

An Analysis of the Persuasive Strength of Arguments in Procedural Texts

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1 Motivation and Aims

Argumentation (e.g. (Amgoud et al 2001, Moeschler 1985)) and, in particular, persuasive argumentation is a process frequently encountered in several types of texts where the challenge is to convince the reader to adhere to a certain point of view. Arguments come with forms of emphasis which give them more strength than normally expected, or, conversely, they may come with forms of irony or of depreciation, which influence the reader's perception of the facts associated with the arguments.

Persuasion appears in different types of texts with similar objectives but with slightly different linguistic forms. This is, for example, the case in legal text analysis (Moens et alii., 2007). The situation of procedural texts, although ranging over a large set domains, seems to be simpler in terms of linguistic forms and underlying interpretation(s). One of the reasons is that procedural texts are basically action-oriented, and, therefore, the number of inferences that the user may have to do is limited as much as possible. Nevertheless, there are crucial problems associated with argumentation and persuasion which are typical of procedural texts: arguments, in particular warnings, implicitly indicate that some actions are difficult to realize, and that there is a risk of failure (Dautriche et al. 2009). In terms of Action Theory, this is an interesting way to measure the complexity of a procedure and the chances to succeed, or the risks to fail.

The challenge in procedural texts is to convince the reader that the procedure which is proposed for reaching a certain goal (concrete as in do-it yourself texts, or more abstract as in social relation texts) is among the bests, that the user gets some help, hints and advices while following the procedure and that results are guaranteed, modulo some precautions (e.g. caring about warnings, reading and considering advices, carefully realizing instructions in the order they are given, etc.). It is a way of 'selling' the procedure, in comparison with other procedures describing the same task (since the web abounds in procedures, often quite different in form and contents, for realizing a certain task).

A second type of underlying objective is to make sure that the reader, when realizing the procedure, will effectively strictly and fully realize the instructions as they are given, while indicating him that otherwise he may undergo problems. In procedural texts, this is essentially realized by means of advices and warnings. It seems that these two forms of argumentation in procedural texts follow a small number of quite standard schemas (Walton et alii., 2008). Finally, a third register in persuasion, positively oriented, consists in supporting the reader when the task is complex, long or risky.

In conjunction with arguments, procedural texts abound in persuasive forms of various kinds. These forms are made visible via by a variety of marks, essentially linguistic, but also typographic, iconic or even possibly by means of images. At a global level, the presence of a number of advices and warnings in a text, is, by itself a form of persuasion based on an implicit perception by the user that the text has received an in-depth elaboration and results from a long experience. Besides persuasive arguments, we observed a variety of explanation forms which have a certain implicit persuasive impact, such as reformulations, hints, definitions, etc. Besides persuasion, at a theoretical level, it is of much interest to define a formal model of procedurality in terms of Action Theory (Dautriche et al. 2009). Within procedures, a number of persuasive forms also introduce some form of comfort for the user, so that he can work safely and without too much stress and worries.

2 The explanation structure in procedural texts

2.1 A global view of the explanation structure

We first constructed a quite large corpus of texts oriented towards action (about 1700 texts in French from a large number of web sites) from several domains. These texts which are, roughly, procedural texts, are quite diverse in style and complexity, from cooking, do it yourself, gardening, equipment maintenance, to social relations, health, and didactics. Those texts are in general not very long, ranging from half a page to 4 pages.

From this corpus, we established a classification of the different forms explanations may take (Fontan et al 2008). The main structures we identified are facilitation and argumentation structures. These structures are organized as follows:

- **facilitation structures**, which are rhetorical in essence (Kosseim et al. 2000, Van der Linden 1993), correspond to *How to do X ?* questions, these include two subcategories:
 - (1) user help, with: hints, evaluations and encouragements and
 - (2) controls on instruction realization, with two cases:
 - (2.1) controls on actions: guidance, focusing, expected result and elaboration and
 - (2.2) controls on user interpretations: definitions, reformulations, illustrations and also elaborations.
- **argumentation structures**, corresponding to *why do X ?* questions. These have either:
 - (1) a positive orientation with the author involvement (promises)

or not (advices and justifications) or
 (2) a negative orientation with the author involvement (threats) or
 not (warnings).

In procedural texts, we essentially observed advices and warnings since there is seldom any involvement from the author.

User help structures aim at making the user more comfortable with the current document: the way hints (*prefer a sharp knife*) and encouragements (*at this stage you've done the difficult part*) are termed and are perceived by the reader is a crucial step in the persuasion process. Evaluations are in general accurate and positively oriented, guiding the user and preventing him from any questioning and discouragements (*now your sauce must look yellow, if not add more flour*). User guidance and controls on user interpretation provide the necessary assistance (possibly user parameterized, depending e.g. on how much interactions the user wishes, the type of help it requires, etc.) to guarantee a certain success, in particular when the procedure is difficult or long, with several subparts. This contributes to a feeling of control and safety w.r.t. actions being realized.

2.2 Arguments in Explanation Structures

Arguments in procedural texts serve very different purposes. They make explicit the risks that the user may undergo if he does not follow the instructions, its responsibility is clearly made explicit and his role is more active. In terms of persuasion, the strength of the arguments and the illocutionary force of the statements aim at convincing the reader of the reality and the importance of the risks, in the case of warnings, or of the gains in the case of advices.

It is important to note that all these aspects do not operate in isolation, but they all contribute to the success of the procedure realization. For example, well designed hints will convince the reader that the document is of high quality and that, therefore, warnings should be taken seriously. An example, using the square bracket notation, of such a structure within an instructional compound is:

[instructional compound
 [Goal To clean leather armchairs,
 [argument: advice
 [instruction choose specialized products dedicated to furniture,
 [instruction and prefer them colorless]],
 [support they will play a protection role, add beauty, and repair some small damages.]]]

We have here an argument of type advice which is composed of two instructions (or conclusions) and a conjunction of three supports which motivate these two instructions.

The explanation structure is realized by language expressions, characterized by dedicated linguistic marks typical of help statements, reformulations, etc. The typography is also an important factor via the ease of readability it introduces and also by the professionalism it suggests. Obviously, the impact to the layout in general is very difficult to measure. Our goal is to identify and categorize most of these marks, and then to a priori sort them on various scales related to persuasion strength, so that, ultimately, the parameters of persuasion can be measured on a given procedural text, instruction by instruction. It is also crucial to evaluate how these elements are interpreted by a variety of users. It is obviously difficult to derive a formal model due to the subjectivity of the measures (Grosz et al. 1986): in this short document, we focus on argument strength identification.

3 Processing arguments

3.1 Processing warnings

Warnings are basically organized around an 'avoid expression' combined with a proposition. The variations around the 'avoid expression' capture the illocutionary force of the argument, ordered here by increasing force, the latter expression being very strong. We give below, for the three major classes we have observed, the basic pattern (between quotes) for the conclusion part of the argument (which has the form of an instruction), an example and the frequency observed in our corpus:

1. 'prevention verbs like avoid' (NP / to VP) (*avoid hot water*), (frequency: 48%)
2. 'do not / never / ... VP(infinitive) ...' (*never put this cloth in the sun*), (frequency: 36%)
3. 'it is essential, vital, ... to never VP(infinitive)', *it is vital to never take this medicine at the beginning of the meal*, (frequency: 6%).

Supports for warnings convey statements with a negative polarity. These are identified and delimited from various marks:

1. connectors with a negative orientation such as: *sinon, car, sous peine de, au risque de* (otherwise, under the risk of), etc. verbs expressing a consequence or verbs in the conditional form (*could damage...*),
2. negative causal expressions of the form: *in order not to, in order to avoid, etc.*
3. specific verbs such as risk verbs introducing an event (*you risk to break*). In general the embedded verb has a negative polarity.
4. very negative terms, such as: nouns: *death, disease, etc.*, adjectives, and some verbs and adverbs.

We built a lexicon of about 200 negative terms found in our corpora. While forms (1) and (2) are quite standard, those in (3) and (4) are much stronger, they appear in our corpus in about 28% of the situations. As reported in (Fontan et al. 2008), we carried out an indicative evaluation (e.g. to get improvement directions) on a corpus of 66 texts over various domains, containing 262 arguments. Those texts were manually annotated by a trained linguist, and the results were then compared with the system output. We get the following results for warnings:

conclusion recognition	support recognition	(3)	(4)
88%	91%	95%	95%

(3) conclusions well delimited (4) supports well delimited, with respect to warnings correctly identified.

3.2 Processing Advices

Conclusions of type advice are essentially identified by means of two types of patterns (English glosses given here):

1. advice or preference expressions followed by an instruction. The expressions may be a verb or a more complex expression: *it is advised to, prefer, it is better to, preferable to, etc.*,

2. expression of optionality or of preference followed by an instruction: *our suggestions: ..., or expression of optionality within the instruction (use preferably a sharp knife).*
3. very negative terms, such as: nouns: *death, disease, etc.*, adjectives, and some verbs and adverbs.

Supports of type advice are identified on the basis of 3 distinct types of patterns:

1. 'Goal exp + (adverb) + positively oriented term'. Goal expressions are e.g.: *in order to, for*, whereas adverb includes: *better* (in French: *mieux, plus, davantage*), and 'positively oriented term' includes: nouns (*savings, perfection, gain, etc.*), adjectives (*efficient, easy, useful, etc.*), or adverbs (*well, simply, etc.*). We constructed a lexicon of positively oriented terms that contains about 50 terms. Not surprisingly, positive terms are far less numerous than negative terms.
2. Goal expression with a positive consequence verb (*favor, encourage, save, etc.*), or a facilitation verb (*improve, optimize, facilitate, embellish, help, contribute, etc.*),
3. the goal expression in (1) and (2) above can be replaced by the verb 'to be' in the future: *it will be easier to locate your keys.*
4. very negative terms, such as: nouns: *death, disease, etc.*, adjectives, and some verbs and adverbs.

Advices are related to optionality or preferences. The different marks above do not introduce a priori any strong difference in terms of persuasion. It seems that if some terms look stronger than others, some informal experiments tend to indicate that it is more a matter of personal interpretation.

Similarly as above, we carried out an indicative evaluation on the same corpus of 66 texts containing 240 manually identified advices. We get the following results for advices:

conclusion recognition	support recognition	(3)	(4)	(5)
79%	84%	92%	91%	91%

(3) conclusions well delimited, (4) supports well delimited, both with respect to advices correctly identified. (5) support and conclusion correctly related.

A short example of an informally annotated argument is given in Fig. 1 hereafter. We plan to use norms, as suggested in the AIF project (Chesnevar et al. 2007).

4 Linguistic Marks of Argument Strength

Let us now review marks related to the 'illocutionary' force of an argument, contributing to its persuasive effect, in addition to the intrinsic force of arguments presented in the classifications above. These marks can be combined with the basic patterns given in the previous section. The categories given below are a priori identical for any kind of argument, positive (rewards and advices) or negative (threats or warnings). We concentrate here on those criteria that reinforce the persuasive effects, their absence could lower these effects in some cases, but this is also a matter of style.

The criteria and evaluations given below emerged from a few informal experiments carried out on readers in our lab:

- **Number of supports:** a conclusion associated with several explicit supports seems to be stronger than if it has just one: *do not open the door when washing is ongoing*). The strength of a conclusion with no supports is quite difficult to evaluate: in a number of cases, the support is not mentioned because it is obvious for the reader and would sound odd or verbose otherwise: *do not water your plants when the temperature is below zero degrees (not mentioned: because this may 'burn' the leaves)*.
- **Supports associated with some forms of rhetorical developments.** We observed, especially in large public texts, the presence of segments of texts in a rhetorical relation with the argument support (Mann et al. 1988, Van der Linden 1993). Among the most frequently encountered relations we have: exemplification, elaboration, development and reformulation: *because you risk to break the connectors which cannot then be repaired*, with here a kind of development (but such relations may be difficult to assign unambiguously).
- **Position of supports in the argument:** a left-extraposed argument is stronger than when it appears at the end of the argument. This is a general rule in pragmatics, where left extraposed elements gets higher focus, since this position is not the expected one.
- **Typography and punctuation:** we identified several marks of emphasis: capital letters, large size, italics, bold, underlined, etc. Exclamation marks are also frequent (*do not leave in a humid place!*). However, typography and punctuation mark strength is relative to their global use in the procedure. If they appear exceptionally in an instruction, then they get more strength. In general procedures, except for video game solutions and similar types of texts, are quite sober and make a very limited use of punctuation.
- **Icons and other devices:** In a number of large public documents, extra-linguistic signs such as icons are very rich and very suggestive. There are many categories such as road signs, faces, etc. Their strength is important, but quite difficult to measure. As above, a profusion of these signs lowers their impact.
- **Marks of negation:** some marks of negation are stronger than others: 'never' is stronger than 'do not', *never use X, do not use X* and at the lower level we have advice verbs combined with a negation *we do not advise you to use this paint*.
- **Dedicated forms:** *pay attention:, important:, advice:, etc.*, these forms are close to icons. They are often highlighted.
- **Adverbs of intensity:** adverbs of intensity (e.g. *very* or of affirmation (e.g. *certainly*), when applied to action verbs also introduce levels of strength *we strongly advise you not to buy..., this will certainly break*

We also noted forms that weaken the argument. For example, the presence of a positively oriented support and a negatively oriented one for a given instruction shows the pros and cons without developing too strong a positive or negative orientation. This may be viewed also as a subtle form of persuasion where a kind of objective analysis is provided to the reader.

The above linguistic marks are quite stable over a large set of types of procedural texts. Some are more frequent in some types of texts, for example, marks related to typography and text visualisation are more frequent on the web for large public audiences. Those marks can be combined to stress supports more strongly. However, we observed that, in most cases, a maximum of two of these categories may be used jointly: beyond this level supports lose their effect.

For each of these categories, we can tentatively define scales, but this is quite arbitrary and subject to errors. Research in lexical se-

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< procedure > < title > How to embellish your balcony < /title >
< Prerequisites > 1 lattice, window boxes, etc.< /prerequisites >
....
< instructional – compound > In order to train a plant to grow up a wall, select first a sunny area, clean the floor and make sure it
is flat.....
    < Argument >    < Conclusion att = "Advice" > You should better let a 10 cm interval between the wall and the lattice.
< /Conclusion >
    < Support att = "Advice" > This space will allow the air to move around, which is beneficial for the health of your plant.
< /Support >< /Argument > ... < /instructional – compound > .....
..... < /procedure >

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Figure 1. Extract of an annotated procedure

mantics, originating from (Cruse 1986) proposed some schemas for organizing along scales collections of terms which exhibit various levels of strength for a given property. However, we feel that, for each domain, these scales need to be constructed from complex and heavy psycho-linguistics experiments. We indeed noted that the relative importance of the strength of terms do depend quite heavily on the domain at stake and on the author of the text and the target audience. Obviously this is a task worth pursuing over some domains.

In a text where, in general, several arguments are found, the strength of an argument must also be evaluated w.r.t. the global strength of the others. This would be a useful contribution to Action Theory.

4.1 Perspectives

In this short paper, we presented the different forms arguments and their associated persuasive forces may take in a large variety of procedural texts. We have developed several natural language patterns to recognize conclusions and supports and related persuasion marks, with quite good an accuracy. Persuasion marks cover a quite large spectrum of devices, from icons, punctuation, to more semantic aspects such as verb classes, and to pragmatic aspects.

This is obviously only a first step in the analysis process, since the heart of the problem is to be able to effectively measure the persuasion force associated with an argument, in isolation and in relation with the other arguments in the procedure. At the moment, we can simply, based on patterns, say if the argument has a strong positive or negative orientation. We also gave a few syntactic and morphological factors that tend to reinforce this first evaluation.

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