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VARIATION IN THE CONTEXTUALITY OF LANGUAGE: AN EMPIRICAL MEASURE

ABSTRACT. The context of a linguistic expression is defined as everything outside the expression itself that is necessary for unambiguous interpretation of the expression. As meaning can be conveyed either by the implicit, shared context or by the explicit form of the expression, the degree of context-dependence or "contextuality" of communication will vary, depending on the situation and preferences of the language producer. An empirical measure of this variation is proposed, the "formality" or "F-score", based on the frequencies of different word classes. Nouns, adjectives, articles and prepositions are more frequent in low-context or "formal" types of expression; pronouns, adverbs, verbs and inter-jections are more frequent in high-context styles. This measure adequately distin-guishes different genres of language production using data for Dutch, French, Italian, and English. Factor analyses applied to data in 7 different languages produce a similar factor as the most important one. Both the data and the theoret-ical model suggest that contextuality decreases when unambiguous understanding becomes more important or more difficult to achieve, when the separation in space, time or background between the interlocutors increases, and when the speaker is male, introverted and/or academically educated.

KEY WORDS: context, contextuality, formality, language, personality, situation, word frequencies

1. INTRODUCTION

One of the fundamental issues when studying context is to determine the degree of context-dependence in a given situation. All communi-cation or linguistic expression necessarily refers to the context to some degree (Heylighen, 1999), but in some situations context will obviously play a much higher role than in others.

The anthropologist Edward T. Hall (1976) has distinguished two fundamental types of situations: *high-context* and *low-context*. In low-context situations, communication is explicit and overt, stating the facts exactly and in detail. In high-context situations, communi-

cation is implicit, and information is conveyed more by the context than by the verbal expression. Although Hall introduced this concept primarily to distinguish different types of cultures (e.g., American and Northern European cultures are typically low-context, while Mediterranean and Eastern cultures are high-context), the same distinction can be applied to different communicative situations within the same culture. For example, twins who have grown up together will be able to make themselves understood with a minimum of explicit communication (high-context), while lawyers in a courtroom need to formally state all their assumptions, arguments and inferences (low-context) (Hall, 1976).

Such distinctions between high and low context situations in cultural anthropology are largely based on personal experience and on global impressions of how people in a particular culture behave. Moreover, the association of context with specific cultures seems to imply that the degree of context-dependence is merely the result of historical accidents or of idiosyncratic differences between ethnicities. To develop a more systematic, scientific understanding of the relative importance of context in different situations, we need to be able to measure context-dependence in a reliable, objective and accurate way. If we could make a quantitative estimate of the degree of contextuality in a particular situation, then we would be able to determine how this degree covaries with different features of the situation. For example, using such a measure, we would be able to either confirm or refute the above assumption that twins maximally rely on context when communicating with each other. Moreover, we could use such a measure to either suggest or test hypotheses about the fundamental factors that determine the amount of context-dependence.

The present paper will first examine in more depth the role of context in linguistic communication. This will allow us to define a fundamental dimension of variation between different linguistic styles, going from the high-context pole, which we will call "contextual", to the low-context one, which we will call "formal". By analysing the degree of context-dependence of words belonging to different grammatical categories, we will then develop an overall measure for the degree of contextuality or formality of a language excerpt. Using a variety of data from different languages, we will

show that this measure accurately distinguishes the more contextual from the more formal genres. Finally, we will examine a number of external factors that affect the degree of contextuality of a communicative situation, confronting theoretical hypotheses with the empirical data that are as yet available. Thus, our approach fits in with the "grassroots" approach to context, which starts from the observation of concrete phenomena rather than from *a priori* abstractions. This will allow us to put context into context, that is, examine the features of the wider situation that determine how important context is in any given communication.

2. FORMALITY VERSUS CONTEXTUALITY IN LANGUAGE

2.1. *Ambiguity in Natural Language*

In order to minimize ambiguity and maximize the objectivity and universality of its statements, science tries to express its result as much as possible through formal languages (Heylighen, 1999). This is necessary in particular for models that are to be implemented as computer programs. Artificial Intelligence can be defined as an approach that tries to develop computational models of human cognition and communication. To achieve this, AI makes use of various formal languages, such as predicate logic or semantic networks. However, recent developments have made it clear that complete formal representation is not only theoretically, but practically impossible, and that AI systems will have to take into account the context in which they use their models (AAAI, 1997). A major source of inspiration for this shift from closed, formal models to context-dependent ones is natural language, where context enters the interpretive process from the very beginning.

It is a commonplace that natural languages, such as English, are very different from formalisms. However, Grice's (1975) classic paper on "Logic and Conversation" sets out to show that the divide is not as deep as one might believe. Much of what in a formal language must be expressed explicitly in order to avoid ambiguity, will be conveyed in natural language by *implicature*, that is, by implicit reference to a shared framework of knowledge and its implications. For example, if a person entering a room with an open window through which wind is blowing says "It is cold here", the likely

implicature is "I would like the window to be closed". Though that message was not uttered literally, it is easily inferred from the background knowledge that heated rooms become warmer when windows are closed, and that people prefer not to feel cold. Grice (1975) points out that if one takes into account this shared context (including the general rules or "maxims" of conversation), expressions which appear ambiguous or non-sensical when interpreted on their own become clear and logical.

The conclusion is that natural language will appear much less ambiguous and more logical than it might have seemed if one takes into account different unstated background assumptions. What really sets formal languages apart is the fact that they try to achieve the same clarity *without* unstated assumptions. In order to analyse this further we must examine the essential role of context in resolving semantic ambiguity (cf. Gorfein, 1989) and in understanding linguistic structure (cf. Duranti and Goodwin, 1992).

This role can be illustrated most clearly by considering simple expressions, that must be anchored, or attached, to some part of the spatio-temporal context in order to be meaningful. Such anchoring is called *deixis* (see e.g., Levelt, 1989, p. 58). Examples are simple expressions like "I", "his", or "them", which must be connected to a particular person, "here", "over there", or "upstairs" which must be attached to a particular place, and "before", "now", or "tomorrow", which must be linked to a particular time. Deictic words on their own have a variable meaning. "He" might refer to John Smith, to Peter Jones, or to any other male member of humanity. Yet, only one of them will be referred to in any actual expression. Which person that is will be determined by the context.

2.2. *A Definition of Context*

We will use the general term context-dependent or *contextual* for expressions such as these, which are ambiguous when considered on their own, but where the ambiguity can be resolved by taking into account additional information from the context (cf. Heylighen, 1999). In philosophy, such expressions are usually called "indexical" (Bar-Hillel, 1954; Barnes and Law, 1976). The term "contextuality" encompasses both the case of deixis, where a connection is to be made with a concrete part of the spatio-temporal setting,

and the more abstract case of implicature, where the information to be added must be inferred from unstated background assumptions. It also includes reference to information expressed earlier, which is called "anaphora" in linguistics. More generally, the *context* of an expresssion can be defined as *everything available for awareness which is not part of the expression itself, but which is necessary to correctly interpret the expression.*

An expression is any finite statement, part of a statement, or collection of statements that can be made in some language. Although this paper will focus on natural languages, the definition equally applies to formal languages. Any model, description, or system of axioms, e.g. in mathematics, physics, or AI, can be seen as an expression. Although by interpretation we primarily refer to the understanding of an expression by a human interlocutor, "correct interpretation" in the above definition can be seen more generally as "achievement of the intended purpose". For example, a formal model of a system will achieve its intended purpose if the predictions that can be deduced from it turn out to be correct. Similarly, the internal representation that a robot uses to decide about its actions will achieve its intended purpose if the robot behaves adequately with respect to its goals and the environment with which it interacts. As was discussed in detail in a previous paper for this journal (Heylighen, 1999), all these forms of "correct interpretation" or "adequate usage" require context. No expression, model or representation can ever be *complete*, in the sense that it can do the job without taking into account something external to itself, namely, a context.

The last part of the definition that needs to be clarified is "available for awareness". This means that whoever is the intended addressee or user of the expression must be able to readily extract information from that context, in order to complement the information carried by the expression. For example, the position of a star in the Andromeda galaxy will in general not be "readily available" and therefore not be part of the context of any expression used here on Earth, but the position of the sun above the horizon, indicating whether it is morning, afternoon, or night, will be. Thus, the expression "it is getting late" will in general have a different meaning during the day and during the night. Our definition states

that contextual information is necessary for interpretation, implying that it should be obvious how to extract this information, because otherwise the expression may still be misinterpreted. Thus, information that is in principle available, such as a formula listed in an encyclopedia, but which would require special effort to retrieve, will in general not be part of the context.

It is up to the producer of an expression to ensure that all necessary information is *either* readily available in the context, *or* clearly specified in the expression. If the producer fails to do that, the result will be incomplete understanding of the expression and therefore failed communication. Since the context typically consists of the most salient aspects of the present situation, such as the time of day, the persons present, and the memory of what just happened, together with generally shared background knowledge, a human speaker will in general not have to reflect about what information is available in the context, but only about what information must additionally be coded into the expression.

2.3. *The Formality/Contextuality Continuum*

Although some degree of context-dependence cannot be avoided, the producer of an expression can choose to make an expression either *more* or *less* contextual. The opposite of contextuality may be called "formality". Formal language will avoid ambiguity by as much as possible including the information about the context that would disambiguate the expression into the expression itself, that is to say, by explicitly stating the necessary references, assumptions, and background knowledge which would have remained tacit in a contextual expression of the same meaning. Thus, formality means that a maximum of meaning is carried by the explicit, objective *form* of the expression, that is to say, the actual sequence of linguistic symbols used, rather than by the cluster of implicit, poorly delimited, and subjective factors that constitute a context.

This definition of "formal" as the opposite of "contextual" is more or less equivalent with the way it is used in mathematics and the sciences. A scientific theory is called "formal" when it is expressed in a form (usually mathematical) such that there is no ambiguity as to the meaning and implications of its expressions. This implies that the same statement read by two different scient-

ists, at different moments and in different parts of the world is supposed to be interpreted in exactly the same way. Even computers, which are totally unaware of context, should be able to interpret a fully formalized statement (Heylighen, 1991). Striving to formalize theories or hypotheses is an essential part of the quest for objectivity, universality and repeatability that characterizes scientific research.

We must note that there exist another, more everyday sense of "formal" as "ceremonial or required by convention". Here, form appears to be used more for the sake of form itself than for the sake of unambiguous expression. This may be called "surface formality", as opposed to the "deep" formality that we defined before. In the present paper we will focus on "deep" formality and its opposite, contextuality. In fact, we hypothesize that attention to form on the surface level will in most cases merely reflect attention to unequivocal expression on the deep level. For example, as we will illustrate later, polite speech, which seems like a prototype of superficial formality, can actually be understood as a highly evolved routine to prevent potentially dangerous miscommunication when addressing people that are either strangers (implying that they do not share the same context) or very important (implying that misunderstandings are particularly important to avoid).

The rare instances of surface formality where meaning or understanding is neglected for decorum, thus flouting the conversational maxims (Grice, 1975), could be viewed as parodies or corruptions of deep formality, which retain some stylistic attributes from their deeper origin but without the original purpose. They may be the result of ill intentions (e.g., a politician may use a formal style of language in order to create the impression that he presents precise, objective information, while he really wants to hide the exact details of his policy), or simply of rigidified conventions or traditions, where the maintenance of the initial form has taken precedence over the maintenance of the original message.

It must further be noted that complete formal description in the "deep" sense is in principle impossible (Heylighen, 1999; Van Brakel, 1992). Even in pure mathematics it is recognized (through the theorem of Gödel) that it is in general impossible to explicitly state all the necessary and sufficient conditions for a particular expression to be valid. There always remains an element of inde-

terminacy, and completely unambiguous description is impossible. This is confirmed in the physical sciences by Heisenberg's "Uncertainty Principle", which is related to the "Observer effect" in the social sciences (Heylighen, 1999). These different epistemological restrictions are expressed most generally by the "Linguistic Complementarity Principle" (Löfgren, 1991), which states that *no language can fully describe its own interpretation processes* (and therefore the meaning of its expressions). On a more intuitive level, the principle can be explained by noting that the meaning of an expression can only be fixed by means of a *definition*, which explicitly states the background knowledge or information about the context needed to understand the expression. However, the definition itself contains new expressions which need to be defined themselves. But those second-order definitions again contain new terms which must be defined, . . . , and so on, in an endless chase for a complete description of the world (Heylighen, 1999).

On the other hand, expressions must have a minimal formality in order to be understandable at all. If the meaning changed with the slightest variation of context between the utterance of the expression and its interpretation, communication would be impossible, as the sender and the receiver of the message will never share exactly the same context. For example, there will always be a certain lapse of time passing between the moment a sender forms an expression in his or her mind, and the moment the receiver has processed that expression. Sender and receiver will also always have a somewhat different background knowledge and awareness of the present circumstances. So, a minimal invariance of meaning over changes of context is necessary.

We must conclude that formality/contextuality is a relational concept: an expression can be more or less formal relative to another expression, implying an ordering of expressions, but no expression can be absolutely formal or absolutely contextual. All linguistic expressions will be situated somewhere in between these two extremes. Where exactly on that continuum the expression will lie, depends on the choices made by the one who produces the expression.

The choice between more or less contextual ways of formulating the same idea will clearly depend on how much knowledge the

persons to whom the message is addressed are presumed to have about the context in which it was uttered. The less they know, the more important it is to avoid contextual expressions, replacing them by explicit characterizations. On the other hand, when the audience has a good knowledge of the context, there is a clear advantage in using contextual expressions, such as "I", "there" or "now", which are shorter and more direct. This may be illustrated by considering the following sequence of increasingly formal descriptions of the same person: "he", "John", "John Smith", "Dr. John K. Smith, assistant anaesthetist at the neurology unit of St. Swithin's hospital". Each term in this sequence is less dependent on the context for its correct interpretation, but correspondingly longer, than the previous one. Which level of formal specification is chosen will depend on Grice's (1975) maxim of quantity: the message should be as informative as is required, but not more.

2.4. *Reasons to Prefer either Contextuality or Formality*

Let us summarize the main reasons why someone would prefer more formal expressions to more contextual ones, or vice-versa (Dewaele, 1995; Heylighen, 1999). The basic advantage of formality, which follows from its definition, is that more formal messages have *less chance to be misinterpreted* by others who do not share the same context as the sender. This is clearly exemplified by written language, where there is no direct contact between sender and receiver, and hence a much smaller sharing of context than in speech. As we will show later, written language is in general less contextual than spoken language (see also Dewaele, in press a). The definition also implies that validity or comprehensibility of formal messages will extend over wider contexts: more people, longer time spans, more diverse circumstances, etc. This makes it easier for formally expressed knowledge to maintain and spread over many different persons, groups or cultures (Heylighen, 1993, 1999).

The concurrent disadvantage of invariance over contexts is that formal speech is more static or *rigid*, and will less easily accommodate to phenomena that demand expressions with a meaning different from the one found in dictionaries. Contextual speech, by definition, is *flexible*: meanings shift when the context changes. This is particularly useful when phenomena are to be described for which

no clear expression is available in the language as yet. By using eminently contextual expressions like "it" or "that thing there", it is possible to refer to the most unusual phenomena.

The second disadvantage of formal language is that it is structurally more complex. Therefore, formal expressions require more time, attention and cognitive processing to be produced and understood. The absence of context, as Givón (1985) observed, forces the language user to code the necessary presuppositions within the message. Contextual speech, on the other hand, can do the job with less, shorter, and more frequent words, which are easily and quickly retrieved, and less need for precision, since the context shared by sender and receiver will provide the additional information lacking in the linguistic expression itself.

Contextual speech-styles will also be more *interactive* or *involved*, reacting directly to the interlocutors, events or other elements of the context in which one takes part, rather than describing things from the detached, impersonal, "objective" point of view that would be used by a scientist who tries to express universal laws or a journalist or UN observer trying to neutrally report what is going on in a foreign country.

The conclusion is that the degree of contextuality of an expression will depend on the requirements of the situation, but that there will still be an element of personal choice, depending on whether the sender prefers accuracy over flexibility, detachment over involvement, or fears possible misinterpretation more than additional cognitive load. As a general rule, we expect contextuality to be lowest in the more static, intellectual or informational forms or expression, especially those where it is most crucial to be accurate, objective and unambiguous. This includes official, legal, technical or scientific documents and press reportage. We expect contextuality to be highest in the more interactive and personal communication situations, where misunderstandings carry little risk and can be easily corrected, and where the interlocutors are involved in a shared, specific context. This includes relaxed conversations, dialogues, spontaneous speeches, and personal letters. We finally expect intermediate degrees of contextuality in communication situations that restrict interactivity or personal involvement to some degree, but do not require detailed, objective descriptions.

This includes interviews, prepared speeches, broadcasts, fiction, entertainment, and lighter forms of information.

The most reliable way of studying these dependencies is by empirical observation, where expressions produced in different situations or by different subjects are compared as to their overall contextuality, in the hope of finding recurrent relationships. In order to research such dependencies, however, we must first devise an empirical measure for contextuality.

3. MEASURING LANGUAGE CONTEXTUALITY

3.1. *Methodological Considerations*

Although the above theoretical definition of contextuality appears intuitively adequate, one might wonder whether it is possible to extend it to some practically useful and reliable measure that would allow an observer to distinguish more contextual from less contextual discourses. Such a measure should be both *valid*, in the sense that what it measures effectively corresponds to contextuality as it was defined and as it is intuitively understood, and *practical*, in the sense that it does not require an inordinate amount of effort to apply. These two criteria are inherently at odds: the more valid a measurement needs to be, the more precise and detailed the procedure will be, and the more time and effort will be invested in carrying it out.

The measure we wish to devise should offer a good compromise between these two requirements. Its procedures should be easy to apply to large corpora of linguistic data, without requiring specific rules for handling all possible subtleties or exceptions of the particular language or situation. Yet, it should be capable to unambiguously distinguish discourses that can be considered formal from those that can be considered contextual.

Measuring context is fundamentally difficult, since contexts by definition are subjective, variable, and open-ended. A context can only be defined negatively: as everything that is not part of the (measurable) expression, but that still somehow affects its interpretation. Therefore, there cannot be a universal way of measuring a given context. Every individual linguistic expression will have its own, unique context, and it is impossible to *a priori* determine how far that context extends.

For example, consider the expression "Of course, I'm going to the police". It might seem that the only context element you need to interpret this sentence is the identity of the speaker. Assuming the speaker is John Smith, the expression would simply appear to say that John Smith is on his way to the police. Now imagine a situation in which John Smith has been boasting to a member of his gang about the last burglary he commited, and a bystander who only heard part of the conversation gives him the advice to warn the police about this burglary he witnessed, to which John with a big grin responds, "Of course, I'm going to the police", while his accomplice sniggers. In this context, the expression means just the opposite of what the straightforward interpretation suggests. But only the accomplice knows this context, while the bystander's more limited grasp of the context misleads him to choose the more straightforward interpretation. Of course, this is a unique situation, but every context is unique in some aspect, however minor.

Trying to determine the importance of context from a single expression is like trying to determine a person's character from a single event. It is not because someone prefers to stay home and read a book rather than go to a party that that person is an introvert. There can be any number of reasons for refusing the invitation (Heylighen, 1999). However, if it turns out that that same person regularly avoids parties and other occasions that are noisy or involve a lot of social contacts, then it seems reasonable to infer that he or she is indeed an introvert. Social scientists have learned to make abstraction of the uniqueness and complexity of social or psychological situations by looking for recurrent patterns in large collections of poorly structured data, using instruments such as questionnaires where the items are individually unreliable, but collectively provide a reliable estimate.

Such instruments are typically developed through a "bootstrapping" procedure, where a list of questions (e.g., "Do you like going to parties?") that seem indicative of the phenomenon being measured (e.g., introversion) are used in a first round to try and determine which people are introverts. The accuracy of the procedure is estimated by comparing its results with the results of various other indirect estimates, such as intuitive impressions, evaluations by other people, or theoretical considerations as to who

are the most introverted. If the results of the questionnaire do not score too badly, the questionnaire is refined by checking questions individually and determining which questions seem best able to distinguish introverts (as determined by the rest of the questionnaire and the other methods). The worst performing questions are eliminated, while the best performing ones may suggest some new questions. This produces a new questionnaire, which can be considered more accurate. After a second round of measuring introversion, the questionnaire is again refined in the same way, leading to a third round, and so on. This bootstrapping results in an increasingly reliable measuring instrument for a phenomenon, in this case introversion, that cannot be objectively determined by any other means.

Although it is still in its early stages of development, the measure for formality/contextuality that we propose in this paper belongs to the same family of statistical measuring instruments. Although its individual components may not be very reliable, the measure as a whole should reliably distinguish more from less contextual forms of expression, at least when given a large enough sample. This method was developed by us through a bootstrapping procedure in which initial theoretical concepts together with some data suggested an empirical measure which in turn suggested more refined theoretical models leading to a more refined empirical measure, etc. Thus, the order of presentation of this paper, which starts with theoretical definitions and then goes straight to an empirical measure of the defined concept, is largely imposed after the fact. It is in that aspect not different from the majority of scientific texts, which tend to present their results in a logical, deductive sequence very different from the intuitive, inductive sequence of trial-and-error events that actually generated the model.

As we will discuss in section 3.5, further rounds of bootstrapping could be applied to refine our proposed measure. However, we have not done that because initial indications are that this would not produce a large gain in precision, yet would make it more difficult to compare results across different languages. The emphasis in this paper is not so much on small-scale precision, but on generalizability of results across very different languages and situations. Therefore, we have opted for a relatively "coarse" measure.

3.2. *Word Category Frequencies and the F-measure*

Determining an average degree of contextuality seems easiest when focusing on cases of deixis at the level of single words rather than contemplating complex implicatures at the level of sentences and situations.[1] Analysing language at the level of the lexicon makes it possible to avoid all intricacies at the level of phonetics, syntax, semantics and pragmatics. The analysis of the numbers and types of words in a text is quite easy to automatize by means of computer programs. In contrast, recognition of phonetic patterns, syntactical parsing, and even more semantic and pragmatic interpretation of natural language are still very difficult – if not plain impossible – to perform automatically.

The basic approach we propose is to divide the words of the lexicon into two classes, depending on whether they are used mainly to build *more* context-dependent or *less* context-dependent speech. Note that we only estimate the degree of context-dependence of words *relative to other words*: there are no absolute limits of complete context-dependence or complete context-independence that could be used to ground the scale. In the first class, we will list all words with a deictic function, i.e., that always require refer-ence to the spatio-temporal or communicative context for their interpretation. Levelt (1989, p. 45) distinguishes four types of deixis: referring to person ("we", "him", "my", . . .), place ("here", "those", "upstairs", . . .), time ("now", "later", "yesterday", . . .), and discourse ("therefore", "yes", "however", . . .). Further examples of discourse deixis are exclamations or interjections like "Ooh!", "Well", or "OK". In logic, deictic words would seem to correspond to *variables*, which do not have a fixed referent or interpretation.[2]

The other, non-deictic, class includes the words that refer to an intrinsic class of phenomena, which does not automatically vary under changes of the immediate context. These would correspond in logic basically to *predicates*. Examples are most nouns and adject-ives (e.g., "tree", "woman", "red", . . .). Although such words still depend on a shared context for their interpretation (e.g., they at least require a shared knowledge of the language and of basic common-sense facts), this context is less specific than the one required by the deictic words. For example, it will be understood in a much wider context what the word "cupboard" refers to, than what the word "it"

refers to, even though in a given context they may denote the same entity.

It may further be noted that most nouns have multiple meanings (e.g., "bank" as "financial institution" or as "river edge") that require a context for their disambiguation. Yet, the specification of this context requires relatively little information: it is sufficient to see a word like "money" or "interest rate" appear in the vicinity of "bank" to reliably guess that all subsequent uses of that word refer to a "financial institution" (Heylighen, 2001). It would require much more information to determine for every appearance of the word "it" in a text whether it refers to "bank", "interest rate", "cupboard", or any other of dozens of possible entities. Most generally, deictic words like "it" or "there" can have billions of possible meanings whereas even the most polysemic nouns only have a few dozen distinct senses.

Ideally, a measure of contextuality would start from a classification in which an average degree of deixis would be attributed to every word of a language (cf. Leckie-Tarrie, 1995). The contextuality of a text could then be determined by calculating the total deixis averaged over all of its words. The development of such a classification, however, would be a very long and intricate task, which would have to be started from scratch for every new language. A much simpler, but coarser, measure can be developed by determining an average degree of deixis not for individual words but for the conventional grammatical categories of words. Our examples of contextual words belong basically to the categories of pronouns, adverbs and interjections. Pronouns are particularly clear examples of deictic words. Typically context-independent words are nouns, adjectives (which further specify the meaning of nouns) and prepositions (which mainly create a relation introducing a noun phrase with additional information).

Although verbs seem to function as predicates, and might therefore seem similar to the non-deictic nouns, inflected or "finite" verbs are intrinsically deictic because they refer implicitly to a particular time through their tense (time deixis, cf. Levelt, 1989, p. 55), and to a particular subject through their inflection (person or object deixis). The latter feature is especially important in languages like Spanish, Latin or Italian, where a pronoun does not have to be stated as a

subject of the sentence, since it can be inferred directly from the inflection of the verb. This makes an expression using an inflected verb much more contextual than an equivalent expression without the verb.

This can be illustrated by eliminating deixis from a simple sentence like "They destroyed a building". Removing person deixis, we get the more formal, passive expression: "A building was destroyed". In order to further remove time deixis, we must replace the verb by a noun (this is called "nominalization"): "The destruction of a building". The latter phrase is much less contextual, but correspondingly more static, detached and impersonal. It might be used to express an abstract or general rule (e.g., "The destruction of a building is a dangerous activity") rather than a specific event taking place in a given context, like the original phrase.

Apart from simple exclamations ("You there!"), it is impossible to build sentences without verbs or nouns. Since verbs and nouns are to a certain degree interchangeable (by nominalization or its inverse, verbalization), it will depend on the speaker whether he or she will primarily use verbs or nouns as means of expression. Given the fact that (inflected) verbs are necessarily deictic, whereas nouns are not, we may assume that a speaker using a formal style will prefer nouns (cf. Halliday, 1985), while a speaker using a contextual style will prefer verbs. This increase in verb proportion in contextual styles will be reinforced by the fact that the more formal noun phrases, including nouns, articles, adjectives and prepositions, used to specify additional details about the context, will tend to be left out completely or replaced by pronouns without further determiners.

Verbalization/nominalization of phrases will normally also transform adjectives into adverbs, or vice versa. Thus, the frequency of adverbs will increase with an increase in verb frequency, and decrease with an increase in noun/adjective frequency. This puts adverbs indirectly (via their connection to verbs) in the deictic category, although they might otherwise seem similar to the predicative adjectives, both categories expressing attributes added to other words (nouns, adjectives or verbs). Moreover, the most frequent adverbs have a direct deictic function: e.g., "thus", "yes" (discourse deixis), "later" (time deixis), or 'there" (place deixis). In that use,

they are similar to possessive or demonstrative pronouns ("my", "this", etc.).

Although articles ("a", "the") might seem related to demonstrative pronouns ("this", "that"), Kleiber (1991) argues convincingly that they are non-deictic. Moreover, their frequency for obvious reasons covaries with the one of nouns. Therefore, they may be put in the non-deictic class.

Conjunctions, which have no reference, neither to an implicit context, nor to an explicit, objective meaning, do not seem to be related to the deixis or formality of an expression, but only to its structure. Therefore, they are not put into either category (cf. Dewaele, 1996a,b).

In conclusion, the formal, non-deictic category of words, whose frequency is expected to increase with the formality of a text, includes the *nouns, adjectives, prepositions* and *articles*. The deictic category, whose frequency is expected to increase with the contextuality of a discourse, consists of the *pronouns, verbs, adverbs,* and *interjections*. The remaining category of conjunctions has no a priori correlation with contextuality. If we add up the frequencies of the formal categories, subtract the frequencies of the contextual categories and normalize to 100, we get a measure which will always increase with an increase of formality. This leads us to the following basic formula:

$$F = (\text{noun frequency} + \text{adjective freq.} + \text{preposition freq.} + \text{article freq.} - \text{pronoun freq.} - \text{verb freq.} - \text{adverb freq.} - \text{interjection freq.} + 100)/2$$

The frequencies are here expressed as percentages of the number of words belonging to a particular category with respect to the total number of words in the excerpt. F will then vary between 0 and 100% (but obviously never reach these limits). The more formal the language excerpt, the higher the value of F is expected to be.

Although the subcategories (nouns, verbs, etc.) are here listed explicitly, the formula can be made more general by just adding whichever words seem the more formal and subtracting whichever words seem the more deictic. This is useful in situations where the above grammatical categorizations are ambiguous or where data are lacking (e.g., the number of nouns might be known, but not the

number of articles or interjections). As long as there are sufficient words in each of the two supercategories, the resulting measure should be sufficient to distinguish different degrees of contextuality. The practical effectiveness of this measure will now be illustrated by applying it to data from different languages.

3.3. *Application of the F-measure to Data*

A number of studies by one of us (Dewaele, 1995, 1996a,b, in press a,b), on the use of advanced French interlanguage in different situations, provides extensive data about frequencies of different word categories. A corpus of 2 speech-styles and 1 written style (each containing about 30,000 words) was collected from a group of some 30 students in three situations, in decreasing order of contextuality: (1) an informal conversation; (2) an oral examination, testing the subject's knowledge of the language; (3) an essay produced during a written examination. In agreement with our predictions, the frequency of nouns, adjectives, articles and prepositions increased with an increase of formality in the situation, while the frequency of pronouns, adverbs and verbs decreased. The frequency of conjunctions had no special relation with contextuality. This led to values for the F-scores of respectively 44 (conversation), 54 (examination) and 56 (essay).[3]

These results could be interpreted as a mere peculiarity of interlanguage or of exam situations. More general data about word frequencies for different languages and situations are available, however. A number of authors have analysed extensive corpora of spoken and written language, counting the number of times particular words are used in different genres (e.g., novels or newspaper articles). The results are normally published in the form of "frequency dictionaries". For our purposes, most frequency dictionaries are of little use, though, since they list individual word frequencies rather than frequencies of grammatical categories. Yet, we did find a few large collections that also provide the latter frequencies. Unfortunately, these data only include the average frequency for a given genre, not the degree of variation (e.g., standard deviation) between samples within a genre. After an analysis of extensive frequency dictionaries for Italian and Dutch, some more limited data about word categories in English, and a small corpus of French, we

found similar variations of word frequencies between more and less contextual styles.

Written language scores much higher on the F-measure than spoken language (Dewaele, in press a), as could be expected from the fact that one can rely much less on shared context in writing than in speaking. For the Dutch list of frequencies of Uit den Boogaert (1975), which seemed the most reliable (frequencies based on a total of about 120,000 words per genre), we get an average F(written) = 62, F(spoken) = 42. More specifically, word frequencies taken from more informational genres, such as scientific texts (F = 66) or (broadsheet) newspapers (F = 68), lead to much higher formality scores than those from more involved genres like novels (F = 52) or family magazines (F = 58) (Uit den Boogaert, 1975), in agreement with our predictions. Within spoken language, the speech of people with an academic degree (F = 44) not surprisingly scores higher than the one of people without an academic degree (F = 40) (calculated on the basis of data from Uit den Boogaert, 1975), and, less obviously, that of men (F = 42) higher than that of women (F = 39) (calculated on the basis of data from De Jong, 1979). The general ordering agrees quite well with intuition as to which genres are the more formal. The formality scores for different sources in Dutch are summarized in Table I.

When we look in more detail at the frequencies of the separate word categories (Table I), we notice that the frequency of the "formal" categories (nouns, articles, adjectives, prepositions) increases with an increase of formality, while the frequency of the "contextual" categories (pronouns, verbs, adverbs – data on interjections are not available for all genres) decreases, except for one or two outliers per category. This confirms our hypothesis that these categories increase or decrease together when the style becomes more formal, but that the overall effect captured in the F-score is more reliable than any single category. The frequency of the conjunctions, on the other hand, does not clearly increase or decrease (the tendency towards decrease in the Dutch sample is counterbalanced by a slight tendency towards increase in our advanced French interlanguage data, and an almost constant trend for the Italian data).

TABLE I

Frequencies in percents and resulting formality scores for Dutch language coming from different fields (words for which the category is unclear or ambiguous were left out, so that the frequencies do not add up to 100%)

	Formal categories				Contextual categories			Conj.	Formality
	Nouns	Articles	Prepos.	Adject.	Pronouns	Verbs	Adverbs		
Oral female	10.4	6.9	5.9	8.1	17.0	19.4	17.5	7.5	**38.7**
Oral n. acad.	12.8	8.5	6.3	6.7	16.0	18.8	19.3	6.3	**40.1**
Oral male	11.5	8.2	6.7	7.6	15.8	18.5	16.5	7.1	**41.6**
Oral acad.	13.2	9.6	7.9	7.1	14.0	17.8	17.9	7.1	**44.1**
Novels	18.5	10.5	10.3	10.0	13.3	20.6	10.5	6.1	**52.5**
Fam. magaz.	21.8	9.8	12.2	11.1	10.1	18.7	9.7	6.4	**58.2**
Magazines	24.2	11.6	13.9	10.9	8.6	17.7	8.7	4.3	**62.8**
Scientific	23.1	15.0	13.8	10.8	6.7	16.6	8.0	6.0	**65.7**
Newspapers	26.0	14.7	14.5	10.6	5.6	16.7	7.2	4.7	**68.1**

When comparing the individual categories, we note that the pronouns (decreasing) are the only ones moving monotonically with formality. This could be expected since pronouns form the most clearly contextual category, which might therefore be expected to correlate best with formality. Verbs, on the other hand, decrease rather slowly and irregularly, perhaps signalling their dual predicative/non-finite and deictic/finite nature. Within the "formal" categories, prepositions perform best. This becomes less surprising if we note that prepositions are typically used to start a further specification, replacing a direct reference to the context (e.g., replacing "there" with "*on* the table", or "afterwards" with "*after* the dinner"), or simply adding precise information on the circumstances in which something happens.

On the basis of the frequency dictionaries of Bortolini et al. (1971) [A], and of Juilland and Traversa (1973) [B], we made similar calculations for Italian. The ordering of genres we get is remarkably similar to the one for Dutch, except for a reversal of the positions of the "scientific" and "newspaper" sources, which may be due to a different way of selecting the sources. Language used in Italian movies and theatre (which is supposed to approximate every-day conversations) has formalities of 48 (A) and 52 (A) or 53 (B) respectively. Novels, depending on the sample chosen, score 58 (A) or 64 (B). Newspapers and magazines score 66 (A) or 71 (B). Essays, and Technical and Scientific Writings, (both B) score respectively 69 and 72 (see Table II).

We notice a clear difference between the two dictionaries, the samples from dictionary B scoring systematically higher than the corresponding samples from dictionary A. This is probably due to the way the data were collected, including definition of the word categories and selection of the samples. A systematic difference is that the corpora used for B date from before the 2nd World War, while the ones used for A date from after the war. This might signify that a less formal writing style developed in more recent periods.

When we look at word categories, we again see results very similar to the ones for Dutch, except for one complicating factor: subject pronouns in Italian do not have to be stated explicitly, as the referent can be inferred from the form of the verb. As a result, the frequency of pronouns does not correlate well with the other

TABLE II

Frequencies in percents and resulting formality scores for Italian language coming from different fields (words for which the category is unclear or ambiguous were left out, so that the frequencies do not add up to 100%)

	Formal categories				Contextual categories				Conj.	Formality
	Nouns	Articles	Prepos.	Adject.	Pronouns	Verbs	Adverbs	Interj.		
Movies A	13.4	8.3	8.6	5.1	1.6	27.0	10.0	0.8	6.0	**48.0**
Theatre A	14.8	10.2	9.4	5.5	1.4	24.5	8.7	0.8	5.6	**52.3**
Theatre B	14.0	10.2	10.5	4.8	1.4	23.9	8.1	0.1	7.2	**53.0**
Novels A	16.7	13.8	14.0	5.6	8.5	20.1	6.5	0.1	6.4	**57.5**
Novels& Sh. Stories B	18.2	16.0	15.5	6.7	7.0	17.7	4.5	0.1	6.3	**63.6**
Newspapers A	18.9	16.8	16.7	7.7	5.1	17.5	4.9	0.0	5.2	**66.3**
Essays B	19.0	16.9	17.2	8.1	5.8	12.9	4.2	0.0	7.0	**69.1**
Newspapers& magazines B	20.4	18.4	18.4	8.4	4.3	15.4	3.5	0.0	5.3	**71.2**
Technical& scientif. B	18.6	18.0	20.2	7.6	4.3	12.7	4.1	0.0	6.0	**71.6**

formality components, since the absence of a pronoun does not imply the presence of a noun. Still, the other components, and in particular the verbs, seem to make up for this effect by even stronger correlations with formality. This may be due to the fact that the removal of pronouns as subjects of the phrase puts the burden of person deixis wholly on the verb. The relatively small number of pronouns may also explain the higher overall formality scores of Italian when compared to Dutch. The categories best correlating with F seem to be the prepositions (confirming their role in Dutch) and the interjections (which were not used in our calculations for Dutch). The overall frequency of interjections is very small, though, so that their effect is not very important.

It is interesting to note that Zampolli (1977) performed different statistical analyses (Chi^2, Z, …) on these same data about word categories from the two Italian frequency dictionaries. He found the same unequivocal mathematical ordering of the different genres, and calculated that the probability of this ordering being due to chance is virtually zero. However, he concluded by regretting the lack of any theory that could offer an adequate explanation of these results. It seems that our present concept of formality/contextuality would answer Zampolli's questions.

Hudson (1994), in a similar reflection about the proportions of word classes in the data he gathered (mostly for English), comes to the following conclusion:

> there seem to be regularities in language of which most of us have been completely unaware – regularities which involve the statistical probability of any randomly selected word belonging to a particular word-class. At present we have no hope of explaining these regularities, but they are a challenge that our grandchildren may (possibly) be able to meet (Hudson, 1994, p. 337).

Again, a large part of his questions can be answered by our theory of contextuality. Although Hudson's data are less detailed than the data used by Zampolli (lacking frequencies for several of the word classes), the data from his table 6 for written and spoken English are sufficiently elaborate to apply a simplified formality measure, F* (where the star denotes the absence of numbers for the article and interjection categories). The results are shown in Table III.

Again, we note that the formal categories mostly increase together with formality, while the contextual categories decrease,

TABLE III

Formality* (lacking frequencies of some word categories) scores for English language coming from different fields

	Formal categories			Contextual categories			Formality
	Nouns	Prepos.	Adject.	Pronouns	Verbs	Adverbs	
Phone conversations	14	7	4	17	25	11	**36**
Conversations	15	8	4	16	24	11	**38**
Spontaneous speeches	18	9	5	15	21	9	**44**
Interviews	18	11	6	13	21	10	**46**
Imaginative writing	22	10	6	15	22	7	**47**
Prepared speeches	21	11	5	11	19	8	**50**
Broadcasts	24	12	6	7	14	12	**55**
Writing	28	12	7	9	18	5	**58**
Informational writing	30	13	8	7	17	5	**61**

and that the ordering of genres according to formality corresponds quite well with intuition and with expectations based on our theoretical model (although it is not clear why the phone conversations would be more contextual than the face-to-face conversations). From Hudson's other data, the only ones elaborate enough to allow a comparison of formality measures are the data from New Testament Greek, where the higher formality of the letters compared to the narrative follows the same pattern as the one between informational and imaginative genres in written English, and the data from children's English, where the free play excerpts are markedly more contextual than the interviews, and where boys' language is less contextual than girls' language.

Finally, as an additional check, we analysed a few samples of French. A television interview with a call-girl scored 45, an interview with the president of the republic scored 52, an address to the nation by the president scored 58, and an article in an intellectual newspaper scored 78, confirming the general tendencies observed for English, Dutch and Italian.

3.4. *Formality as a Universal Factor*

In spite of these empirical confirmations, our definition of F may seem to some degree arbitrary, just another one of many related, but different, dimensions proposed by different authors, which all correlate to some degree with variations such as written vs. spoken, but whose underlying motivation is debatable. We will now attempt to show that a dimension akin to contextuality/formality appears like an inevitable outcome of any in-depth analysis of linguistic variation.

In the previously mentioned studies on French interlanguage (Dewaele, 1995, 1996a, 2000, in press a, b) a variable similar to the F measure automatically emerged from a principal components factor analysis conducted on the proportions of word categories between different samples of language, produced by different subjects in a similar situation. All samples were characterized by their values on 7 variables, representing the frequencies of the following word categories: nouns, determiners (articles + adjectives), prepositions, verbs, pronouns, adverbs, and conjunctions. Factor analysis is a statistical technique which attempts to reduce

the variation between the samples to a minimal number of newly derived components or factors. The resulting factors are linear combinations of the original variables. First the combined variable is selected that explains the highest amount of variance, then the one with the second highest variance, and so on, until the remaining variation becomes too small to be significant.

For each of two situations (informal conversation, formal oral examination), a separate factor analysis was performed. Each time, two main orthogonal factors appeared. The first one, which explained over 50% of the variation, was called explicitness/ implicitness. It is practically identical to formality/contextuality as we have defined it, since nouns, determiners and prepositions obtained strong positive loadings on this factor, whereas pronouns, adverbs, and verbs obtained strong negative loadings. The second factor, explaining between 10 and 20% of the variation, shows only weak correlations with the different frequencies, except for the one of the conjunctions. It was therefore interpreted as a measure of the complexity of sentence structures, independent of their degree of formality (cf. Dewaele, 1995).

In conclusion, even if we do not compare situations or genres with different external requirements of formality, there appears a stylistic variation between samples that very closely mirrors our definition of the contextuality variable. This variation is apparently due to the personal preferences of the subjects for more or less contextual styles of expression. Moreover, this variation – at least at the level of word categories – is by far the most important one, explaining more than half of the variance between samples.

This result is further strengthened when a similar factor analysis is performed with the above-mentioned data (Tables I and II) of word frequencies for different genres (unfortunately, the number of genres is too small for a reliable factor analysis), in each of three languages, Dutch, Italian and French. The results are quite similar, except that the variance explained by the first factor, formality, is even greater: from 70% (for French, where the samples were very limited) to over 80% (for Italian and Dutch). A likely cause is that the samples were more diverse in situational formality than the samples in the former study, which were all produced in similar (formal or contextual) situations.

A very extensive factor analysis of different styles in English by Biber (1988) confirms these general results. He starts with a long list of linguistic variables, including fine-grained word categories (e.g., private verbs, 2nd person pronouns, place adverbials), but also different grammatical and stylistical features, some of which are typical for English (e.g., "do" as proverb, number of agentless passive sentences, contractions, "that" clauses as relative complements, etc.). His analysis produces 7 factors. The first one, "an extremely powerful factor representing a very basic dimension of variation among spoken and written texts in English" (Biber, 1988, p. 104) is very similar to our definition of contextuality. This factor, which Biber calls "involved versus informational production", correlates positively with the most frequent verb and pronoun forms, with adverbs and different types of interjections. It correlates negatively with nouns, prepositions and attributive adjectives.

Biber's interpretation of the factor seems compatible with our analysis, except that he has some difficulty fitting the empirically derived factor into a single theoretical construct. He rather distinguishes two separate parameters (Biber, 1988, p. 107): on the one hand, precision and density of information; on the other hand, interaction, involvement and affection. He proposes a not very convincing explanation why these *a priori* independent dimensions are negatively correlated, by noting that involved situations, such as conversations, tend to be characterized by time pressure, which makes it difficult to achieve high precision. This forces him to paradoxically explain the low precision characterizing personal letters by self-imposed time constraints (Biber, 1988, p. 108). In our analysis, both involvement and lack of precision are characteristic of a contextual style of expression, where references to the shared context both signal close contact or involvement, and obviate the need for a precise description of that context. In this view, personal letters lack detailed expositions not because of time pressure (composing letters can take as much time as desired), but because the intimately known person to whom the letter is addressed is assumed to already know the details about the context in which one is writing.

The scores of different genres of language on Biber's factor 1 also confirm our results (cf. Table III, based on Hudson's (1994)

reprocessing of part of Biber's original data). Ordered from the most involved genres to the most informational ones, we get: telephone and face-to-face conversations; personal letters, spontaneous speeches and interviews; different types of fiction, prepared speeches, professional letters and broadcasts; biographies, academic prose and press reportage; and finally official documents, which score lowest of all on involvedness (see also Biber, Conrad and Reppen, 1994, p. 182). This ordering seems to reflect expectations based on either intuition or our theoretical analysis of contextuality. Our application of the F-measure to (part of) the same data (Table III) produces an identical ordering of genres, however, with a much smaller effort of analysis, a clearer interpretation, and an easier generalization to other languages.

In later work, Biber (1995) extends his factor analytic methodology to the very different languages of Somali (Biber and Hared, 1992), Korean (Kim and Biber, 1995) and Nukulaelae Tuvaluan (Besnier, 1988), a language spoken by a few hundred people on a Polynesian atoll. In all three cases, the same involved versus informational factor as in English comes out markedly as the strongest dimension of variation between registers. It is variously called "involvement versus exposition" (Biber and Hared, 1992), "interaction versus information" (Besnier, 1988), and "informal interaction versus explicit elaboration" (Kim and Biber, 1995). Adding our results on Dutch, French and Italian, this brings us to a total of seven languages, belonging to four completely different language families, which all appear to share the same fundamental dimension of variation, captured by our concept of contextuality/formality.

Of course, as Biber notes (1988), no single variable can represent all types of variation between genres or registers. Between 3 and 7 major dimensions came out of the four factor analytic studies reviewed by Biber and Hared (1992). However, only the involved-informational factor was shared by all samples, while the less strong narrativity factor (characterized by the use of past tense and third person) was shared by all samples except the Tuvaluan. The remaining factors seemed to reflect specificities of the different languages. It is hard to avoid the conclusion that a dimension similar to contextuality appears as *the* most important and universal feature distinguishing styles, registers or genres in different languages.

3.5. *Further Refinements of the Formality Measure*

The main criticism that can be raised against the present measure of formality is that it is much too coarse, reducing variations to mere frequencies of the most general word categories. Yet the measure seems to do its job, clearly distinguishing types of language which we would intuitively and theoretically expect to differ in their degree of context-dependence. The advantage of such a coarse-grained approach is that it facilitates the collection and processing of data for different samples or styles.

A second advantage of working at such a high level of generality is that the resulting measure is relatively independent of language. We have shown that the measure is applicable at least to English, French, Dutch and Italian. We expect that it would be easily generalized to further languages. Even if certain word categories (say, articles or pronouns) would not exist in a particular language, we may assume that it will still be possible to distinguish more deictic from more explicit word (or morpheme) categories, in a way similar to the one we used. It would then suffice to add the frequencies of the predominantly explicit categories and to subtract the frequencies of the predominantly deictic categories in order to get an overall formality measure. We would like to stress that the resulting values for the measure can only be used for comparing excerpts within the same language.

Within a given language, it is in principle possible to refine the formality measure, taking into account more subtle differences in formality than the ones between the most general word categories. That would make the measure more precise, allowing finer distinctions between texts and a reliable measurement of formality for smaller samples. At present, a sample would probably need to contain a few hundred words for the measure to be minimally reliable. For single sentences, the F-value should only be computed for purposes of illustration: as we showed with the burglary example, there are too many syntactic, semantic and pragmatic subtleties and exceptions involved to reliably distinguish more contextual from more formal sentences.

A simple way to refine the F-measure would consist in subdividing the abstract categories into more specific ones, for example distinguishing different types of pronouns, verbs and articles. With

the resulting, larger set of variables a new factor analysis can be carried out. We have done this with the data of the corpus of advanced French interlanguage (Dewaele, 1993a), starting with 27 variables denoting more fine-grained categories. Something similar to the explicitness factor still comes out first, but it explains only 22% of the variance. This could be expected, since a much larger number of variables allows for many more sources of variation different from formality.

The correlations of the explicitness factor with the variables are similar to those with the more coarse-grained word categories, although it turns out that some subcategories show an opposite trend to the one of the global category. For example, although determiners show an overall positive correlation with explicitness or formality, the subcategory of "indefinite" determiners (e.g., "some", "certain" . . .) has a slight negative correlation. This could be expected, since rather than adding explicit information about the context, they make the meaning of the subsequent noun more ambiguous. The general result of the analysis seems hardly more informative than the result of the more coarse-grained analysis, though. In most circumstances it would not seem worth the additional effort.

Ideally, we could imagine a very refined measure where each word (or at least each of the most frequently used words) in a language would get an average degree of formality, and the formality of an excerpt would be calculated as a normalized sum of the (positive and negative) formality degrees of all its word. This could be achieved by applying a bootstrapping procedure to a very extensive collection of samples (e.g., the millions of documents available on the web): first, determine the degree of correlation between the relative frequency of a given word in a sample and the formality score of the sample as determined by the existing, coarse-grained measure. Positively correlating words can then be assigned a positive formality score (e.g., proportional to their correlation coefficient), negatively correlating ones a negative formality score. In a second round, the formality score could then be further refined by calculating correlations not with the initial, coarse-grained measure, but with the more refined measure resulting from the first round. Most likely, such an analysis would uncover some words behaving contrary to their general category. For example, the words "thing"

and "daddy", being nouns, should be put in the formal category if we follow the coarse-grained procedure. It seems likely, though, that they will be effectively more common in contextual discourses ("thing" typically being used to substitute for a more accurate description, and "daddy" denoting a very personal, involved relation, in contrast to the more impersonal "father"), thus fitting better in the high-context category. With such a more refined measure, smaller samples could be more reliably scored, but this will never eliminate the intrinsic impossibility to objectively measure the context-dependence of an individual expression.

4. NON-LINGUISTIC DETERMINANTS OF CONTEXTUALITY

As the contextuality concept appears both theoretically and empirically to be well-defined, the time seems ripe to test its predictive and explanatory power in practical situations. We will now examine some non-linguistic variables that affect the degree of contextuality. This degree will in the first place be determined by the characteristics of the situation in which the linguistic behavior was produced, and by the psychological characteristics of the speaker. Both situation and personality are complex, multidimensional phenomena. In the following we have limited the list of factors that may affect contextuality to those variables for which we have some empirical evidence, and a (preliminary) theoretical interpretation.

4.1. *Situation*

We defined formality as avoidance of ambiguity in order to minimize the chance of misinterpretation of an expression. This means, first of all, that formality will be highest in those situations where correct understanding is essential, such as contracts, laws, or international treaties. This may explain the very high formality of official documents according to the data from Biber (1988). It also explains why in our French interlanguage experiment, the oral exam scored much higher on formality than the relaxed conversation.

Second, formality will be higher when correct interpretation is more difficult to achieve. One way to secure accurate understanding is corrective feedback: if the listener can signal to the speaker when he or she doesn't understand, so that the speaker can reformulate

the phrase, the speaker will need to worry less about unambiguous expression. Thus, conversations require less formality than speeches or than written texts (cf. Table III). Within written language, letters, which normally expect a reply, will be more contextual than articles or books, without possibility for reply, as confirmed by the data from Biber (1988). This also fits in with Gudykunst and Ting-Toomey's observation (1988) that in a low-context culture the burden of communication is placed on the sender, whereas in a high-context situation, communication is much more interactive, involving both sender and receiver.

The most important determinant of the probability of misinterpretation, though, is the context shared by sender and receiver of a message. We could summarize an act of communication or transfer of information by the following formula: $E + C \rightarrow I$, where E stands for the expression produced by the sender, C for the context shared by sender and receiver, I for the interpretation by the receiver, and the arrow for "determines" (cf. Heylighen, 1999). The larger C, the smaller E can be, and therefore the lower E's formality. The smaller the size of the shared context, on the other hand, the more information needs to be put into the expression in order to make sure that all information intended by the sender effectively reaches the receiver.

The number of elements in the context is potentially infinite: any characteristic of the physical, social or mental situation can influence the interpretation of an expression. However, in order to simplify the analysis, we will limit ourselves to the most common dimensions. Following Levelt's (1989) classification of linguistic deixis, we can distinguish four categories of context factors: the *persons* involved, the *space* or setting of the communication, the *time*, and the *discourse* preceding the present expression. The general principle that a decrease in shared context leads to an increase in formality can now be used to produce specific predictions for each of these dimensions.

The persons involved are in the first place the sender and the receiver of the message. All other things being equal, the larger the difference in psychological or cultural background (including characteristics such as age, class, nationality, or education) between these interlocutors, the smaller the shared context, and therefore the higher the formality of their communication. This may explain

the requirement of politeness, characterized by a formal style of language that uses more nouns (Brown and Levinson, 1979), when addressing strangers or people of a different rank. On the other hand, people who are psychologically close, such as siblings, spouses or intimate friends, will tend to be minimally formal in their exchanges. In agreement with Hall (1976), we would hypothesize that the highest degree of contextuality will be found among identical twins that were raised together, who completely share their cultural, social and even biological backgrounds. More generally, we can assume, together with Hall (1976), that high contextuality will be found primarily in environments where there are strong social ties between the participants, and where there is a high level of mutual knowledge, shared experience and commitment. This explains why the USA, where people travel a lot, have many, short-term relationships, and diverse cultural backgrounds, is a typical example of a low-context environment. Japan, on the other hand, where culture is much more homogeneous and social bonds are much stronger and more rigid, is a typical high-context environment (Hall, 1976).

Another implication of this model is that contextuality shifts within a personal relationship will signal changes in intimacy: an increase in contextuality indicates a warming of the relationship, whereas a (more unlikely) decrease communicates distancing or unease, implying that expectations have not been met. The study of Fielding and Fraser (1978) on interpersonal interaction indeed found that speech addressed to a liked listener is significantly less nominal (formal) than speech addressed to a disliked person. A further confirmation comes from Biber's (1988) analysis, which finds personal letters (addressed to a well-known person) to be markedly more involved (contextual) than professional letters. Our study of French interlanguage (Dewaele, 1993a, 1996a, 1996b, in press a,b) provides some further evidence. The subjects (university students) were classified on a four point scale measuring social background, depending on whether their parents finished their education after junior secondary school, senior secondary school, non-university higher institute, or university. The formality of their language correlated negatively with the parents' educational level. This might be explained by assuming that the interviewer (a university assistant) was viewed as more distant on the socio cultural

level by the subjects whose parents came from a lower educational background.

A further implication of our model concerns audience size. All other things being equal, the larger the audience, the less the different receivers and the sender will have in common, and thus the smaller the shared context. Moreover, the larger the audience, in general, the more important it will be to secure accurate understanding. Therefore, we may expect that speeches or texts directed to a large audience will be more formal than comments addressed to one or a few persons. This is confirmed by the higher formality score of speeches compared to conversations, of broadcasts compared to speeches (see Table III), and of published texts compared to letters (Biber, 1988). A more detailed method to test this hypothesis would consist in gathering texts of speeches delivered to different audiences, and trying to correlate the formality score of the language with the size of the audience.

The more different the *spatial setting* for sender and receiver, the smaller the shared context. Therefore, conversations over the telephone or another indirect medium would be expected to be more formal than conversations which take place in the same location. Fielding and Cooper (1976) found that conversations over the intercom are more nominal (formal) than face-to-face conversations. Moscovici and Plon (1966) found that speech becomes more nominal over the telephone or when conversants are put back-to-back, so that they cannot see each other. Biber's (1988) data (Table III) do not confirm this result: telephone conversations get a slightly more contextual score than face-to-face conversations, but this may be due to the fact, as noted by Hudson (1994), that Biber's telephone data were of rather poor quality and collected in a way very different from his conversation data.

The longer the *time span* between sending and receiving, the less will remain of the original context in which the expression was produced. For example, reports written for archiving purposes will be more formal than notes taken to remember tomorrow's agenda. This may also in part explain why spontaneous speeches, produced on the spot, have a much higher contextuality than speeches prepared at an earlier moment (Table III). Another way to test this proposition empirically might consist in measuring the

contextuality of messages sent through fast media(e.g., fax or electronic mail) versus slow media (e.g., postal mail). A message that can be expected to reach the addressee the same day should on average be more contextual than a message that takes several days to get through.

Finally, the factor of discourse deixis suggests that formality would be higher at the beginning of a conversation or text, because there is not any previous discourse to refer to as yet. Every document or conversation needs to set out its proper context before it can start using anaphoric expressions such as "therefore", "it", "him", etc. Although we have not analysed any data yet that could support this hypothesis, testing it seems straightforward: it suffices to collect a range of opening sentences or opening paragraphs from articles, speeches or conversations and compare their average formality with the formality of sentences from the middle of the same language sample.

Although we have discussed these different situational variables affecting formality separately, we must note that they are usually mixed in practical situations, which makes it more difficult to unambiguously test our hypotheses. For example, written and spoken language tend to differ in several of these aspects: sender and receiver of written texts are usually separated by time as well as by setting, and the possibility of feedback is usually much smaller than for speech. In this case, all differences point in the same direction, though: written language in general is less contextual than speech in general. This is confirmed by all the data we have reviewed. However, this does not mean that writing is *always* more formal than speech. For example, Biber (1988) found that broadcasted speech (e.g., radio or TV comments on live events, such as funerals or sports competitions), which is addressed to a very wide audience without possibility of feedback, is more "informational" (formal) than personal letters, addressed to one, intimately known person, who would be expected to respond. Some other situations we discussed depend on less variables. For example, the difference in formality between a presidential interview and a public address by that same president seems to reside mainly in the size of the audience, and the possibility for feedback.

4.2. *Gender*

There have been many studies of possible differences between the language of men and women, with interesting, but not easily interpreted, results. Though most researchers find gender-related effects, there is some discussion on whether these differences are firmly substantiated (Thorne, Kramarae and Henley, 1983).

Our present data seem to indicate that women use a markedly more contextual speech style. On the basis of the Dutch frequency dictionary of De Jong (1979), we calculated a difference of 3 points on the F-measure between the sexes for speech (see Table I). These data are based on speech produced by 40 male and 40 female informants. A similar 3 point difference between male and female children's English is readily calculated from the data provided by Hudson (1995). The significance of these differences is confirmed by a more detailed statistical analysis of De Jong's data (Dewaele, 2000), and by our study of advanced French interlanguage (Dewaele, 1996a, 1998, in press b).

In the latter study, the female part of the group scored F = 39 on average in the relaxed conversation, whereas the male group scored on average F = 45, an overall difference of 6 points. In the formal examination situation and the written essays, no significant differences could be found, though. This seems to indicate that the influence of the situation is stronger than the effect of gender, which it overrides in those cases where spontaneous expression is more restricted. The difference in overall formality between formal and relaxed situations (10 points) is also clearly larger than the differences between genders within the same situation. The same pattern appears in the data from the Dutch frequency dictionaries (Table I), where the differences between genres are much larger than those between the sexes.

Let us try to interpret this apparent preference of women for more contextuality. From socio-linguistic and psychological studies (e.g., Hogg, 1985; Tannen, 1993; Coates, 2000), it appears that women tend in general to be more intimate or *involved* in conversations, whereas men remain more distant or detached towards their conversation partners. Tannen (1993, 1992) concludes that men focus on the literal, informational content of the message, while women tend to focus on the implied relationship with their partner, an

ill-understood difference in attitude, which creates many conflicts and misunderstandings between the sexes. As we discussed earlier, involvement entails contextuality of the used language, since it implies direct and repeated reference to the people involved and to their previous reactions. This would lead, among other things, to more frequent use of pronouns, adverbs, inflected verbs and interjections. It also explains why the difference in contextuality between men and women was absent in the formal and written situations, where involvement is restricted for both sexes.

Tannen (1992) summarizes the stylistic differences between men and women by noting that the former are most comfortable with a style she calls *report-talk*, the latter with *rapport-talk*. Rapport-talk is aimed at building connection between the conversation partners and is most appropriate for what Tannen (1992) calls private speaking, involving conversations among couples or small, intimate groups. Report-talk functions to present objective information:

Report-talk [...] does not arise only in the literally public situation of formal speeches delivered to a listening audience. The more people there are in a conversation, the less well you know them, and the more status differences among them, the more a conversation is like public speaking or report-talk. The fewer the people, the more intimately you know them, and the more equal their status, the more it is like private speaking or rapport-talk (Tannen, 1992, p. 89).

Tannen's criteria for distinguishing the private and public situations are practically identical to the person-related situational variables which, we suggested, determine the degree of contextuality: size of audience, and difference in backgrounds. Her thesis that women feel more comfortable in private situations, and prefer to use a style of language specifically adapted to those situations (sometimes inappropriately when the situation is of the public type) supports our observations on the relations between contextuality, situation and gender.

It is interesting to speculate about the causes of these different communicative styles. Although there are obvious cultural influences on the way men and women communicate, recently a consensus seems to have emerged about the existence of deeper, biological differences between men and women that affect their language and thinking (Kimura, 1992). On average women are significantly better at tasks involving fluency in language, memor-

ization of concrete items, and rote calculation. Men, on the other hand, perform better with problems requiring spatial insight and abstract, mathematical reasoning. Anastasi summarizes the effect of these biological differences in cognitive development:

> girls' acceleration in verbal communication, considered together with boys' greater ability to move about and to manipulate objects, may provide a clue to subsequent sex differences in problem-solving approaches. From early childhood, girls may learn to meet problems through social communication, while boys may learn to meet problems by spatial exploration and independent action (Anastasi, 1985, p. 22).

This confirms Tannen's (1992) observation that women use language preferentially for establishing social ties, while men use language preferentially for individual problem-solving. She illustrates the difference in approach with the classic situation where a couple are arguing about how to find their way in an unknown city: while the woman wants to ask directions to a passer-by, the man prefers to orient himself by studying a map.

These differences might be explained by considering the evolution of early hominids, where there would have been a clear division between male and female roles (Kimura, 1992): men would have concentrated on hunting and scavenging, which requires exploration and movement over large distances; women would have stayed more in the vicinity of their camp, gathering fruit and tubers, and caring for the children, which requires sensitivity for small details, and strong social and communicative competence. The general picture that seems to emerge is that women would be more sensitive to the immediate social and physical context, whereas men would tend to see problems more from a distance, with less attention to details, but more eye for abstract or general features.

Most of this is still speculation, but we hope that the measurement of differences in formality between male and female language may help to clarify these issues. For example, it might be used to determine to what degree the relative preferences of men for more formal expressions is dependent on culture or education.

4.3. *Introversion*

In personality psychology, a consensus has emerged that the most important differences in personality can be reduced to combinations of 5 basic dimensions: the "big five" (Digman, 1990). These were derived by several independent factor analyses of very large numbers of personality variables. The most important of these is the factor introversion/extraversion. Intuitively, extraverts are characterized as outgoing, gregarious and fun-loving, whereas introverts are seen as more quiet, reserved and pensive.

To this intuitive distinction between types of social behavior, Eysenck (1981) has added a biological dimension. According to Eysenck's theory, which has been confirmed by a number of experimental findings (Strelau, 1984), introverts are characterized by a higher level of intrinsic activation or arousal in the brain cortex. As any individual operates ideally with a moderate level of cortical arousal, the more extraverted will be inclined to look for external stimulation to reach an optimal level, whereas the more introverted would rather try to avoid strong stimuli in order not to raise their activation level too much. This means that typical introverts are highly sensitive, reacting strongly to relatively mild stimulation, whereas typical extraverts are excitement-seekers, with a much higher endurance for loud noise, strong light, and other forms of external stress.

Extraverts and introverts also seem to have different reminiscence capabilities (Eysenck, 1971). Reminiscence is due to consolidation of the memory trace. This consolidation, which is a direct function of cortical arousal, proved to be stronger in the introverts, at least in the long run (after more than 30 minutes). Extraverts, on the other hand, showed better memory and greater reminiscence in the short run (Howarth and Eysenck, 1965; Helode, 1985).

Furnham (1990), reviewing the literature on language and personality (for native English speech), estimates that introverted speakers are likely to use a more formal style, characterized by a higher proportion of nouns, adjectives and prepositions, and a lower proportion of pronouns, verbs and adverbs. Our studies on French interlanguage referred to earlier (Dewaele, 1996a, 1998; Dewaele and Furnham, 1999, 2000) provide a few more details. In the examination situation, the degree of extraversion was found to

have a significant negative correlation with the explicitness factor measuring formality. Weaker correlations were found for the relaxed conversation and for the essays.

A possible interpretation of these results is that introverts would spend more time reflecting before they speak, whereas extraverts would be quicker to react, avoiding pauses in the conversation. Eysenck (1971) notes that the introvert is more thoughtful than the extravert, taking more heed of the maxim that "one should be sure brain is engaged before putting mouth into gear" (p. 213). This would follow from the extraverts' need for the recurrent stimulation that a conversational interaction provides, and the introverts' preference for undisturbed, inner reflection. The longer time spent on reflection would make the introvert's speech more precise and richer in information, but less fluent and less reactive to the immediate context of the conversation. This also fits in with the introverts' better long term memory allowing them to retrieve more accurate descriptions, while the extraverts' better short term memory allows them to react and speak more quickly. This intrinsic difference in styles will be reinforced by the differential reactions of introverts and extraverts to external stress. The more sensitive introverts will become markedly less fluent in stressful situations, which interfere with their interior processes. The stress will also make them more anxious so that they become even more motivated to avoid misunderstandings (Dewaele and Furnham, 2000). This may explain why the difference in formality scores was greatest in the intrinsically stressful examination situation.

4.4. *Level of Education*

Normally, we could expect that the higher the academic level a person has reached, the richer his or her vocabulary and the wider his or her outlook. This would lead academically educated persons to express their thoughts in a more precise and less subjective way, that is to say with more formality. More generally, since the major obstacle to the use of formal descriptions is the increased cognitive load, we would expect cognitively more skilled individuals to be less inclined to avoid formality. Thus, we might hypothesize that formality would correlate positively with the general factor of intellect

(also called openness to experience), which is also part of the big five (Digman, 1990).

The empirical evidence we found for this hypothesis is as yet limited. In the Dutch frequency dictionary of Uit den Boogaert (1975), word frequencies for speech of people with an academic degree are contrasted with frequencies for speech of people without such a degree (Table I). The resulting formality scores are 44 and 40 respectively. The other Dutch frequency dictionary (de Jong, 1979) compares the speech of people from a high social background with the speech of people from a low background, where background is determined on the basis of education level and occupation. The formality scores (46 and 43 respectively) differ 3 points, which is comparable to the 3 points difference between male and female speech we calculated on the basis of the same dictionary.

Our more detailed analysis of these Dutch data (Dewaele, 2000) confirms their significance. Interestingly, we found moreover that background interacts with situation: the difference in contextuality scores between formal and informal situations is much larger for high background people than for low background ones. A possible interpretation is that when the situation requires more formality, people with a higher education are capable of a greater shift to such a cognitively more demanding communication style, confirming our hypothesis that cognitive load is an important constraint on the degree of formality.

For written documents, our data show that more intellectual sources (scientific and technical documents, essays, broadsheet newspapers, academic prose), addressed to a more high-brow audience, are markedly more formal than sources addressed to a more average audience (family magazines, novels, fiction) (cf. Tables I and II).

In conclusion, we have proposed three independent personality variables that correlate with formality: gender, introversion and level of education. Although the empirical evidence is limited, and the theoretical justification is as yet tentative, the existence of these relations seems to match intuitive expectations. The effect of each separate variable is not that strong (of the order of 3 or 4 points on the F-score), but it will become more visible when the effects are added. For example, the difference of 7 points we found for

interviews with the French (male) president and with a French call-girl may illustrate a combination of gender and background effects (and possibly some situational effect, in that it would seem more important for a president not to be misunderstood). Combining all three personality effects, the prototypical producer of formal speech would be a male, introverted academic. The most likely person to speak in a highly contextual way would be an extraverted woman without formal education.[4]

5. SUMMARY AND CONCLUSION

We have defined the context of a linguistic expression as the whole of the factors external to the expression itself that are necessary to correctly interpret it. Since context defined in this way is unique for every expression and not delimited, we did not try to analyse context directly. Instead we studied how language produced in different circumstances varies in its *degree* of context-dependence. Our basic hypothesis is that this relative degree determines a fundamental dimension of linguistic communication: the formality/contextuality continuum. Formal communication tries to put as much information as possible in the explicit form or expression of the message, whereas contextual communication implicitly relies on the context shared by sender and receiver to convey most information. A formal style of expression is characterized by detachment, precision, and objectivity, but also rigidity and cognitive load; a contextual style is much lighter in form, more flexible and involved, but correspondingly more subjective, less accurate and less informative.

We have proposed a simple empirical measure for this dimension, which is based on the relative degree of deixis for the most important word classes. Nouns, adjectives, articles and prepositions are used typically for more context-independent expression. Pronouns, adverbs, verbs and interjections are used more frequently in highly contextual language. These properties were summarized by introducing an F-score for formality, in which the frequencies of the former word categories are added, the frequencies of the latter categories subtracted, and the result is normalized, so that it would vary between 0 and 100%. It was shown that this measure, though coarse-grained, reliably distinguishes more from less contextual
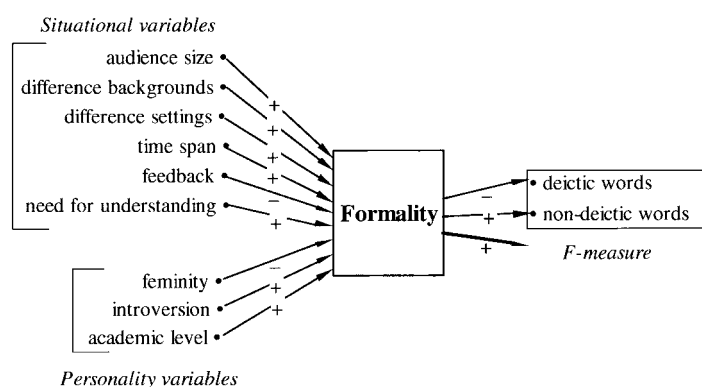
Figure 1. Summary of the formality model. Arrows with + signs denote positive correlations, – signs denote negative correlations; to the left (with arrows entering formality) are the behavioral variables that affect the formality of linguistic expressions, to the right (outgoing arrows) are the linguistic variables affected by formality.

genres of language production, for some available corpora in Dutch, French, Italian and English.

A review of several independent factor analyses showed that a factor similar to the F-score automatically emerges as the most important one when different samples are compared, and this in the most diverse languages. This confirms our hypothesis that formality/contextuality is the most fundamental and most universal dimension of stylistic variation. Given the simplicity, generality and explanatory power of this concept, the most surprising observation is that no other language researchers seem to have considered a similar model. At best, some researchers have noted the strong, recurrent patterns in their data, but lacked a good theory to explain them, while others have suggested theoretical concepts such as explicitness or indexicality, but without operationalizing them so that they could be applied to empirical data.

Both our theoretical model and the empirical data suggest a number of clear correlations between formality and different situational and personality variables (see Figure 1). The formality of the language produced in a situation will increase with the importance of avoiding misinterpretation and the lack of feedback. It will decrease with the size of the shared context. This size is larger when the interlocutors are more similar or know each other more intimately, when the audience is smaller, when the sender and receiver

are in the same settings, when the time interval between sending and receiving is smaller, and when a shared context has been created by previous discourse.

Moreover, contextuality appears to depend on the characteristics of the language producer. Speech is likely to be less contextual if the speaker is male, introverted and/or of a high education level. These observations can be explained by our model if weassume that: (1) women prefer intimacy and involvement, whereas men prefer a more detached, independent attitude towards their conversation partner; (2) extraverts prefer on-going interaction, whereas introverts prefer undisturbed reflection; (3) people with higher education prefer accurate description, whereas people with lower education prefer minimizing cognitive load.

Although none of these correlations has been fully confirmed yet, both the theoretical model and the empirical measure of contextuality we propose seem ripe for an extensive application to these and others issues in the interaction between language and situation. We hope that other researchers will adopt this formality measure, or further refinements of it, and use it to test different hypotheses about language and behavior in a variety of settings.

NOTES

1. A preliminary investigation by Mazzie (1987), extending work by Prince (1981), concluded that the relative proportion of "evoked" contextual information (deictic or anaphoric, directly referring to contextual elements) versus "inferrable" contextual information (indirectly derived, e.g., by implicature) did not depend on the mode of expression (written vs. spoken) but only on its content (abstract vs. narrative). It would be interesting to check in how far thisresult can be generalized to corroborate our simplifying assumption that evoked contextuality is a good measure of overall contextuality, and thus of formality.

2. In fact there exists at least one programming language (HyperTalk) in which variables can be used in a way similar to deictic words in natural language: e.g., "it" refers to the last expression put in memory, "me" refers to the object that is performing the command.

3. The relatively small difference in formality between the written and spoken formal situations might be explained by the specificity of the interlanguage situation: the limited vocabulary in the second language will tend to restrict the higher precision of expression which would otherwise be expected for written essays.

4. The first category might be exemplified by a professor of mathematics or theoretical physics, for example Albert Einstein, and the second one by a singer or actress, say Marilyn Monroe. We leave it as an exercise for the reader to calculate the formality score of two typical expressions characterizing these well-known figures: "energy is equal to the product of mass with the square of the velocity of light", and "I wanna be loved by you, by you, nobody else but you . . .".

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