Leveraging Comparisons between Cultural Frameworks: Preliminary Investigations of the MAUOC Ontological Ecology

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Abstract. Many theoretical cultural frameworks have been proposed in the literature. For comparisons and critiques of these frameworks to make sense, community members have to assign similar-enough meanings to the terms that they use when interacting. This entails overcoming the challenge of dealing with the imprecise and interpretable definitions conveyed in frameworks due to the use of common language. The MAUOC Ontological Ecology (MOE) approach offers a strategy for dealing with this through reinterpretation of all cultural frameworks along a singular, common conceptual baseline. In this way, a far more cohesive, consistent, and controlled representation of cultural frameworks becomes available compared to just common language descriptions. The purpose of this paper is to clarify the MOE methodology, and report initial efforts into practically applying it to the Hofstede cultural framework.

Keywords: Culture, Heavyweight Ontology, Systematic Methodology, Hofstede Framework

1. Introduction

Culture is a key phenomenon in many academic disciplines such as psychology, anthropology, sociology, education, philosophy, and therefore has been studied from diverse perspectives. Consequently, many theoretical frameworks have been proposed, each with specific purposes as endorsed by different research communities. These frameworks are mostly described with common language terms which disguise the complexity and philosophical nuances within. For these reasons and others, frameworks are frequently prone to misinterpretation, and disagreements are common when conflicting claims are made regarding particular frameworks. A common source of dispute is the use of the same terminology across frameworks which may or may not refer to the same conceptualization, such as *Individualism* and *Collectivism* in the GLOBE and Hofstede frameworks [4].

As an emerging interdisciplinary field, research on Culturally-Aware Tutoring Systems (CATS) is driven by scholars with different profiles, both in terms of cultural

backgrounds and expertise. This rich diversity places the CATS community in a unique position to properly tackle the techno-cultural objectives it has assigned to itself. However, the variety of existing cultural frameworks and the lack of time for many community members to deeply understand them creates challenges for cumulating research efforts and findings. Indeed, for comparisons and critiques to make sense, community members have to assign similar-enough meanings to the terms that they use when interacting. This is one way of overcoming the challenge of dealing with the imprecise and interpretable definitions conveyed in frameworks due to the use of common language.

The More Advanced Upper Ontology of Culture (MAUOC) aims to identify conceptual building blocks of the cultural domain, and it has several potential applications for CATS. The one that is considered in this paper is the possibility it offers for reinterpretation of all cultural frameworks along a singular, common conceptual baseline. In this way, a far more cohesive, consistent, and controlled representation of cultural frameworks becomes available compared to just common language descriptions. This would in turn promote objective comparisons between frameworks, and enhance interoperability between research efforts. Before this can be done, a structured, scientific methodology is necessary. One such strategy has been theorized and presented in [3]. It is referred to as the MAUOC Ontological Ecology (MOE) approach, and the purpose of this paper is to clarify this methodology, and report initial efforts into practically applying it to the challenges articulated earlier.

The remainder of the paper is organized as follows. Section 2 presents a justification for the choice of heavyweight ontology engineering as the basis for this research, and briefly describes the development processes behind MAUOC and the MOE approach which motivate the systematic methodology taken in the paper. Section 3 goes into the specifics of this methodology, briefly describes the Hofstede cultural framework, and gives insight regarding why this framework was chosen for analysis. The section then provides illustrative examples arising from the preliminary analysis of the Hofstede framework using the MOE approach, along with a brief discussion of each example. Section 4 discusses what is to be learnt from this preliminary investigation and identifies the limitations of the work so far. The paper concludes in Section 5 with future plans for the investigation.

2. Ontological Grounding of our Analytical Process

2.1 A Heavyweight Ontology Initiative

Heavyweight ontology engineering is strongly connected to the original philosophical meaning of ‘ontology’. Whereas heavyweight and other (lightweight) ontologies look similar to non-specialists (simply put, they could be seen as a set of concepts/constructs interconnected with relations), the critical difference lies in the way heavyweight vs lightweight ontologies assign identities to these concepts/constructs and relations. Authors of lightweight ontologies commonly refer to a ‘rule of thumbs’ approach: they may look for, and accept a definition that makes sense to them in the context of the specific application(s) they have in mind, and according to their personal experience. This obviously limits its applicability while bringing risks of per-

sonal and socio-cultural biases. Heavyweight ontologies on the other hand must not target a specific application, but rather aim to capture the true essence of a domain or task (as in philosophy). A definition obtained following proper heavyweight ontological analyses can thus be reapplied in any situation related to the domain of interest.

Eventually, distinctions between heavyweight and lightweight ontologies are largely ignored by non-specialists. This is a major issue since these ontologies have very different properties. However, the purpose of this paper is not to reflect upon this point, and readers are invited to look at [8] for clarifications. Overall, if heavyweight ontologies are innately superior from a conceptual perspective, they have a major drawback: they are far more complex and consequently require more expertise and development time before being considered to be sufficiently stable for use. But for ontology specialists, these difficulties are overshadowed by the breadth of applicability and the subsequent interoperability that heavyweight ontologies allow once stable-enough. We therefore adopt a heavyweight ontological approach because capturing the philosophical essence of cultural frameworks requires careful, precise definitions that can bridge the operational data/solutions produced by different disciplines [3].

2.2 From MAUOC to MOE: Two Phases in Framework Reinterpretations

Initiated in 2008 [1], MAUOC is a heavyweight ontology initiative. Rather than describing MAUOC itself, which is prohibitive in this paper due to space constraints (see [3] for an overview), we will now make a brief presentation of MAUOC's development process. This is essential for understanding the remainder of the paper because it forms the basis for the systematic methodology described in the next section. The process has several objectives:

- Distinguishing 'natural concepts' (i.e. conceptual units which exist inherently in nature. See [8]) from 'constructs' (i.e. artificial conceptual units defined in the context of a framework to better carry out its message, connect with a user community, and/or facilitate its adoption and use) for the cultural domain,
- Providing precise definitions for natural concepts by figuring out their essential parts and properties. These features are 'essential' because the removal of one of them leads instances to be classifiable in more than one definition. In the same time, a proper definition has to respect Okham's razor principle, i.e. the simplest definition is always the best one.

The development process of MAUOC can thus be decomposed into five steps:

1. Acquiring a deep understanding of several cultural frameworks representing different schools of thought and disciplines
2. Identifying major framework terms as 'natural concept' candidates
3. Classifying the ideas behind these terms as trans-framework or framework-specific into a more restricted ensemble of 'natural concept' candidates while discarding those that are too specific or not innately cultural
4. Eliciting ontology-grade definitions for the remaining 'natural concept' candidates and their relations, and testing if the resulting ecology of concepts allows for expressing any cultural situations and issues that may arise
5. Iteratively repeating one or more of the previous steps if d) has failed, because this would mean that the current version of the ontology is incomplete, and/or includes inappropriately-defined elements.

In the course of its development, MAUOC has thus been revised many times before reaching the first version thought to be stable-enough [3]. Yet, one cannot be certain that the current version of MAUOC will not be challenged by cultural issues to be tested in the future. Developing MAUOC is both a top-bottom and bottom-up process that attempts to identify cultural building blocks by cross-analysing various frameworks. Now that a stable-enough version has been proposed, the MAUOC Ontological Ecology (MOE) aims to further this initiative by following a bottom-up approach where ontological translations of cultural frameworks will be designed and grounded on these building blocks. In other words, the goal of MOE is not to state what frameworks should or should not say, but rather to achieve clearer and more precise formulations of what they already intend to say.

Figure 1 presents a simplified view of MAUOC and MOE processes. Note that YAMATO is a top ontology, on which MAUOC is grounded (see [9]).

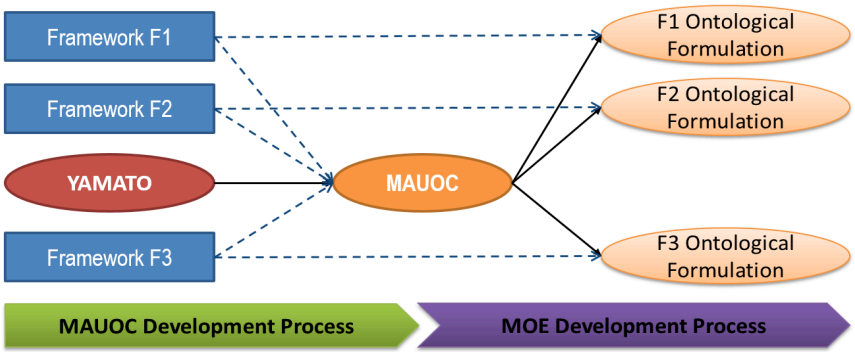

Figure 1. A Simplified View of the MAUOC and MOE Development Processes.

3. Applying the MOE Approach to Hofstede's Framework

3.1 A Systematic Methodology

The systematic methodology described in this section is framework-independent and therefore it can be applied to any cultural framework for which intercultural comparisons are desired using the MOE approach. It is important to note that this process first requires the perspective of external reviewers who have no connection to the particular framework being studied in order to guard against bias [2]. This is crucial since the analysis deals with matters of interpretation and comparison of meanings. At this early stage, only the two authors of the paper are solely involved in the process. Both authors are independent of the cultural framework to which the methodology is being applied and both have different cultural backgrounds which provide an additional layer for guarding against bias.

a) Identify major references for the cultural framework within the literature. Here, sources may include books, journal articles, or conference papers where the overarching quality is the frequency of reference.
b) Identify key terms and several corresponding quoted definitions within these references, by authors of the framework and/or the representative user com-

munity. Key terms, for our purposes, refer to words or phrases which define essential features or ideas that contribute towards the major theoretical underpinnings of a cultural framework.

c) Highlight any discrepancies, consistencies, and/or differences (if any) in the quoted definitions for the key terms. Two levels of analysis are performed in this step: Terminological analysis - which asks whether the definition is consistent over time from a grammatical and a lexical perspective, and Conceptual/ontological analysis - which asks whether the definition is precise enough. Consistency refers the number of changes in the grammatical and lexical structure across the quoted definitions, and it is used to assess whether those changes may alter the meaning in the definitions over time. Precision refers to the self-explanatory nature of expression used in the quoted definition, and the extent to which that expression is potentially subject to interpretations amongst readers.
d) Determine whether a coherent, durable definition can be extracted for each key term. In this step, a key term would still be expressed in common language, but it would now be ontology-ready. In other words, the term would have a logical and consistent structure that is made up of several other conceptualizations that fit together precisely.
e) Consult with experts of the cultural framework to assess the validity of the extracted definitions in keeping with the intended 'spirit' of the framework. If necessary, the definitions would be refined or modified to eventually come to a consensual definition that satisfies both the experts and reviewers while still remaining ontology-ready.
f) Interpret and convert the resulting common language, consensual definitions to MAUOC-grade formulations, using logical representations such as mathematical notations or those originating from HOZO.

Our approach currently focuses on achieving 'heavyweight ontology'-grade definitions for constructs articulated in various cultural frameworks, and as such it only partially reflects the vision stated in MOE. Subsequent and interleaved steps are thus required to clearly state relations and dependencies between these construct definitions in order to achieve true MAUOC-grounded ontologies.

3.2 Primer on Hofstede's Framework

The Hofstede cultural framework was chosen as the starting point in this research for several reasons. Firstly, it is the most popular one used in intercultural research as evidenced by the large body of work using the framework for theoretical and practical reference. Due to over 30 years of study, it is also one of the best documented and consequently one of the most attacked and critiqued of the available frameworks. This rich body of work and the clear evolution that naturally has taken place in the framework due to intense scrutiny, further provides a good distribution of terms upon which to test our methodology.

A brief description of the Hofstede framework is necessary at this point in order to give readers a sense of what the framework is about. The Hofstede framework takes an empirical, generalized approach towards studying cultural differences. It focuses on the identification of dimensions of national culture which were originally: Power Distance, Individualism, Masculinity, and Uncertainty Avoidance [5]. Since then, two

more dimensions have been added to the framework: Long Term Orientation and Indulgence vs Restraint [7]. These dimensions are used to score and classify countries according to how members of those societies cope with problems and concerns that are basic to all human societies [7]. Using these scores and statistical relationships between the dimensions, the framework quantified the differences reported across 40 countries originally in 1980. The data set has since been extended to 107 countries [7]. Country clusters were used to account for cultural observations about behaviour which may apply at various levels (national, regional, individual). Table 1 shows definitions of the six Hofstede dimensions, as well as scores for three countries.

Table 1. Hofstede Dimensions and Country Scores for Three Sample Countries

Hofstede's Dimension	***Dimension Description***	***U.S.A.***	***Spain***	***Japan***
Power Distance	The degree to which the less powerful members of a society accept and expect power to be distributed unequally	40	57	54
Individualism	Preference for a loosely-knit social framework	91	51	46
Masculinity	Preference for achievement, material rewards, assertiveness over modesty, cooperation, caring	62	42	95
Uncertainty Avoidance	The degree to which members of a society feel uncomfortable with uncertainty and ambiguity	46	86	92
Long Term Orientation	The degree to which a society maintains links with its own past while dealing with challenges of the present and future	26	48	88
Indulgence vs Restraint	The degree to which a society allows relatively free gratification of basic and natural human drives over suppression and regulation with strict social norms	68	44	42

3.3 Illustrative Examples and Analyses

In applying the MOE systematic methodology to the Hofstede framework, three reference sources [5, 6, 7] were selected. These three refer to some of the most commonly cited sources of the framework, and together they cover over 30 years of the framework's evolution: the original source in 1980, the currently most cited source from 2001, and the most recent source in 2010. To illustrate part of the process, only 6 framework-specific terms were selected for analysis and presentation in this paper due to space constraints. The 6 key terms were chosen since they are core terms for the Hofstede framework (and most other frameworks), they test different situations in the methodology, and they are commonly used in the user community. These terms

are considered according to their meaning in the scope of the Hofstede's framework. Hence there must be no confusion between some of these constructs (e.g. *value,* or *dimensions)* and heavyweight ontology concepts using the same labels (see [9]).

Table 2 below shows the directly quoted definitions (if present) extracted for each key term from each source. Summarized, unquoted descriptions are provided if there were no formal definitions found for a given key term. The sources [5, 6, 7] are referred to as 1), 2), and 3) respectively. It should be noted that only the first three steps of the systematic methodology were carried out on the Hofstede framework in this paper.

Table 2. Six Key Terms in Hofstede's Framework and their Representative Definitions in Reference Sources from 1980, 2001, and 2010.

Key Terms	***Key Term Definitions from Hofstede Sources***
Value	1) "*A value is a broad tendency to prefer certain states of affairs over others*." (1980, p.19) 2) "*A value is a broad tendency to prefer certain states of affairs over others*." (2001, p.9) 3) "*Values are broad tendencies to prefer certain states of affairs over others*." (2010, p.9)
Culture	1) "*The collective programming of the mind which distinguishes the member of one human group from another*." (1980, p.25) 2) "*The collective programming of the mind that distinguishes the members of one group or category of people from another*." (2001, p.9) 3) "*The collective programming of the mind that distinguishes the members of one group or category of people from others*." (2010, p.6)
Dimension	1) Empirically verifiable, independent phenomena (behaviours of individuals or situations, institutions, or organizations) on which cultures can be meaningfully ordered. (1980, p.36) 2) A dimension is described by two possible extremes which can be seen as ideal types. "*A dimension is rooted in a basic problem which all societies have to cope, but on which their answers vary*." (2001, p.28-29) 3) "*A dimension is an aspect of a culture that can be measured relative to other cultures*." A dimension groups together a number of phenomena in a society that were empirically found to occur in combination. (2010, p.31)
Individualism	*1) "... the relationship between the individual and the collectivity which prevails in a given society*." (1980) *2) "... the relationship between the individual and the collectivity that prevails in a given society*." (2001, p.209). "*Individualism stands for a society in which the ties between individuals are loose: Everyone is expected to look after her/his immediate family only*." (2001, p.225) *3)* "*Individualism pertains to the societies in which the ties*

	between individuals are loose: everyone is expected to look after him- or herself and his or her immediate family." (2010, p.92)
Collectivism	1) No formal definition in the 1980 source. 2) "*Collectivism stands for a society in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty*." (2001, p.225). "*Collectivism is the degree to which individuals are supposed to remain integrated into groups usually around the family*." (2001, p. xx) 3) "*Collectivism pertains to societies in which people from birth onward are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty*." (2010, p.92)
IDV Dimension	1) "*It describes the relationship between the individual and the collectivity which prevails in a given society*." (1980) 2) "*It describes the relationship between the individual and the collectivity that prevails in a given society*." (2001, p.209) "*Individualism versus collectivism is related to the integration of individuals into primary groups*." (2001, p. 29). The IDV dimension is defined also by combining the Individualism and Collectivism definitions from 2) above.(2001, p.225) 3) The IDV Dimension is defined by combining the Individualism and Collectivism definitions from 3) above. (2010, p.92)

Value. Terminologically, the definition of value is cohesive from 1980 to 2010 with one grammatical change in 2010. The grammatical change, i.e. pluralisation, does not affect the meaning of the definition so it is cohesive from this perspective. However it is ontologically since inner terms leave room for interpretation (*state of affairs*, *broad tendency* – what do they refer to? Are these to be understood from a group, individual, or both levels?).

Culture. The definition is terminologically-inconsistent due to changes between 1980 and 2001 from *member* to *members*, and *one human group* to *one group or category of people*, and from *another* to *others* in 2010. In all of the definitions, comparisons are made between A and B, but the nature of A and B changes with each evolution of the definition. This has ontological implications for the cardinality of the comparisons namely a shift from a one-to-one comparison between two individuals in 1980 to a many-to-many comparison across individuals from two groups in 2001 to a broader comparison between not just two groups but amongst many groups in 2010. There are also imprecise inner terms: *collective programming of the mind* and *human group*.

Dimension. The first plain definition for dimension is found in the 2010 source. The term was used and described in 1980 and 2001 across a few pages, however neither source provides a precise definition; the salient parts are summarised in Table 2. Terminologically, there is no cohesion amongst the descriptions. Ontologically, the lack of more than one plain definition provides more room for interpretation. The 2001 quote is imprecise since inner terms (*rooted on*, *basic problem*) are subject to

interpretation, whereas *society* is not clearly defined. The 2010 quote is also ontologically imprecise due to interpretable inner terms such as *aspect*, and *culture*. The measurable property of a dimension is however coherently and consistently articulated across all three sources.

Individualism. The quotes are terminologically cohesive for the first part between 1980 and 2001. The additional section added in 2001 is not cohesive with 1980, and not consistent with the 2010 due to two evolutions: society to societies and immediate family only to him or herself and his or her immediate family. Ontologically, there is a change in cardinality as in the culture definition, and the inner terms are imprecise in 1980 (*relationship*), and imprecise and subjective in both 2001 and 2010 (*ties, loose*).

Collectivism. Terminologically there is limited cohesion with no formal definition in 1980, and one evolution between the common quotes in 2001 and 2010: society changes to societies. Ontologically, the definitions in 2001 and 2010 are imprecise due to inner terms requiring further explanations (*strong, cohesive in-groups, society, protect* - from what, why, and by whom? -, *unquestioning loyalty* - allegiance to whom?, forced or voluntary? -).

IDV (Individualism-Collectivism) Dimension. The quotes from 1980 and the first part of 2001 are terminologically cohesive but ontologically imprecise due to inner terms requiring further definition (*relationship, collectivity)*. The quotes from the second part of 2001 and that of 2010 have the same outcome as the individualism and collectivism analyses above.

4. Discussion

The analysis in the previous section should not be construed as a criticism or praise of the Hofstede framework, nor should it be seen as an effort to create our own definitions for key terms. Rather, the intention is to raise awareness of the possible interpretations of the framework's core terms which can have wide-reaching implications for CATS research especially if misunderstanding and oversights are not cleared up. Contradictions from incorrect usage of framework term can lead to wrong conclusions in educational applications, and cascade dangerously in culturally-aware contexts. The goal is therefore to understand the cultural framework and confirm whether existing definitions are prone to significant misunderstandings.

At this point we cannot say that the MOE methodology is fully validated yet since the research is still in its early stages. More work is needed, and naturally there are limitations. Only three quotes were used for each term and we agree that more and deeper reflection is needed for each term in order to solidify the analysis. In addition, quotes were sourced from material written by authors of the framework only. User community quotes can help identify further misunderstandings as well as consensus from a broader perspective, and should be investigated as well. Finally, only the first three steps of the MOE systematic methodology were carried out on the Hofstede framework. Despite this, clear risks of misinterpretation were identified for key term definitions in the framework in these early, simple stages. As ontology-ready definitions are extracted and validated through consultation with experts of the cultural framework, the systematic process hopefully will reveal weaknesses in the MOE

approach as well as provide additional validation of the soundness of existing concepts in MAUOC. For example, if a definition requires particular concepts that should have been defined in MAUOC, the missing concepts can be added to strengthen the ontology. If successful, this investigation will then create a baseline for analysing other existing cultural frameworks, and produce further validation of MAUOC as a deep ontological model of culture. Folk-based validation of definitions could also provide practical insight since ontologies, both lightweight and heavyweight, require a community of users. This type of validation however needs to be moderated since reliance on inexperienced users can lead to the design of a folksonomy. It is nonetheless still useful to be considered for future work.

5. Conclusion and Future Research

Derived from the MAUOC Ontological Ecology (MOE) approach, this paper presented a systematic methodology for overcoming the challenge of dealing with the imprecise and interpretable definitions conveyed in cultural frameworks due to the use of common language. Preliminary analysis of the Hofstede framework, using the MOE approach, indicates that the methodology is holding up. The next steps involve analysis of more Hofstede framework key terms, such as national culture, and country score for examples, and figuring out whether ontology-ready definitions are possible for the quoted definitions collected thus far in consultation with framework experts.

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