continue the research.
Unlimited development	The isolation of the parasites from the anal glands (GA09) was only possible in the NNN medium. This difficulty can be associated with the heterogeneity of the samples of <i>T. cruzi</i> (Brener, 1977; Miles & Cibulskis, 1986), which would also be reflected in culture medium, as Thomaz et al. (1984 and Steindel et al. (1988) isolated parasites from anal glands in LIT medium of experimentally and naturally infected skunks, respectively. However, after the parasites of the glands were isolated, our strain presented an abundant growth in LIT medium. This result was also observed when the isolation was performed direct from the blood forms via hemoculture or xenodiagnoses, suggesting there may be an inhibiting factor for the growth of the parasite in the gland	The idea of “unlimited development” is corroborated by the moves of “reason of limitation”: “This difficulty can be ... naturally infected skunks” and “ “suggesting there may be ... or even increased in the LIT medium”. The combination of the recovery of results with the support of literature suggests that this research should be continued in this direction, to be “purified”. The modal of uncertainty for the limitation of the research (“this difficulty <u>can</u> be”); the modal of speculation (“would also be reflected”), projecting the action to the future; the discursive connector, “However”, to recover the data are all linguistic elements contributing to directing the attention of the audience to the research. The order of moves – unexpected result, justification, statement of results, reference to previous research for support, statement of results, deduction and hypothesis also direct the interpretation to the continuation of



	content of the skunk (GA09). This inhibiting factor could be nullified in NNN medium and not nullified or even increased in the LIT medium. (YH)	research.
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Table 5: Types of arguments

Therefore, the analysis of the perlocutionary level was the result of an interrelation of the analyses of the locutionary and illocutionary levels (see Figure 1). The combination of the three levels of language was, in turn, interpreted considering the data of the context in which those texts were produced.

3 Results and discussion

3.1 Historical context

There were some evident differences between the discursive communities of the 1909-1919 and the 1980-1989 periods (Table 6). In terms of public objectives, the first period was characterized by the production of sera and vaccines and the international dissemination of the local research, while the second period was basically marked by the struggle of insertion in a more internationalized and standardized context of research. In the first period, there was a general pioneer spirit, because the researches were about typically Brazilian diseases and species. The context was positive because the Institute was successful in accomplishing its mission in Brazil and it was able to gain international acknowledgement. The Brazilian research was independent, in the same level of equality of that of the international science.

The period of the 80s, on the other hand, was marked by a constant effort to find a place in the international scenario of science. At this time, the world of science gained larger dimensions (*big Science*) and the interactions among scientists were more complex, beyond local interests. Science and technology were associated with a new kind of economy and industrial production. For Brazilian scientists, the pressure was even more dramatic because there was no governmental support. Science language and peer scrutiny was becoming standardized and institutionalized.

Characteristics	1909-1919 Period	1980-1989 Period
Public objectives	Production of sera, vaccines and medicines to meet local needs; research and education; and international dissemination of local research (Scientific pioneering and positive scenario)	Insertion in the international and institutional context of the <i>big science</i> (Competition and negative scenario)
Intercommunication mechanisms	Mostly journals, but also doctoral theses, articles in popular tabloids and talks in congresses and events. Higher internal publishing.	Similar to the first period. All means were more internationalized and accessible. Efforts towards external publishing. Images, graphs and tables with increased relevance.
Shared genres	Descriptive articles (of species) were the most common ones. The IMRD sessions were not	The IMRD research article prevailed, with IMRD sessions clearly delineated. Descriptive



	delineated in the text.	articles were still frequent, with the same IMRD sessions (until 1987). Emergence of the notes, which, in practice, were smaller research articles.
Shared epistemological position	<ul style="list-style-type: none"> - Science as progress and civilization, associated with patriotism. - Valorization of the expert. Scientific activity as a pursuit for excellence (higher vocation). - Values in construction: peer scrutiny and language as a faithful reproduction of reality. - Interaction of applied and basic researches for the resolution of practical problems. - The new microbiologic paradigm. -Discovery-driven. Investigative and experimental spirit. 	<ul style="list-style-type: none"> - Science as a globalized activity, directly connected to economy and technology. - Researcher as a restless worker and competitor (pressure group) - Values in consolidation: standardized and institutionalized peer scrutiny and language. - Overcoming the dichotomy of applied research and basic research in favor of the results. - Interdisciplinarity. - Valorization of the quantity of works published, of the novelty and of the experimental model.

Table 6 - Characterization of the 1909-1919 and 1980-1989 discursive communities

As for the intercommunication mechanisms, both periods were similar, because works were mostly published in journals. However, in the first period, most works were published in national journals, what is exactly the contrary situation compared with the second period. In the 80s, even the MOCI was opening to international submissions, and most of the articles were written in English. In addition, images, tables and graphs gained importance as intercommunication forms in the second period.

Concerning genres, however, the first period presented a higher quantity of descriptive articles of species. In the 80s, there was a high quantity of experimental scientific research articles in the IMRD format, with the sessions delineated in the text. In addition, there appeared the notes, which reproduce the structure of research articles in a smaller size. Probably, this genre was an alternative for the growing number of articles published and the reduced space for publishing.

In both periods, science was valued as progress. In the first period, though, this idea of progress was associated with the establishment of civilization, the suppression of a colonial delay and the expression of patriotism. The second period was marked by struggle to fit into a new standard of science production: a more globalized and economy-bound science. In this period, science was following the laws of market: competition, pursuit of innovation and prominence.

The scientist in the first period was considered a hero. The “expert” was valued by his passionate work, and, at the time, he reached high levels of prestige in the international community. The expert was opposed to the “man of rhetoric”, a symbol of the colonial mentality. In the 80s, the scientist was a restless soul because his task was Herculean, considering budget constraints and competition to publish.



In the first period, the values of the scientific language and of the peer scrutiny were being established. Language was seen as a source of interference to science, so it should be controlled to function as a “mirror of reality”. The peer scrutiny became a cornerstone of the team work and validation procedures of science. In the 80s, those values were already consolidated aligned with institutional standards.

Regarding the dichotomy Basic Science and Applied Science, both moments represented integration. In the first moment, integration was favored by the urgency of the problems (i.e. human and cattle pests). In the 80s, that integration was motivated by the pursuit of new results, which should be profitable. There was a general movement towards interdisciplinarity as well.

Another characteristic of both periods was the value of novelty. In the 1909-1919 period, novelty was expressed by the change from the “miasmatic” paradigm to the new microbiological paradigm. The period was marked by pioneering and discovery, as a result of knowledge exploration. In the 80s, novelty was made concrete in the attempt to adapt to an internationalized and market-driven science, characterized by competition. To be new meant to be innovative and prominent.

3.2 Linguistic aspects

In the 1909-1919 period, there were explicitly subjective/personal linguistic marks, such as first person (relevant frequency) and verbs expressing volition and judgment. On the other hand, an attempt to hide the subject was also noted (following the logics of the objective scientific language) by means of the passive voice (relevant frequency). In terms of connectors, the results show a trend for cause and effect. The findings do not reveal complexity and variety in terms of adjectives and adverbs, which could express values or assertiveness. There were no evidences of modalization or hedging, and no trace of speculation. A trend of assertive projection into future, denoting promise/commitment, was found in the use of the future. The following example illustrates the coexistence of subjectivism, in the presence of first person, and rhetorical simplicity:

Conclusions

From our experiences, observations and researches, we can briefly conclude:

1st The anaplasma is not a protozoa.

2nd The anaplasma is a corpuscle of hematic nature, a product of the degeneration of the red blood cells.

3rd The anaplasma is one of the blood cell degenerations resulting from some types of anemia determined by hemolytic poisons of diverse nature.

4th There does not exist a disease named bovine anaplasmosis, which is, in the cases described by THEILER, a clinic form of piroplasmosis. The anaplasmosis of the other mammals is due to diverse causes (9A)

The 1980-1989 period was characterized by the absolute presence of passive voice and by the frequent presence of less personal and more objective verbs in relation to the object of knowledge. These findings reveal a more complete alignment with the demand for objectivity in language. However, together with the objective evidences, there is a higher complexity in terms of adverbs and adjectives, expressing veracity, emphasis and preference; more modalization traits, working as hedges and supporting persuasion (especially through “should” and emphasis resources); higher complexity in terms of logical connectors, expressing opposition, intensity and emphasis; and more speculation, by means of “would”.

All those evidences together seem to suggest a more dialogical scientific text towards consensus.

Discussion

The experimental susceptibility of B. amazonica and B. peregrina from different geographic regions, together with the changes observed in relation to the susceptibility of B. straminea and B. tenagophila to the infection by S. mansoni in Minas Gerais, demonstrates the need of more researches for a better evaluation of the potentiality of other species of the same genus as hosts of this trematode. B. straminea and B. tenagophila planorbidae, considered non-transmitters in Minas Gerais, but experimentally susceptible, are being found naturally infected in this State. Dias Pinto et al. (1984), reported the finding, in 1981, of B. straminea naturally infected by S. mansoni in the Samambaia Dam, located in the boundary of the municipalities of Lagoa Santa and Pedro Leopoldo, Minas Gerais. Melo, Pereira & Corrêa (1982) recorded the first finding of B. tenagophila naturally infected in the municipality of Jaboticatubas, MG. This focus is still active and Melo, Pereira & Corrêa (1983) isolated the S. mansoni local strain for studies. Carvalho, Souza & Katz (in publication) registered the first finding of B. tenagophila naturally infected in Itajubá, South of Minas Gerais. Carvalho et al. (oral presentation) reported the finding of this planorbidae naturally infected by S. mansoni in the Pampulha lake, Belo Horizonte, MG.

Those findings seem to suggest that the mollusks B. straminea and B. tenagophila of these regions are changing into natural intermediate hosts of S. mansoni, as it occurs in the Brazilian Northeast and in São Paulo.

In the present work, the experimental infection of B. schrammi with that trematode was attempted, without success. This species of planorbideo was never found naturally infected or experimentally infected with this parasite (Paraense, Fauran & Courmes, 1964).

During the experiment, it was observed that the planorbideo, of small size (6-7 mm of diameter), has a great tendency to escape from water containing miracidia; then, covered Petri dishes are used to avoid its exit from water during miracidia exposure. In the maintenance aquariums, during the prepatent period, it was also observed that 30% to 40% of the specimens went out of water and died dissected on the walls, cover or outside the aquariums, despite being constantly returned to water. That behavior, probably related to the poor adaptation to the conditions of the laboratory, was responsible for the observed mortality rate.

Thus, the inherent characteristics of this species were considered, and it seems little probable that it gains any importance in the epidemiology of the esquistossomosis mansoni. However, more experiments will be necessary with specimens of other populations of B. schrammi for a safer evaluation of the potentiality of this planorbidae to be an intermediate host of the S. mansoni. (6B).

In sum, the linguistic evidences of the first period suggest subjectivity, but the text is focused on the scientific object and it shows a simple rhetoric. In the 80s, there are a lot of objectivity evidences, but the text shows a complex rhetorical structure, through which the object of study is constantly interconnected with the network of peers.

3.3 Rhetorical moves

Two different scenarios in terms of the overall frequency of rhetorical moves were observed for the two periods. Considering 70% as a frequency cut, “virtually obligatory” (Peacock, 2002) moves were identified in both periods. In 1909-1919, only the ‘Statement of Results’ and ‘Deduction and Hypothesis’ were virtually obligatory. Conversely, in 1980-1989, the ‘Reference to Previous Research for Support’ (present throughout the corpus), ‘Statement of Results’, ‘Deduction and Hypothesis’, ‘Background Information’, ‘Reference to Previous Research for Comparison’ and ‘Practical Implication’ were virtually obligatory. In 1909-1919, the ‘Recovery of Method’, ‘Practical Implication’ and ‘Statement of Limitation’ moves were optional (frequency cut: 40%). In 1980-1989, the optional moves were ‘Explanation’ and ‘Recovery of Method’.



Thus, there was an increase in the use of ‘Reference to Previous Research for Support’, ‘Background Information’, ‘Reference to Previous Research for Comparison’ and ‘Practical Implication’ in 80-89. This profile seems to reflect a complex interlocutor network. In addition, the value of practical application reveals a connection of science to the objective demands of the external world. In 1909-1919, the rhetorical moves reflect a focus on the findings and on the method, which, due to the novelty scenario, was probably in consolidation.

The subdivision of the ‘Reference to Previous Research’ move proved important, as the ‘support’ surpassed the ‘comparison’ in the 80s. This fact points to a more positive and close peer network, implying the values of ‘safety’ and ‘validation’, in opposition to an antagonist and distant network.

The ‘Reference to Previous Research’, especially for support, appears in the whole Conclusion, but it specifically constitutes beginning and ending patterns in the Conclusions of the 80s. Therefore, it is also important to consider the distribution of moves. A study that considers move cycles (Peacock, 2002) can predict order and cyclicity, and move cycles are sensitive to variations in disciplines and in time.

Profiting from Peacock’s proposal (2002: 481) of splitting Conclusions in three parts, (introduction, evaluation and conclusion) the move cycle patterns found in the present work were organized in the same manner. In the introduction, the findings for the 1909-1919 period were the presence of ‘Statement of Results’ and ‘Deduction and Hypothesis’, together or separately. In the 80s the only pattern found was the appearance of the ‘Reference to Previous Research’ move.

In the evaluation, the 1909-1919 period only presented the pattern ‘Statement of Results’ + ‘Deduction and Hypothesis’. In the 80s, the cycles were ‘Deduction and Hypothesis’+ ‘Reference to Previous Research for support’; ‘Statement of Results’ + ‘Reference to Previous Research for Support’; ‘Statement of Results’ + ‘Reference to Previous Research for Comparison’; and ‘Statement of Results’ + ‘Deduction and Hypothesis’; ‘Background Information’ + ‘Reference to Previous Research for Support’ and ‘Reference to Previous Research for Comparison’ + ‘Reference to Previous Research for Support’.

In the conclusion, the 1909-1919 period revealed a different pattern: ‘Acknowledgement of Collaborators’ + ‘Reason for Acknowledgement’. In the 80s, the following moves appeared separately: ‘Deduction and Hypothesis’, ‘Practical Implication’ and ‘Reference to Previous Research for Support’ (the latter appeared in the three parts of the Conclusions in the 80s).

Swales (1990) showed higher cyclicity in Introductions of Human Sciences compared with Exact Sciences. The present work showed a diachronic difference, for the 1909-1919 period presented less cyclic conclusions when compared with the texts in the 80s.

3.4 Arguments

In 1909-1919, the ‘waste’ argument is the only one “virtually obligatory”. In 1980, the ‘pragmatic’ and ‘waste’ arguments are virtually obligatory, being the former more frequent than the latter. The ‘waste’ argument repeats the frequency rate found in the 1909-1919 period.



These results reveal the interaction of demonstration and argumentation in the scientific discourse, echoing Rauch's (1997) claim that values and beliefs coexist with the rational scientific knowledge. They also favor the idea that there are no linguistic aspects that can solely determine objectivity or subjectivity.

Particularly, the present study reveals the presence of argumentation in the scientific discourse by two means: entanglement and co-existence. In the first means, the argumentation and the demonstration are so interconnected that the distinction cannot be perceived. The consequence is the "illusion of objectivity". In the co-existence way, on the contrary, the argumentation can be distinguished and it works projecting the scientific work, through its promotion.

In general, the results reveal that in both periods argumentation coexists with demonstration. This fact is evidenced by the presence of the 'waste' argument in equal proportion in both periods. This argument promotes the scientific work by implying the idea that it has to be used, profited from, that it must be continued. Below, there is one example of this argument in each period.

Here we conclude the presentation of our results about the vaccination against the spirochetosis, of which employment seems to us in all aspects recommendable, as one of the most practical means to obtain the prophylaxis of the destroying epizootia, so common among us. The same technique we use is recommended, equally in our point of view, for the preparation of vaccines for the other spirochetosis such as the Tick fever, the recurrent fever etc. (6A)

The present work, clarifying in details the pathology of the experimental pest in two species of rodents potentially capable of participating in epidemics in human populations, proved the possibility of the development of serious pulmonary, splenic and hepatic lesions in these animals. Such findings can perfectly explain the high mortality observed in laboratory.

*It is possible that, at least partially, some of these findings can be extrapolated to men, thus ensuring a better knowledge of the pathology caused by *Y. pestis* in the organism of other susceptible hosts. (3B)*

Particularly in the 1980-1989 period, there is the entanglement of argumentation in the scientific discourse, which is expressed by the 'pragmatic' argument, highly frequent in the period. This argument is intertwined with typically demonstrative moves and it contributes to the construction of cause and effect relations involved in the experimental work. In the following example, the 'pragmatic' argument is entangled in the presentation of the findings, favoring the cause "blocking or exhaustion of the host's immunologic system".

Another interesting histopathological finding concerns the aspect of the white pulp of the spleen of the infected animals, a severe atrophy of Malpighi follicles is observed, with the absence of reactional centers, suggesting a possible blocking or exhaustion of the host's immunologic system, in response to the intense antigenic aggression caused by the massive release of bacterial endotoxin. (3B)

This occurrence reveals a more complex argumentative manifestation in the 80s: either internal and subtle or external and evident.

3.5 Synthesis of results towards an integrated model

In this section, integrated analyses of the Conclusions of both periods are presented and an overall model, irrespective of diachronic peculiarities, is proposed.



The 1909-1919 analysis (Table 7) suggests a focus on scientific findings. That aspect is corroborated by the simplicity of the textual logical sequence and by the absence of a persuasive complexity. The predominant rhetorical moves also corroborate this focus as the findings are recovered (Statement of Results) and become the axis of the researcher's reasoning (Deduction and Hypothesis)

Levels of Analysis	1909-1919
Locutionary	Marks of explicit subjectivity: first person and judgement and volition verbs; passive voice; cause and effect connectors; assertive future projection (future tense)
Illocutionary	<u>Obligatory moves:</u> Deduction and Hypothesis and Statement of Results. <u>Optional moves:</u> Recovery of Method, Practical Implication, Statement of Limitation. <u>Linear arrangement.</u> <u>Patterns:</u> Statement of Results + Deduction and Hypothesis (beginning and middle of conclusions); Acknowledgement + Reason for Acknowledgement (end of conclusions).
Perlocutionary	Waste argument (coexistence of argumentation and demonstration).
Synthesis	Focus on the dissemination/projection of scientific findings.

Table 7: Analysis of Conclusions (1909-1919)

In addition, the period implies promotion/projection of the findings, sustained by the 'Waste' argument. That projection is corroborated by the tendency to use future and the moves of 'Practical Implication', 'Statement of Limitation' (as it entails the overcoming of the limitation) and 'Recovery of Method' (which contributes to the continuation of the research).

The 1980-1989 Conclusion seems to focus on the network of peers; the scientific findings are constructed in interaction with this network (an axis) and projected/promoted to this same network. This discursive complexity is corroborated by linguistic and rhetorical elements. The linguistic features reveal marks of dialogue and pursuit of consensus: modals; connectors denoting contrast, intensity and emphasis; use of would representing speculation and, pursuit of consensus; and adjectives and adverbs denoting veracity, emphasis and preference (values that also reinforce the pursuit of consensus). On the other hand, the rhetorical moves of 'Reference to Previous Research for Support', 'Reference to Previous Research for Comparison' and 'Background Information' (by recovering the tacit knowledge shared among the network of peers) are all evidences for the participation of the network of peers in the construction of the Conclusions.

Levels of Analysis	1980-1989
Locutionary	Marks of objectivity: passive voice and objective verbs. Complexity of adjectives and adverbs (notions of veracity, emphasis and preference). Modalization. Complexity of logical connectors (contrast, intensity and emphasis). Speculation (would)
Illocutionary	<u>Obligatory Moves:</u> Deduction and Hypothesis, Statement of Results, Reference to Previous Research for Support, Reference to Previous Research for Comparison, Practical Implication and Background Information. <u>Optional Moves:</u> Recovery of Method and Explanation.

	<u>Cyclical Arrangement. Patterns:</u> Reference to Previous Research for Support (beginning of Conclusions); Statement of Results + Deduction and Hypothesis, Statement of Results + Reference to Previous Research for Support, Statement of Results + Reference to Previous Research for Comparison, Background Information + Reference to Previous Research for Support, Reference to Previous Research for Support + Reference to Previous Research for Comparison, Deduction and Hypothesis + Reference to Previous Research for Support (middle of Conclusions); Reference to Previous Research for Support, Deduction and Hypothesis, and Practical Implication (end of Conclusions).
Perlocutionary	Pragmatic argument (entanglement of argumentation in demonstration). Waste argument (coexistence of argumentation and demonstration).
Synthesis	Focus on the network of peers, the result of the scientific work is constructed in the process of interaction with the network to be, then, promoted/disseminated to the same network.

Table 8: Analysis of Conclusions (1980-1989)

The ‘Pragmatic’ argument reveals the intricate construction of the Conclusions, as the scientific findings and the considerations about them are intertwined in the entanglement of argumentation in demonstration. In contrast, the idea of promotion is expressed by the ‘Waste’ argument, which induces the continuation of the scientific work. The ‘Practical Implication’ move plus the linguistic elements (adjectives, adverbs and emphasis resources) corroborate the idea of continuation.

Comparing the two models of conclusion, the result is the following visual representation (Figure 2). To represent the fact that the research is an object projected/promoted to the discourse community (1909-1919), the arrows are aimed unilaterally at the community.

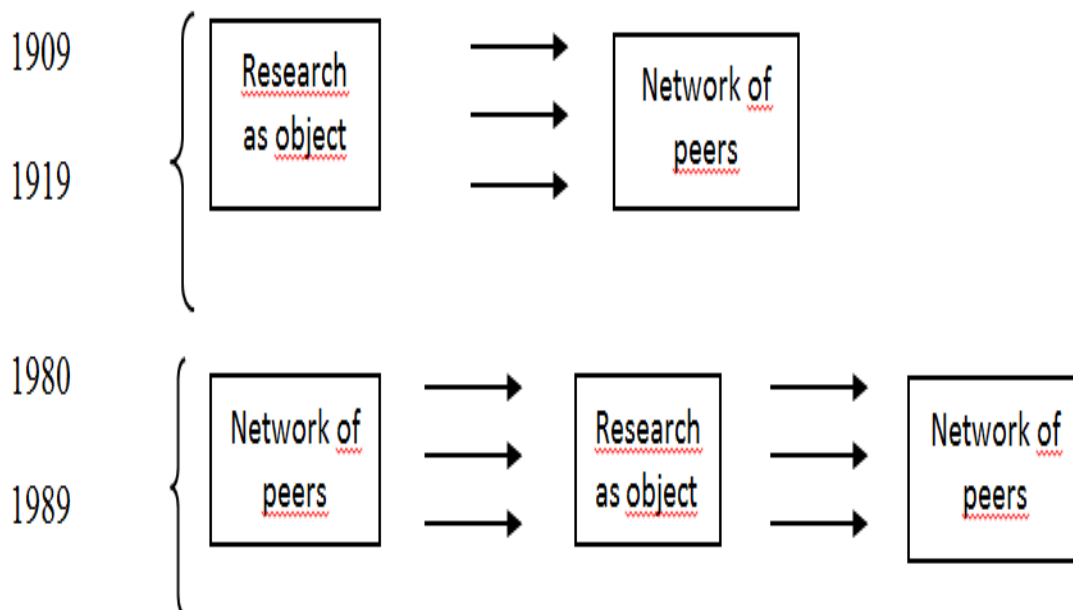


Figure 2: Graphical representation of the Conclusions of both periods

Conversely, the 1980-1989 period is characterized by a higher complexity in the interaction of the community with the research as an object. The network of peers participates in the construction of the conclusions, intertwined in the text, which is, in turn, promoted to this same community. The representation (Figure 2) shows this return by the fact that the network of peers is on the two extreme positions of the scheme.

From another point of view, the model of Conclusions can be designed by removing the peculiarities of each period (Figure 3). The graphical representation shows the model integrating the three discourse levels in interaction with the contextual factors.

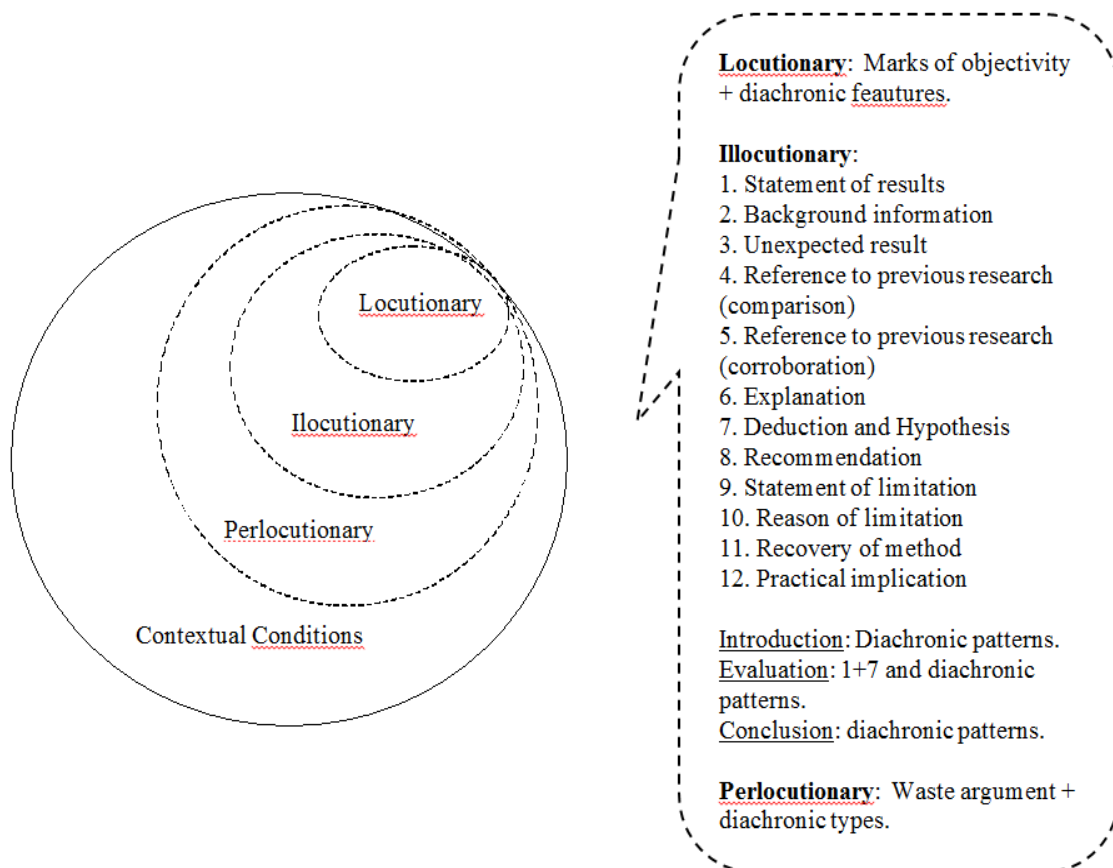


Figure 3: Model of conclusion after the diachronic features are abstracted

In the locutionary level, only the marks of objectivity, such as passive voice, were found, suggesting the project of an objective scientific language had already initiated in the early 1900s. In the illocutionary level, a list of more frequent moves and patterns of moves was drawn, considering the three-part model proposed by Peacock (2002: 481), which seems flexible enough for the purposes of the current paper. The moves that proved diachronic were not considered in the list. Only one pattern was constant in both periods, and only in the 'evaluation' part of the conclusion: 'Statement of Results' + 'Deduction and Hypothesis'. Finally, in the perlocutionary level, the 'Waste' argument is typical.



In terms of contextual conditions, the 1909-1919 community was small, homogeneous, patriot and pioneering. Those aspects are correlated with marks of personalization, a linear text and low complexity in rhetorical terms. The argumentation suggests the promotion of researches in the same prestige level of international researches. In the 1980-1989 period, the community was large and was characterized as a “pressure group”, which struggled to fit in the big standards of the international science. These aspects are correlated with a higher rhetorical force and a complex entanglement of the research and the network of peers. Despite more objective, by the control of certain linguistic marks of personalization, the conclusions in this period were a truly elaborated rhetorical/argumentative artifact.

4 Conclusions

This work analyzed the Conclusions of experimental scientific articles of two periods: 1909-1919 and 1980-1989. In the first period, the Conclusions were linear and relatively simple in rhetorical terms, with a focus on the research findings to be promoted to the community of peers. Those data are correlated with a small and cohesive community, which favored consensus. This community was in the same level of international scientists, enjoying prestige as pioneers in tropical pests and species. Another characteristic was the gradual adoption of a standardized scientific language and peer scrutiny.

In the 1980-1989 period, the Conclusions were cyclic and rhetorically complex. One peculiarity was the occurrence of the ‘Pragmatic’ argument. Those characteristics are correlated with a pressure atmosphere, in which the community of that time counted on no support from the government and struggled to adapt to the big science dimensions. The surface of the texts convey objectivity and pure demonstration. However, a thorough analysis, considering the three levels of language in contrast with the context, shows the opposite.

The work contributes to the studies of genre by proposing a model of Conclusions that goes beyond the traditional description of rhetorical moves and linguistic aspects only, by integrating these language levels with the illocutionary level in contrast with the contextual factors.

Another contribution of the paper is to the studies of Science, as the idea that science is sensitive to diachronic values and that it also includes persuasion was corroborated. Specifically concerning Brazilian science, the articles recovers the moment of prestige and brilliance experienced by the famous scientists of the beginning of the 20th century. On the other hand, another epoch is revisited (80s), revealing a scenario of struggle to adapt to a new scenario of science, with no governmental support.

In pedagogical terms, the present work claims that academic training must consider, in addition to the knowledge of academic texts, a critical perspective of discourse genres and communities. Particularly, learners should be researchers of their own aspiring scientific communities to perceive their values and beliefs and observe how these elements influence the texts. They should also understand that there are no absolute criteria to define good or bad science and that the language/discourse is an evidence that persuasion is part of the scientific practice. The pedagogical approach for academic purposes, therefore, is necessarily critical and it necessarily includes learners in the research of genres and communities aiming at more real discoveries about disciplinary habits and values.



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