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DETERMINANTS OF COGNITIVE MAPS OF THE WORLD AS EXPRESSED IN SKETCH MAPS

by

José de Queiroz Pinheiro

A Dissertation submitted to the Faculty of the

DEPARTMENT OF PSYCHOLOGY

In Partial Fullfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

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As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Jose de Queiroz Pinheiro entitled DETERMINANTS OF COGNITIVE MAPS OF THE WORLD AS EXPRESSED IN SKETCH MAPS.

and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy

William H. Ittelson	4/15/96 Date
Robert B. Bechtel	4/15/96 Date
Terry C. Daniel	4/15/96 Date
Thomas F. Saarinen	4-15-96 Date
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Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Dissertation Director William H. Ittelson	4/17/96 Date

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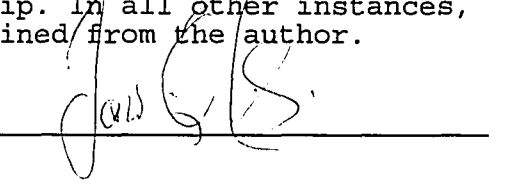
SIGNED: 

Acknowledgements

I would like to express my gratitude to:

My parents, for so many reasons.

Bill Ittelson, for his experienced and knowledgeable advice, many times enriched by examples from his inspiring academic life.

Tom Saarinen, for sharing much of what he has constructed, including the example of human perseverance.

Bob Bechtel, who, from the start, has always been a careful and understanding soul in foreign lands.

Terry Daniel and Jim Sell, for their friendly and scholarly support to my work.

John Hetherington and Charlie MacCabe, for their valued friendship and constant assistance, even when spatially apart.

Universidade Federal do Rio Grande do Norte, and its Department of Psychology, for granting me a license from my academic duties during the period of my PhD studies.

Conselho Nacional de Desenvolvimento Científico e Tecnológico-Cnpq, for the indispensable financial support.

Marilena O. Schneider (UFU), Lineu Bley (UFPR) and José Carlos Borges (UFRN, in memoriam), for collaborating in the collection of data in Brazil.

Peggy Collins and the other members of the Psychology Department's Staff, for their patience and kindness.

and, of course, Heliana, loved partner.

Dedication

To the memory of José A. D. Pinheiro, who was an important example in life, from my earliest days.

To Pablo and Potyra, whose grandchildren will be living on this same planet.

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Abstract

Cognitive representations of the world have been typically studied by means of either qualitative approaches or bivariate association. The sketch map technique and other strategies of data collection have been used in the past, in many instances applied to reduced sets of world nations. In the present study sketch maps of the world drawn by Brazilian university students were examined in terms of frequency of inclusion of nations to verify the combined influence of potential determinants of that inclusion. A graphical procedure was devised to differentiate shared and parochial views of the world and to simultaneously indicate possible predictive variables. The quantitative analysis of the effects of world countries' characteristics upon the inclusion of nations on the sketch maps was proposed as an additional step for a better understanding of the complex process of formation of cognitive representations of the world. Map features and other characteristics of world countries were analyzed and selected by correlational techniques, including exploratory factor analysis, to be part of multiple regression models used to account for the inclusions of nations. The exploratory regression analyses were performed on a random half of the Brazilian

sample of students, according to a combined use of hierarchical analysis, based on classes of causal precedence of the independent variables, and stepwise selection within those classes. The final multiple regression equations accounted for approximately 75% of the variance of the dependent variable. A cross-validation procedure was then accomplished, which confirmed the results of the exploratory phase. The main influences upon the inclusion of nations by the Brazilian students were exerted by world indicators of geo-political, military and economic power, as represented by the strategy board game "WARII" and citations of nations on a Brazilian newspaper. The second group in importance was formed by structural characteristics of the countries, such as their size and map positioning. World countries' cultural traits, including the involvement of the country in soccer, presented the smallest effect.

Introduction

Introduction to the problem

This investigation was about cognitive maps of the world or, in other words, the cognitive representations of the world we construct, keep in our minds, and use in many occasions during the course of our lives.

In the present study sketch maps of the world drawn by Brazilian university students were examined in terms of frequency of inclusion of nations to identify the role of potential determinants of that inclusion. The sketch map technique has been used by numerous studies in the past. The quantitative analysis of the effects of map features and other elements upon the inclusion of nations in sketch maps, however, is here proposed as an additional step for a better understanding of the complex process of formation of cognitive representations of the world.

The investigation was conceived as a peace research effort, under the assumption that a better knowledge of people's representations of the world may improve the human communication processes--education included--that lead to greater understanding among peoples and nations (Saarinen, 1988b). Its results may have significant implications to the teaching and learning of world geography (e.g., Saarinen & MacCabe, 1995; Saarinen, MacCabe & Morehouse, 1988; Stoltman, 1980). Visual

communication and cartographic products are just one example of applied areas which will eventually benefit from the findings of studies on cognitive maps of the world (Boardman, 1989; Wildbur, 1989).

At the same time, a scientific examination of cognitive representations of the world has connection with several other fields of psychological investigation. There is a potential link with the work of environmental psychologists studying the representation of environments at other scales (e.g., Axia & Bremner, 1992; Blades & Spencer, 1986; Thorndyke & Stazs, 1980), and with the efforts of social psychologists interested in the relationship between the formation of such world cognitions and the processes of primary and secondary socialization, as defined by Berger and Luckman (1973). Political psychologists may be interested in the ideological forces that mediate the acquisition and modification of cognitive maps of the world (e.g., Harley, 1988; Montero & Sanchez, 1993). And cognitive psychologists may want to pay attention to perception and memory processes involved in world map representations (e.g., Tversky, 1981, 1992).

"World" is not an easy object of study. Among the more than twenty dictionary meanings offered (Gove, 1961),

one can find: (a) "the earthly state of human existence," (b) "the earth with all its inhabitants and all things upon it," and (c) "all the inhabitants of the earth, the whole of mankind, the human society." The multidisciplinary perspective of this investigation draws upon contributions of social and environmental psychology, human geography and other related areas. Thus the term "world" was used here to designate the interface people-earth or, in other words, the earth with all human beings and human affairs on it.

This study was about the cognitive maps human beings form of the world which, as seen above, is not exactly a synonym of earth. At the same time, the latter encompasses much more than is being considered here. Common cartographic maps of the world represent landmasses juxtaposed with bodies of water. Although some maps may concentrate on climate, ocean life, or geological features, cartographic maps usually do not include other physical aspects that are part of the earth. Rather, they depict continents subdivided into political units or countries which, strictly speaking, are not part of the physical earth. In most instances, social and behavioral science researchers have been more interested in those political subdivisions and their relationships than in

physical and spatial elements of their earth context. Roger Barker's (1968) introductory remarks to the concept of behavior setting seem appropriate:

> "The physical sciences have avoided phenomena with behavior as a component, and the behavioral sciences have avoided phenomena with physical things and conditions as essential elements. So we have sciences of behavior-free objects and events (ponds, glaciers, and lightning flashes), and we have sciences of phenomena without geophysical loci and attributes (organizations, social classes, roles). We lack a science of things and occurrences that have both physical and behavioral attributes. (p. 19)

Studies of cognitive maps of the world would certainly benefit from a greater integration of knowledge from physical and social/behavioral sciences.

Cognitive maps of the world

The process of cognitive mapping refers to the acquisition, organization, storage and retrieval of spatial-environmental information. The notion of the cognitive map was originally devised to explain how humans and animals find their way about their immediate surroundings (Tolman, 1948). It later became enlarged, literally, to encompass greater areas, and to include conceptual and symbolic information. The use of the concept is now more directly linked to the work of Kevin Lynch in the late 1950's (Gifford, 1987; Lynch, 1960; McAndrew, 1993; Saarinen, 1988b). These cognitive maps

are small in scope when compared to the world, i.e., the portions of the environment they refer to are relatively small. The chief input to these maps comes from direct experience of the regions represented, and the maps in turn reflect the particularity of first-hand experience. As the area represented by the cognitive map grows (e.g., a city) the role of secondary sources of information also grows. As originally conceived and largely still considered, cognitive maps are a form of mental representation for relatively restricted area whose function is primarily to support wayfinding and orientation, and secondarily to encode a range of cognitive and symbolic aspects of the environment.

In contrast, cognitive maps at the world scale necessarily take their basic input from cartographic maps, including all the inherent biases in map-making. To this foundation a variety of "distortions" (and corrections) derived from all sorts of secondary sources is added. Contributions from personal, direct experience are quantitatively small, though perhaps qualitatively very important. Therefore the functions of mental maps of the world are primarily cognitive and symbolic with actual wayfinding virtually non-existent.

Presson and Hazelrigg (1984) proposed a distinction between primary and secondary ways of building spatial representations. The former applies to situations of direct experience in the environment, whereas the latter refers to forms of indirectly experiencing an environment. Secondary or indirect learning requires some translation or decoding of abstract information that has been encoded in the form of slides, maps, symbols, video tapes, or any other visual media.

These abstractions of "real world" places are hereafter identified as visual surrogates. As such, they should appear to the perceiver as *representations* of the environments, and should not be confounded with simulations, which are agreed upon replacements of (or substitutes for) "real world" environments (Daniel & Ittelson, 1981; Hetherington, 1991).

A common visual surrogate for very large scale environments is the cartographic map, which is essential for cognitive representations of the world. The attribute of *re*-presentation of real world environments, however, does not seem to be usually perceived by map readers. Instead, as pointed out by Roger Downs (1981), many map viewers subscribe to what he called "naive cartographic realism" (p. 290), because they take the map *as* the real

environment. Naive map viewers, therefore, are easy targets of manipulative geopolitical propaganda maps, as well as of advertisers.

Montero and Sanchez (1993) argued that the sketch maps of the world drawn by the subjects of their study expressed the ideological image those students had of their own countries, in the periphery of the world. According to those authors, this type of mental representation is heavily influenced by the world maps to which people have been exposed. This argument has considerable face validity, considering the highly contentious debate about what a map of the world should look like. Modern projections for two-dimensional world maps such as Robinson's and Peters' have been produced with explicit ideological goals, to offer something different from the "inadequate" Mercator projection (Murray, 1987; Peters, 1983, 1989; Robinson, 1985, 1987, 1990; Saarinen, 1988b). Likewise, commercial maps such as *Down under map of the world* (Anonymous, 1990), and *Turnabout map of the Americas, a new world of understanding* (Levine, 1982; Murray, 1987) propose a vertical inversion of traditional representations (with North on top) to correct a perceived imbalance that implies superiority for countries on the top of the map.

The choice of projection and content of cartographic maps is based on human decision and judgement. Therefore, all maps are necessarily mental maps (Axelsen and Jones, 1987).

The study of the formation of cognitive maps from cartographic maps relies on social conventions related to the shared meanings present in the cartographic representations (Danzer, 1991). However, we know very little about those underlying social representations. As pointed out by Denis Wood (1987), "Even fundamental issues in spatial cognition remain fiercely debated; and little attention--given the consuming problems with spatial cognition in the individual--has been devoted to group manifestations at any scale"(p. 72). Other areas of scientific knowledge, however, have paid attention to similar collective meanings. In his report of travels through inner lands of Brazil, Claude Lévi-Strauss (1957) gave a good example. He told how the bororos were easily converted by missionaries once they were moved from the circular arrangement of their houses into the Europeans' style of a grid pattern. Deprived of a fundamental anchor of their cognitive system of representations, they would even change their daily gestures, losing their sense of

tradition, religion and social life, thereby becoming "easy prey" in foreign terrain.

In this sense, cartographic maps are a powerful mechanism of psychological control, particularly when people do not have other ways of seeking input (i.e. no sensory or direct experience). The analysis of the deliberate use of cartography to manipulate information conveyed through its means and its effects on people, however, exceeds the limits of this paper, but has been considered elsewhere (Harley, 1988; Monmonier, 1991; Murray, 1992; Wood, 1992).

Cognitive maps of the world may have elements in common with cartographic representations of earth, but there is a very important distinction between the two. While cartographic projections are expressed through mathematical formulas, there is no such language to translate our mental maps of the world. While it is possible to reconstruct true sizes, shapes and positions of our spherelike planet from any cartographic projection, "The human mind seems to reorganize the information entirely" (Tversky, 1992, p. 208). Thus, the assessment and understanding of our mental maps of the world is no simple task, and demands tools adequate for their complex nature.

This reorganization, or "re-representation" to use Down's term (1981), of information about the world is certainly related to our goals, as it is normally the case for other environmental scales. The study of relatively systematic distortions in cognitive maps (Lloyd & Gilmartin, 1991; Tversky, 1981, 1992) demonstrates that these distortions are likely to serve functional goals. We mentally link smaller units to superordinate "relatives" in a hierarchical structure to facilitate environmental decision making that would otherwise become too complex and costly. To identify and recognize constellations of stars, for example, is a way of solving the spatial problem of anchoring figures to backgrounds.

Other types of distortions, such as alignment and rotation, also reduce the spatial complexity of spatial images, even if introducing bias and compromising the accuracy of the representation. The same simplifying principle seems to be present in the finding that the decoding process present in the estimation of distances caused shorter distances to be overestimated and longer ones to be underestimated (Lloyd & Gilmartin, 1991). Furthermore, Tversky (1992) mentioned a cross cultural study that found what seems to be a universal preference for the vertical orientation for different types of

objects, when compared to the horizontal orientation. Additionally, positioning at the top has always been chosen for things considered important. Thus, by simplifying the task we make things more inaccurate and, at the same time, we incorporate in our representations of the world--through "naive cartographic realism"--symbolic meanings ideologically loaded.

It is noteworthy, therefore, that distortions in cognitive maps of the world do not mean error, in the sense of physical sciences or engineering, but a reorganization of the information that is functionally oriented (McDonald & Pellegrino, 1993; Tversky, 1992). Concurrently, at the social level, they make the communication process simpler and easier (Gifford, 1987). As summarized by Ittelson and colleagues: "It is this cognitive structuring of the environment that enables us to organize our world in a recognizable and manageable way" (Ittelson, Proshansky, Rivlin, & Winkel, 1974, p. 14).

What functionally relevant ends do we have in mind when looking at a cartographic map of the world? What learning purpose--if any--do we have at that moment? Thorndyke and Stazs (1980) demonstrated that good map learners split the map into subparts and systematically

focus on the subsets, spend more time encoding new material, make conscious use of learning strategies--consistently self-evaluating their own progress, and think in map-like terms. How many of us have followed such a routine, when looking at a world map? And, if so, how many times in our lives? The most likely responses to these queries only corroborate that naive and unquestioning posture people normally assume when dealing with maps, especially world maps.

Amidst the general literature on cognitive maps, few studies have concentrated their attention upon cognitive maps of the world and associated social and psychological implications, despite the importance of such representations for the functioning of the human society, which is becoming more and more globally oriented.

Thomas Saarinen has in recent years coordinated an international project--Parochial Views of the World Project (PVWP)--in the Department of Geography and Regional Development at the University of Arizona, as a continuation of his earlier works on the subject (Saarinen, 1973a, 1973b, 1976, 1988b, 1992). The technique of sketching a map of the world was chosen as the method of measurement, because its simple instructions could be easily understood by students all over the world.

The data base of the Project contains 3568 sketch maps, collected from 75 sites in 52 different countries.

The sketch map images rendered can be interpreted by all countries in an identical fashion, and hence, can be used to answer questions about universal or common factors in this kind of representation, as well as parochial views resulting from regional or national biases.

The relative universality on sketch maps of the world should not be surprising. Notwithstanding the potential variety of cartographic maps of the world, several authors have observed that practically the same images are reproduced all over the world (Montero & Sanchez, 1993; Peters, 1983; Saarinen, 1988b). In addition to political and economic factors that help sustain dominant views of the world internationally, the educational systems of many countries also seem to play an important role. Worldwide elementary level curricula have been found to be very much alike (Benavot, Kamens, Meyer, Cha, & Wong, 1991).

Saarinen, his assistant, and collaborators from different parts of the world have produced a large body of research on the subject (Keidel, 1992; MacCabe, 1987, 1988, 1990; Saarinen, 1988a, 1988b, 1992; Saarinen & MacCabe, 1995; Saarinen, MacCabe, & Morehouse, 1988; Saarinen, Parton, & Billberg, 1992). The project has also

been covered in short articles for popular science audiences (Binney, 1988; Monastersky, 1992; Simon, 1987).

The method of analysis most frequently used in the Parochial Views of the World Project consists of the study of mutual perceptions (i.e., a country's view of the world and the world's view of that country). It is similar to what, in the study of a country's regions, has been called the insider's view, which helps define the cultural meaning of a region--especially when compared to a view from the outside (Lowry, James & Zonn, 1989). In Saarinen's project, the country's view of the world is obtained through the aggregated results of sketch maps drawn by students of that country, whereas the world's view of the country is based on sketch maps from the whole world sample. Studies of this type have included: French-speaking countries (Bailly, Saarinen, & MacCabe, 1992), South Korea (Saarinen, Kim, & MacCabe, 1991), Finland (Saarinen & MacCabe, 1989), Australia (Walmsley, Saarinen, & MacCabe, 1990), and Germany (Saarinen & MacCabe, 1990). The data for these studies relied on the computing of the frequency of inclusion of nations on the maps sketched by the particular sample of students, as nations have been found to be the building blocks of mental maps of the world (Saarinen, 1988b).

A few years ago a meeting of the International Geographical Union's Commission on Geographical Education offered an opportunity to discuss several similar works that dealt with world images of students from places such as Saudi Arabia, South Africa, Africa, China, British Commonwealth, Brazil and Hong Kong (respectively, Al-Maharwi, 1992; Ballantyne, 1992; Berkowitz, Saarinen & MacCabe, 1992; Dean, 1992; Gourley, Saarinen, & MacCabe, 1992; Pinheiro, 1992; Wong, 1992). Given the volume of information, the extension of findings and their implications, this set of studies deserves a review of its own. Here I have concentrated attention specifically on the aspects most directly related with the goals of this investigation.

It is known, from political science studies, that cognitive representations of nations and nationalities usually change--when and if they change--very gradually or at a slow rate (Hirshberg, 1993). The studies done by Saarinen and collaborators have corroborated this fact, despite the differences in theoretical approach and method of analysis. Their data, collected in late 80's, demonstrated that people from different places of the world were still identifying under one name, "Germany," what was then two different nations, partially separated

by the infamous Berlin Wall since a little after the Second World War, forty years before (Saarinen & MacCabe, 1990). Similar results appeared in the South Korea study, because sketch maps from diverse nations showed South and North Korea as just "Korea" (Saarinen, Kim, & MacCabe, 1991). The Brazilian students, whose sketch maps supplied the data for this study, were not different. There were many instances of just "*Coréia*", "*Alemanha*", "*Rússia*" (instead of *União Soviética*), and "*Guianas*", an old and popular collective denomination of Surinam (ex-*Guiana Holandesa*), Guyana (ex-*Guiana Inglesa*) and French Guyana. In this respect, the sketch maps collected from the Brazilian students in early 1990, offer a rare opportunity (the PVWP's database as well) for the study of cognitive maps of the world.

Data was collected before the unification of Germany and Yemen, before the dismantling of ex-Yugoslavia, ex-Czechoslovakia and ex-USSR and some other facts with international repercussion, like the concession of areas by Israel to the Palestinians. It seems fair to consider that those students (and even their parents and teachers) have been exposed to a certain stability of international frontiers, prevalent for several decades. Latent tension in some world regions, provoked by the Cold War or other

forces, may have just helped reinforce the existing borders. It is possible to explore similarities and discrepancies (or "distortions") found in their cognitive representations with the "real" political world, inferring causal explanations for such facts. It would be clearly more difficult to presume explanatory reasons for certain aspects of data collected nowadays, in the mid 90's, after all the changes the world has gone through.

Representations of the earth were used in the present study in two complementary ways. As mentioned before, the earth is too large an environment to be perceived by our senses directly as a whole. We need representations of it, photographs, globes, maps, diagrams, and so on. Therefore, world maps ordinary people are normally exposed to are our first focus of attention, as the potential main input for the formation of cognitive maps of the world. On the other hand, maps sketched on a sheet of paper are the surrogates of the students' cognitive re-representations of earth, an indirect expression of their knowledge of the world. Their sketch maps are personally modified copies--also culturally and ideologically mediated--of the cartographic world maps they have been exposed to and express, at least in part, their cognitive representations of the world. Most people find drawing a

sketch map of the world a difficult task, given the complexity of the object. Even so, the task is readily accomplished and possibly constitutes the best alternative available to express someone's gestaltic representation of the group of world countries (Saarinen, 1988a, 1988b).

Considering the amount of underlying information present in sketch maps of the world, there certainly is space left for additional qualitative and quantitative investigation. Conceptual notions that have been studied in cognitive maps of other environmental scales could be transposed to the investigation at world scale with practical and theoretical benefits for both sides. At the same time, the work that has been produced by geographers and psychologists on cognitive maps of the world could benefit the investigation of international relations, national stereotypes, prejudice and other themes, mostly investigated by sociologists and political scientists. Naturally, the reverse is also true, because many cultural and socio-economic sources seem to underlie our cognitive maps of the world.

Purposes of the study

Studies of mental maps of the world have suggested that they are formed under the influence of a series of

social and cultural variables, such as historical and linguistic ties between nations, countries' economic status and population, subjects' experience of (or desire for) traveling abroad, their previous experience with game boards (e.g., "Risk" and "Diplomacy"), media coverage of nations, and others (e.g., Bosowski, 1981; Cherry, 1991; Kong, 1988).

To my knowledge, however, there has been no attempt to quantitatively analyze those potential determinants of cognitive maps of the world in an integrated fashion, which was the basic objective of this study. In this way, the influence from each characteristic can be simultaneously considered, and their contribution to the formation of our cognitive maps of the world understood in presence of the others.

At this point, some underlying notions of this investigation deserve to be made explicit. The term mental map was considered equivalent to cognitive map, and neither of them necessarily implied that we store spatial information in cartographic-like form. External maps, or more simply just maps, refer to cartographic representations existing on some kind of physical support outside the individual, whereas internal maps refer to mental or cognitive representations. Additionally, the

sketch map (as drawn by an individual) was seen here as a surrogate (a physical manifestation) of the cognitive map (a theoretical construct). Even though the process of environmental cognition is normally based on all sorts of sensorial and perceptual inputs we receive more or less selectively from the environment, the present work concentrated on specific aspects. The models used to explain the inclusion of nations on the sketch maps of the Brazilian students were constructed around two general influential dimensions of world countries: visual-spatial characteristics (basically map derived) and linguistic-abstract input (textual information on characteristics such as population, economic power, etc.).

The explanatory models tested in this investigation (as described in the next section) may be applicable to other intranational and international samples, or to the analysis of the formation of mental maps of the world at different stages of personal development, and so on. Such explanatory models, and the causal links examined, could yet contribute to the development of the construct validity of cognitive maps of the world. This work represents a beginning of a research program where current methodological differences and controversies may be gradually attenuated toward such theoretical integration.

Method

Overview

This investigation was designed to provide a new understanding of how quantitative attributes of world countries mutually interact to explain group frequencies of inclusion of nations on sketch maps.[1] As previously mentioned, this study may also be considered as an extension of the PVW Project (Saarinen, 1992, 1988b). The development of such an explanatory model will contribute to the analysis of differences and similarities among the national samples of the Project, fostering an understanding of the complex process of world cognitive mapping. It may also help to answer specific questions such as "what the universal and parochial aspects of our cognitive representations of the world are?"

Considering the person-environment relationship, the focal point of research in environmental psychology, this study concentrated upon the environmental end, in search of determinants of people's inclusion of nations on sketch maps, an expression of their cognitive representations of world nations. The dependent variable in this study, therefore, is the group frequency of inclusion of nations on the sketch maps. This does not imply that all possible

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[1] To help avoid misunderstandings, I have tried to maintain consistency in the use of the words "nation" and "country" throughout the manuscript. "Nation" is the object of inclusion by the students, whereas "country" either designates the origin of a sample of students or refers to the political entities whose characteristics are used as independent variables in this investigation.

explanations of the phenomena studied here reside on the external (or environmental) side of the equation. There certainly are important aspects at the personal end that deserve scientific consideration, such as preference and attitudes toward world countries, national stereotypes, and so on. The research strategy adopted here by no means discards those influences.

This investigation adopted an exploratory-descriptive approach by finding out the frequencies of nations' inclusion by Brazilian students and the characteristics of countries quantitatively associated with those inclusions. It also went beyond the descriptive level of research when the explanatory models (multiple regression used to imply causation) were cross-validated.

The method may be divided into five progressive stages: (1) data collection and tabulation, (2) selection of independent variables, (3) construction of exploratory multiple regression models, (4) confirmatory multiple regression analysis of such models, and (5) models comparison.

The initial stage included collection and tabulation of data of two kinds: the sketch maps of Brazilian students, from which the inclusion of nations was obtained, and the measures of relevant characteristics of

world countries according to the proposed outline of the two models.

In the second stage, factor and multiple regression analyses, as well as other correlational techniques were employed for selecting the best independent variables.

Countries' traits chosen in the second stage were then used to explain the dependent variable (i.e., the inclusions of nations on sketch maps). They were submitted to multiple regression analyses to contrast two rival explanatory models: map and non-map (or physical geography).

In the fourth stage confirmatory multiple regression analyses were performed on the models.

The final stage comprised the comparison of the two models.

Subjects

Ninety-three students enrolled in the first year of university geography courses in three Brazilian cities took part in the study. The author's collaborators collected the data in Natal, Rio Grande do Norte (n= 21), Uberlândia, Minas Gerais (n= 32), and Curitiba, Paraná (n= 40).[2]

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[2] The initials of the cities' names form the name of the dependent variable: NUC.

Such a group of students was a sample of convenience. Therefore, special care must be taken concerning generalizations of the findings to other groups of people. Regarding the set of world nations, however, the notion of generalization does not apply, because practically all of them are present in the study. In other words, in the analyses reported here, each nation is a "case" or a "record."

Procedure

Data collection and tabulation. Subjects were asked to draw a map of the world on a blank sheet of paper. The instructions were the same described in the literature of the PVW Project (Saarinen, 1988b; Saarinen & MacCabe, 1995; Walmsley et al., 1990), and can be found in Appendix A. The students worked individually, and any source of information related to the task, such as maps on the walls of the classroom, had been previously removed.

The sketch maps were collected during the period of April to June of 1990, just months before the unification of Germany and Yemen and the division of the ex-Soviet Union, Yugoslavia and Czechoslovakia. Hence, both the

subjects' cognitive maps of the world and their surrogates, the sketch maps, express the pre-90's world.[3]

World nations were rated either as included on the sketch map or absent from it, in conformity with the standard procedures of PVW Project. Individual scores for each nation were summed for the group of 93 students and collective percentages of inclusion calculated for each nation.

Selection of independent variables. As mentioned earlier, previous studies have indicated that our cognitive representations of the world may be due, at least in part, to the influence of the characteristics of world nations. Taking into account those suggestions and personal intuition, a set of indicators was identified, as candidates for an explanatory model of the inclusion of nations on the sketch maps.

Some determinants could not be included in the study due to the way information had been coded and/or stored. Tourism to and from Brazil, international penetration of "cultural industry," trade partnerships, and volume of exports and imports of consumer goods were among them.

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[3] World nations are addressed in this study per their names and political status at that time exclusively for historical reasons; there is no attempt of any evaluative action by the author regarding whatever changes have occurred since.

Other indicators also had to be discarded from the study because their sources, despite having usable information, did not cover the whole set of 172 countries. A central notion in this investigation was the concept of world nation. It assumes that the cognitive representation of a nation includes its relationships (spatial, political, mercantile, etc.) with other nations, making up a configurational set of entities, a "gestaltic" representation of what we call world. Accordingly, the multiple regression stage had to include the whole set of countries. Thus, equivalent indicators replaced incomplete measures whenever possible, to avoid the elimination of countries from the multiple regression analysis.

Some of the incomplete indicators were: level of energy consumption, percentage of labor force in agriculture, percentage of agriculture in gross domestic product, military expenditures, general educational level, education assets, and communications capabilities (TV, radio, newspapers, etc.).

In spite of the principle stipulating no exclusion of nations, common sense prevailed in two cases. Vatican City, a political state of exceptional nature, was the only country lacking information on some important

determinants, and consequently was removed from the set of nations. Brazil was also discarded, but for different reasons. Its inclusion on the sketch maps of the Brazilian students had probably much more to do with being their home country than with any of the indicators used in the study. Keeping it in the set could mean the partial distortion of relevant results. Hence, the final set of world countries submitted for analysis contained 170 nations.

The indicators considered appropriate were submitted to selection for model assembling. This stage was accomplished by the combined action of: (1) factor analysis, (2) the analysis of bivariate and partial correlations among possible independent variables and between them and NUC, the dependent variable (or DV), and (3) multiple regression models with a reduced set of candidate variables.

Multiple regression analyses. The regression models were based on three sets of determinants: (a) the general group, formed by determinants of social, cultural, demographic, historic, and economic nature; (b) the Geo group, or physical geography determinants; and (c) the Map group, map features obtained from a typical Mercator world map.

The two models analyzed were: (1) the Geo Model (b + a, above) and (2) the Map Model (c + a). The rationale for this composition was the assumption that cognitive maps of the world are formed by the accumulation of verbal-abstract information about world nations, combined with their spatial configuration. We assimilate this information through visual exposure to world maps (Map), the most common form of representation of the "real" world. To substantiate this proposition, the other model was conceived as an antagonist working hypothesis. The same group of general determinants was combined with physical geography indicators (Geo), which--as much as possible--paralleled the map indicators.

The Map Model, however, offered a theoretical context for additional variables not possible in the Geo Model. The conjectures traced in the following lines bear analogical connection with the notion of hyper-ritualization, developed by Erving Goffman (1976). According to it, advertisements in which gender roles are shown tend to reinforce the social stereotypes of males' privileges in "real" life, through larger areas occupied by men in the photographs, their placement on upper portions of the pictures, and so on.

It seems, then, reasonable to suppose that from the point of view of a world map perceiver, the visual size and spatial disposition of the country on the world map affects the chance of it being perceived, therefore later recalled. This assumption is certainly the basis for the technical, aesthetical and ideological controversies about the "correct" projection for a world map (e.g., Associação dos Geógrafos Brasileiros, 1988; Ramphal, 1985; Robinson, 1990; Saarinen, 1988b; Snyder, 1988; The Economist, 1984; Vujakovic, 1989; Wilford, 1992), as in the case of the "upside down" and "turnabout" experiences (Anonymous, 1990; Levine, 1982) and connected disputes.

The probability of being visually salient may depend, among other factors, on the vertical and horizontal position of the country on the two-dimensional plane of the map. Thus, two variables accounting for such spatial disposition were created: Map Horizontal Position (MHOR) and Map Vertical Position (MVER).

The perceptual prominence of the country on the world map may also be influenced by the amount of coastline the country presents (MCST). Other things being equal, the proportion of coastline may be important to the perception (and recall) of world countries. For example, a country such as Kenya (MCST= 13%) may be less recalled because it

is less salient than Madagascar (MCST= 100%) due to such coastline effect, even though their areas are virtually the same. A similar example is Greece being recalled at a higher level than Austria. Hence the variables in the two models are percentage of coastline as defined "in reality" (GCST) and on a world map (MCST).

In addition, an interaction effect was postulated between Map Size and Map Proportion of Coastline.[4] These two variables, among other issues, may interact to distinctly influence our perceptions (therefore our recall) of world countries. In the absence of other influences, such effect would make Cuba (small, but island) more noticeable than Bolivia (larger, but landlocked), or Japan more prominent than Mongolia. Size and coastline interaction may have its limitations, though. The Soviet Union may not have to be an island to be salient and, on the other hand, the total coastline of island countries in Oceania may not help those tiny countries to be more noticeable.

This interaction effect could not exist in the Geo Model, as defined in this study, given the "abstract" nature of its terms. Additionally, it has no necessary

[4] Many other interaction effects could have been conceptualized to account for the complexity of multiple influences on the cognitive maps of the world. However, the available knowledge about their isolated effects was still very limited, and precluded the generation of numerous interaction effects.

relation with the well-known distortions of size provoked by the Mercator projection (for example, most of us are led to think that Greenland is larger than Algeria, when the opposite is true).

The character of the multiple regression construction of these models was two-fold. The multiple effect of the independent variables on the dependent variable (DV, or NUC) was unknown and, therefore, the analysis was exploratory-descriptive. In this sense, the SPSS procedure for stepwise regression (Norusis, 1990) was employed to select the independent variables for the models. A minimum level of significance of $p=.10$ was adopted as the criterion for each coefficient to be entered in the regression equation. Within the context of exploration and without clues from previous research, this confidence interval seemed appropriate to generate insights about the relationships under investigation. In later stages of the analysis, the criterion for the regression coefficients was restricted to a confidence interval of 95%.

Additionally, literature and common sense guided the process of multiple regression analysis beyond the level of simultaneous equations. The process was extended, even though in a limited way, to hierarchical analysis,

according to which causal assumptions about the relationships are made explicit for the benefit of theory construction (Cohen & Cohen, 1983). The asymmetry of the relationship proposed here--countries' characteristics as independent variables and frequencies of inclusion as the DV--has left no doubt about the basic underlying causal assumption. Moreover, a hierarchy was proposed for the characteristics of world countries. They were classified in classes of gradually less causal precedence, and such classes progressively submitted to stepwise selection of its variables.[5] This way a first level variable, hypothesized to be fundamentally more important in causal terms, would be selected first, if its relationship with the DV was strong enough. A candidate variable in lower classes would enter the model only if its relationship with the DV was expressive beyond the variance shared by the DV and the already selected variable(s), because all of the common variance was partialled out by the selection of the previous variables. For example, let us assume that the countries' physical size has entered the model at the first stage. Population (a lower class candidate) would enter the model only if the number of inhabitants in

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[5] The inherent logic is similar to the recommended procedure for submitting main effects terms before interaction terms in multiple regression equations.

the country was relevant enough, apart from the physical size of the country.

The four classes used for hierarchical organization of the variables are somewhat related to previously discussed definitions of the term "world" (viz., being earth plus human beings and their affairs). The classes have been defined as: (a) basic infra-structure, or the physical characteristics of the country (e.g., Area or Map Size and amount of coastline); (b) the basic humanizing characterization of such pieces of land (e.g., Population and Years of Independence); (c) more elaborate human manifestations, still mostly country specific, including cultural (e.g., religion and language) and economic aspects (e.g., gross domestic product and energy production); and (d) national indicators heavily influenced by the interplay of world relations (e.g., presence in the news, military and political world influence).

This causal stratification of the domain of the independent variables also had important bearing on the differences proposed for the models. The distinctive aspects under scrutiny (e.g., Area vs. Map Size) were positioned at the first class for both models, potentially

having decisive influence upon the inclusion of variables from lower levels into the respective equations.

Another theoretical implication was that such stratification resembled the gradual evolution of the structure of cognitive maps of smaller scale environments, that is, starting at the landmark-like type of knowledge and reaching the configurational form of representation at the last stage. Such stratification could offer an opportunity to analyze scale parallels. In other words, how the isolated characterization of nations--the building blocks of cognitive maps as represented on sketch maps (Saarinen, 1988b)--relate to the "gestaltic jungle" of world relations, the interplay of countries in competition, rivalry, domination, and so forth.

Such a perspective of analysis, however, is the prerogative of the analyst, in a *post hoc* basis, and does not imply that the students' cognitive maps of the world were formed in the same sequence of causal precedence. The very fact that we experience the world, as such, essentially through visual surrogates (always with some limitation in its representation) precludes cognitive maps of this scale from being directly comparable to smaller scale ones.

To add power to the findings of such analyses, a confirmatory stage was designed, based on a split sample approach (Cohen & Cohen, 1983; Norusis, 1990). The original sample of 93 students was randomly split into two parts. The first, NUC46, with 46 subjects, was designated to the exploratory phase. The second half, NUC47, with 47 subjects, was employed in the confirmatory phase, thereby independently testing the explanatory power of the model built in the exploratory phase. New collective frequencies of inclusion were computed for each sub-sample, and NUC47's frequencies of inclusion were put aside to be saved for the final phase. Thus, the exploratory multiple regression phase encompassed the percentages of inclusion of 170 nations by 46 students of the three cities in Brazil.[6]

The last stage of the study comprised the qualitative and quantitative comparison of the two multiple regression models, their assembling processes, their coefficients of multiple determination (R^2s), presence and absence of independent variables, as well as their regression loadings (beta weights), semipartial (sr and sr^2) and partial correlation coefficients (pr and pr^2).

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[6] Stratification did not seem necessary for the process of random division. The frequencies of inclusion of the original groups of the three cities were highly intercorrelated (minimum of .93, all significant at $p < .05$), allowing for their treatment as a single group.

Furthermore, regression models similarities and differences were compared through a hierarchically nested models' approach (Cohen & Cohen, 1983), including the construction of an inclusive model (made of all variables in both models). Such comparison takes into account the explanatory power of each model (R^2s), sample size and the cost associated with the power gained (number of variables needed in each model, basically).

Results

The chapter starts with a panoramic presentation of Brazilian students' frequencies of inclusion and comparisons are made with results from PVWP's samples. Some graphically based insights on universal and parochial aspects of cognitive maps of the world are then introduced. Finally, the selected independent variables are described, and their role in explanatory multiple regression models is analyzed.

Inclusion of nations by the Brazilian students

The percentages of inclusion of nations on the sketch maps varied from 0 to 96%. Even though the data range shows high variability, the distribution of frequencies was concentrated at the lower values, indicating a strong positive skewness with an average of inclusion of 13 and standard deviation of 22 (see Appendix B, for the whole set of inclusions). Only 17 world nations were included by more than 50% of the students, and 31 world nations were included above the level of 25%. Not knowing whether the distribution was typical, I decided to compare it to data from the PVWP's database (MacCabe, 1988; Saarinen & MacCabe, in progress).

Table 1 presents comparisons between the Brazilian sample and other samples arbitrarily chosen. PVWP's data

Table 1. Summary data on nations' inclusion by samples from Brazil, other countries, the World and world regions.

Summaries	**NUC***	**World**	USA	Can*	SeAs*	Afr*	Sau*
No. Sites	**3**	**75**	7	4	4	13	1
Total *n*	**93**	**3568**	332	259	223	656	51
>= 50%	**17**	**16**	16	20	14	12	10
25-49%	**14**	**27**	29	25	19	20	27
10-24%	**16**	**43**	37	37	26	46	20
< 10%	**125**	**86**	90	90	113	94	115
> 0 **	**124**	**170**	161	160	138	155	102
M	**13**	**18**	17	19	14	15	12
SD	**22**	**20**	22	24	22	19	18
Median	**3**	**10**	9	9	3	8	2
Maximum	**96**	**91**	95	99	96	93	84
r_{NUC}	-	**.69**	.69	.68	.54	.58	.40
rho_{NUC}	-	**.75**	.76	.76	.64	.50	.39

* "**NUC**"= Brazilian sample from Natal, Uberlândia and Curitiba; "Can"= Canadian sample; "SeAs"= Southeast Asian sample, comprising students from Indonesia, Philippines, Singapore and Thailand; "Afr"= African sample, from Ivory Coast, Kenya, Madagascar, Morocco, Nigeria, Rwanda, South Africa(3 sites), Sudan, Tanzania, Togo, Zimbabwe; "Sau"= sample from Mecca, Saudi Arabia.

** "> 0"= inclusions greater than zero, or the absolute total number of nations known in the sample, regardless of how many subjects involved.

has a difference of 3 to 4 years of collection from the Brazilian, most of its samples showed in the table are larger than the Brazilian group, and two are even multi-national. Regardless, all samples presented a concentration of data on the lower values somewhat similar to the Brazilian sample. Maybe even more striking is that only 20 nations, or less, have been included by 50% or more of the subjects across all samples, including the world set.

Another common characteristic among all samples was the dispersion of the data. All cases presented standard deviations (SD) larger than the respective means.

Level of development of the subject's country seemed to play an important role, while other differences, such as the number of subjects, were neglected. The only two First World countries, USA and Canada, presented means and total of known nations (> 0) at higher values than the other samples.

Cultural traits (historical similarities, religions, political systems, etc.) and world geographic position of the home country may also exert influence. The two other samples from the Americas correlated with NUC at higher levels than did the African or Asian groups, for both the bivariate correlation (r) and the rank order case (rho).

The least related to NUC is the group of 51 students from Mecca, what is probably due to specificities of their cultural and religious world views.

All samples, however, shared at least moderate portions of their world views with the Brazilian sample, which is not surprising considering that they all share the same planet as their habitat. Even most importantly, all groups are probably exposed to very similar--if not the same--cartographic representations of the world.

Another way to examine the characteristics of the distribution of world nations inclusions was to plot the data. A regular histogram, however, would just show a tiny group of very high columns on the left hand side of the graph (for the low values). Instead, an X-axis containing the rank ordered values of the inclusions was selected. The graph for the Brazilian sample is shown in Figure 1 (see Appendix B, for the abbreviations of nations' names), in which Brazil has the highest level of inclusion, followed by United States, Canada, Australia, Soviet Union, Japan, Argentina, Mexico, and so forth. It was easy to observe how the inclusion level drops fast from the top 95.7% of Brazil to about 10% of other nations (only 47, out of the total of 172, down to this point),

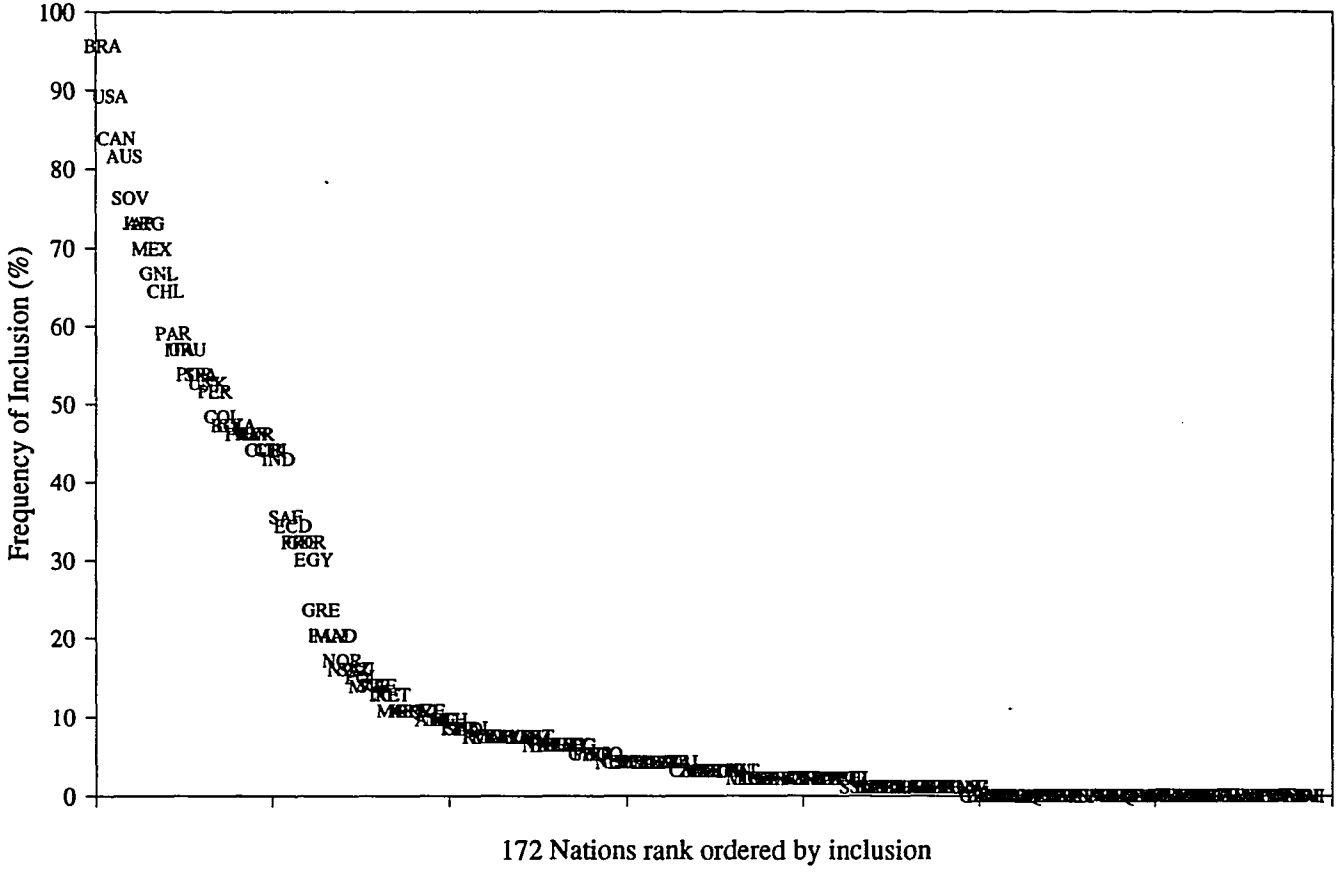

Figure 1. Inclusions of nations by the Brazilian sample (NUC)

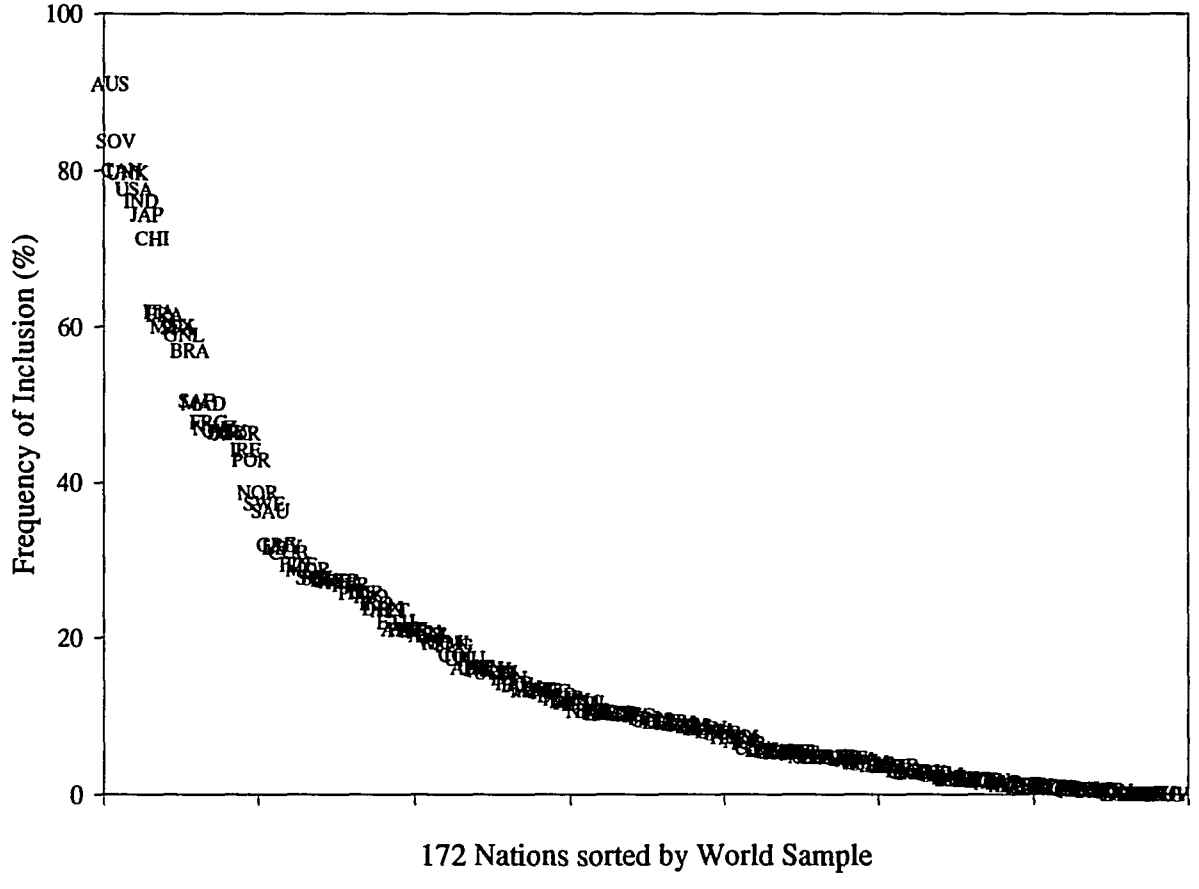

Figure 2. Inclusions of nations by World Sample

and how it extended from there to a long tail of gradually forgotten nations.

In order to provide a comparable visual pattern, the data for the World sample were similarly plotted and are presented in Figure 2. Some of the top nations included were the same (e.g., Australia, Soviet Union, Canada). The data from the world sample showed higher levels of inclusion mid-way down the curve, and reached the zero level only at the very end of the tail.

How would the visual pattern of Brazilian inclusions compare to its equivalent of the world sample? The only way the two curves could be graphically compared was bringing one into the other's rank order. I decided to use the rank order of the world sample as the general standard, against which all other samples could be compared. The comparison between the World and Brazilian data resulted in the graph shown in Figure 3. It was analyzed in three complementary ways.

The first way was to explore one nation at a time, tracing an imaginary vertical line connecting the World frequency (the square) with NUC's (the abbreviation). For example, Australia, the first square at 91% of inclusion by the world sample, is represented on the Brazilians' sketch maps at the lower level of 82%. Canada is an

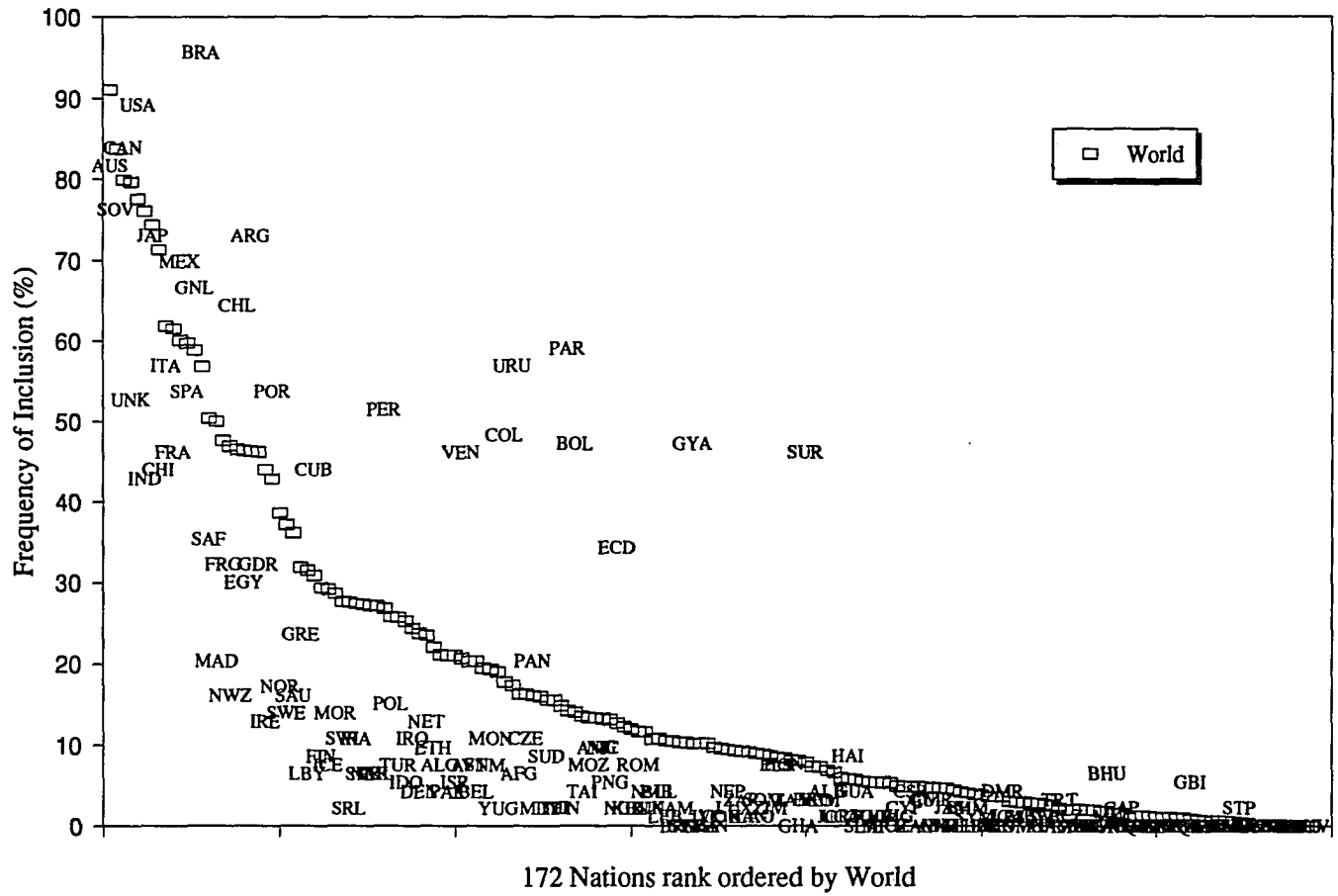

Figure 3. Comparison of inclusions: World and Brazilian samples.

interesting visual tie, and Japan gets closer too. The United States and Brazil received proportionally more inclusions in the Brazilian sample than in the World sample.

The second (and somewhat subjective) manner was to eye-ball the general "closeness" of the two data sets. Despite the presence of some outliers on top of the world curve, it was clear that proportionally (and disregarding the immense differences between the two samples) the inclusions by the Brazilian students stand mostly at lower levels.

Finally, the "outliers" [7] were analyzed, especially those on top of the world curve. They mean that those nations are included by the Brazilian sample at higher levels than in the World sample. In NUC's case, there were 25 nations at this condition, including 19 from the Americas, 12 of which South American (all the South American representatives in the study, because Brazil and French Guyana were not included) with most of whom Brazil shares common historic, religious and cultural ancestry, besides the obvious geographical proximity.

Greenland, a territory politically attached to Denmark, may have been a positive outlier because of

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[7] In this context, outliers are nations reported in the Brazilian sample at values of inclusion clearly different from the World sample.

perceptual reasons. From the point of view of a Brazilian looking at a typical Eurocentric Mercator world map, Greenland may be an inevitably noticeable land form; something like a "lightbulb hanging from the world's ceiling" over his/her country (or his/her own "head"). The other non-American outlier with a large percentage of inclusion was Portugal, whose people colonized Brazil and lent it its language, religion and many other cultural aspects, and with whom Brazil keeps friendship ties to this date. The remaining four outliers (at the end of the tail) are potentially the result of personal idiosyncrasies of Brazilian students, and include one Asian country, Bhutan and three African nations. Bhutan (included by 6 students) may have been a consequence of those Brazilian students being captivated by religious and exotic aspects of that nation, whereas *Guiné-Bissau* (5 inclusions), *Cabo Verde* (2), and *São Tomé e Príncipe* (2) are Portuguese speaking countries, a cultural tie that may have contributed to their inclusion on the sketch maps, even as a peculiarity of a few students.

The sharing of some of the top nations, the fact that samples in Table 1 had about the same number of nations included at or above 50%, and somewhat equivalent large quantities of nations below 10% suggest that there might

be some "universals" in our cognitive maps of the world. Other universal characteristics may also exist, but this study only explored the inclusion of nations on the sketch maps. Important features have not been considered, such as the size of the elements represented on the sketch maps (e.g., Montero & Sanchez, 1993; Saarinen, 1992).

Shared and parochial views of the world

At this point it is tempting to advance a suggestion related to a basic question that was in the origin of the PVW Project: "Are there parochial or shared views of the world?" (Saarinen, 1988b). From data presented in Table 1 and Figure 3, it seems that people from different places of the planet do share some features of their cognitive maps of the world.

At the same time, parochialism may also be detected in people's world views by means of graphical contrasts with a standard, such as the world sample. The positive outliers may constitute the core domain of the insiders' view (Lowry, James & Zonn, 1989), that is, the examined group's most distinctly known nations. In the case of the Brazilian sample (Figure 3), South American nations, along with nations from the other Americas and few others (African Portuguese speaking nations to a lower extent),

make up the core domain of Brazilians' parochial world representation.

To illustrate the graphic comparison and the suggestions made, data from the sites in African countries were plotted against the World sample curve (Figure 4). It can be seen that the inclusions from the group of students of the African countries follow closely the World sample inclusions. There are no detached outliers, maybe with the exception of Madagascar on the positive side, and four or five negative ones. Compared to NUC's data, the African countries' students conform more with the overall pattern of the World sample, which is corroborated by the findings of more extensive analyses of the African countries' samples (Berkowitz, 1992; Berkowitz, Saarinen & MacCabe, 1992).

The long period of colonialism--the African average of years of independence, 68 years, is the second smallest in the world, only surpassed by the average of Oceania, 29 years--probably has a large responsibility for such lack of an autonomous representation of the world.

The multi-national sample of Southeast Asia was also plotted against the World curve (Figure 5) and its general visual profile greatly resembled the graph involving the Brazilian sample. Most of the negative outliers were far

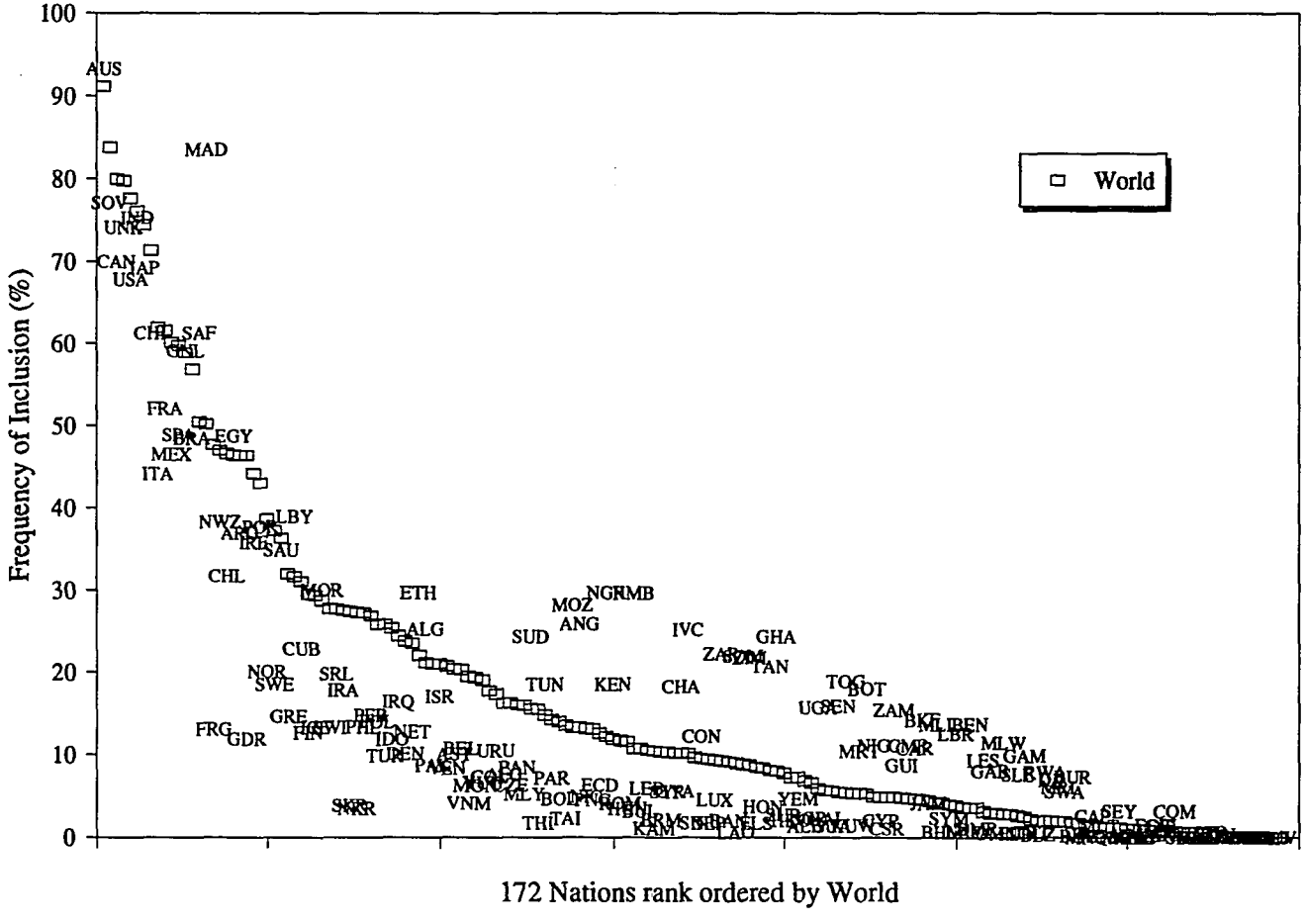

Figure 4. Comparison of inclusions: World sample and African sites.

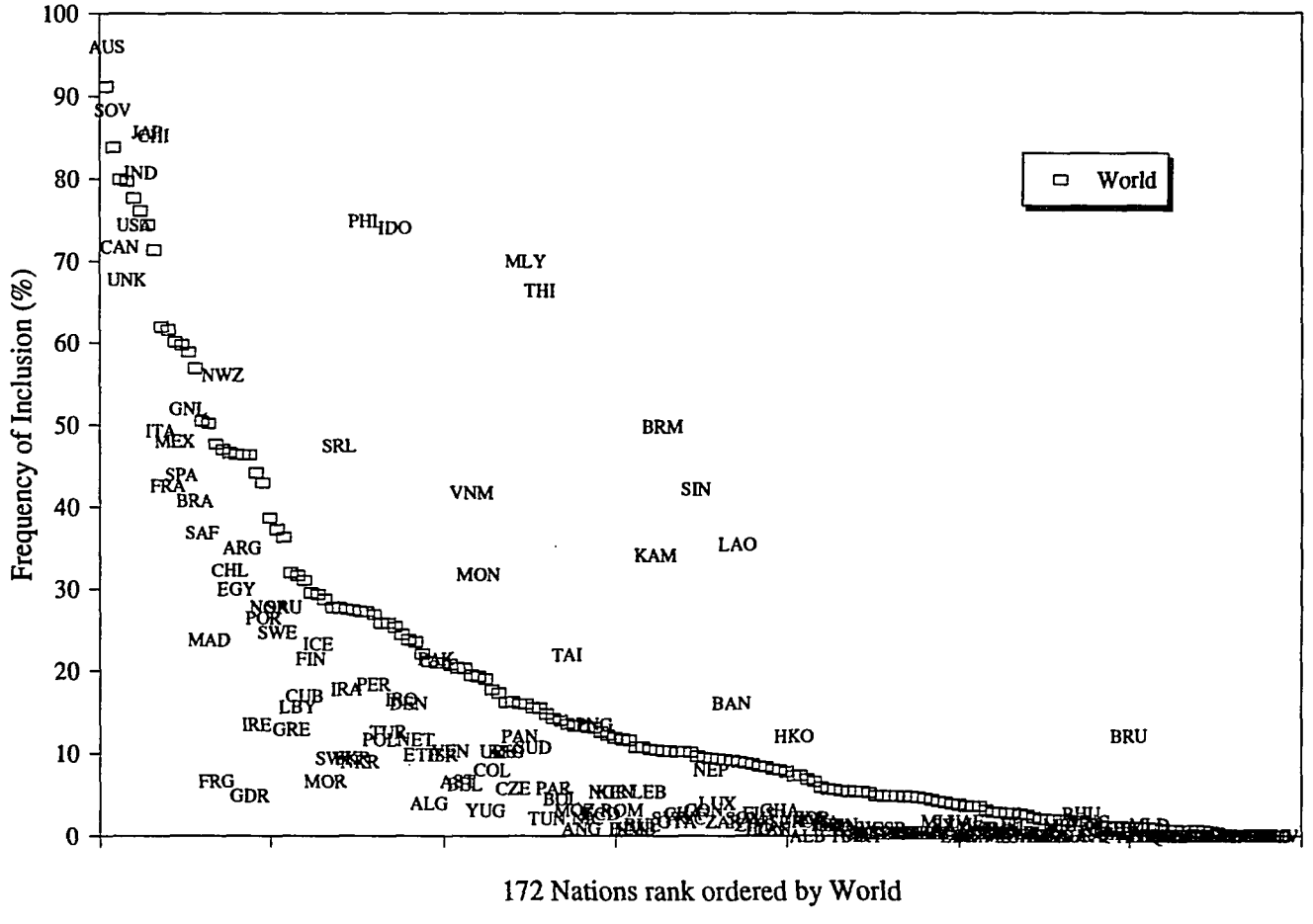

Figure 5. Comparison of inclusions: World and Southeast Asian sites.

below the world curve and 26 nations are above the World sample inclusions. The main difference, however, is that the core domain of their parochial view of the world is made up of nations from "the other side of the world." At the same time, as one would expect, their universal representation contains the most included nations in the World sample, such as Australia, Soviet Union, Japan and others.

Geographical proximity or cultural and historical ties, however, may not be enough to explain the parochialism of certain national samples. Students from an Israeli sample (one site, Beer Sheva, with 25 students, not reported on Table 1) included 44 nations at or above the 50% level, which was more than twice the highest value found in Table 1. Their representations of the world seem to express the idea that nations they consider important are really very important. Furthermore, the positive outliers in Figure 6 suggest that the Israelis' parochial world represents the geo-political situation of the home country (e.g., EGY, IRQ, SYR, JOR), religious matters and the ethnic relationships maintained by them with other countries.

In summary, the opposition and complementarity of shared and parochial views seem to be rather visible in

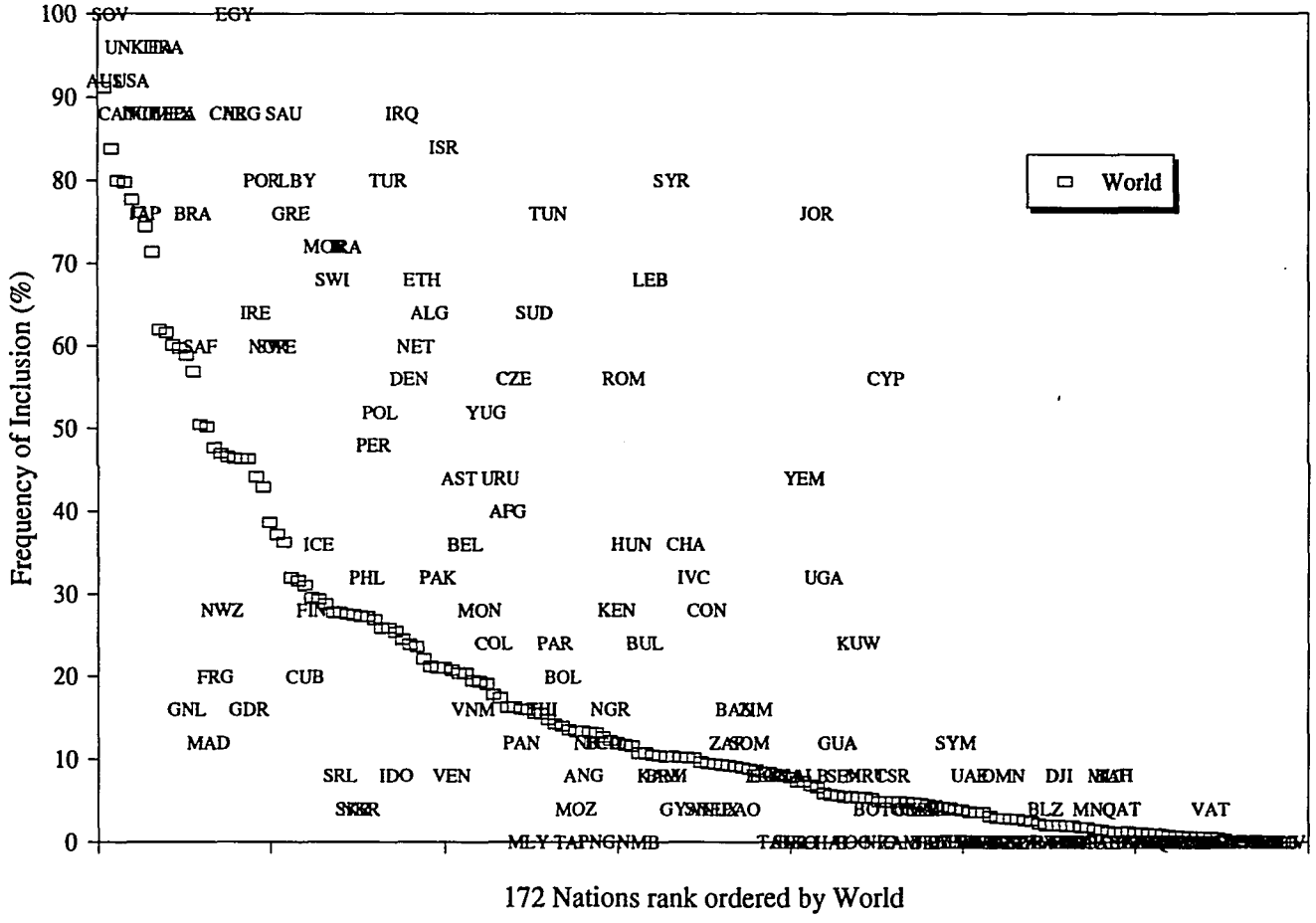

Figure 6. Comparison of inclusions: World sample and Israeli site.

the graphs constructed. The universals of cognitive maps of the world are made not only of some of the top shared nations but also of the amazing agreement of samples about whom the unknown nations should be (note the absence of expressive outliers at the tail of the forgotten, specially in Figures 3 and 5). On the other hand, the parochial portion, or core domain, of those students' cognitive maps of the world is more easily seen at the middle. The positive outliers at these intermediate frequencies signal the exclusive elements of such parochial representation, but the anti-image of the negative outliers also demands attention.

Such analytic explorations of the Brazilian sample's data suggested and inspired the next step, that is, the construction of explanatory models of nations' inclusion on the sketch maps. It seemed important to examine the role world countries' characteristics would play in the determination of people's cognitive maps of the world.

Data from other national samples may generate varied and important patterns for analysis, but such lengthy investigation goes beyond the purposes of this paper.[8]

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[8] The comprehensive analysis of the Brazilian sample in terms of all nations and regions of the world included on the sketch maps is also out of the scope of this study. A preliminary version of such investigation has been presented at the 1992 Meeting of the International Geographical Union's Commission on Geographical Education, in Boulder, Colorado, USA, and the summary has been published in its proceedings (Pinheiro, 1992).

Selection of variables

The dependent variable considered in the following pages was the first half of NUC (NUC46), and the group of world nations studied contains 170 nations, as explained in the Method section.

The final candidate variables are presented in Table 2, including their bivariate correlation with the DV and their classes of causal precedence (see also Appendix C for the names, definitions and sources of all variables).

An important potential determinant of the students' inclusions was the physical size of the country, which was expressed by their area (AREA) in the Geo model and by MSIZ (Mercator Size) in the Map model. The latter was the weight (measured on a precision scale) of the country, after the respective piece of paper had been carefully cut off a Mercator World Map, following standard techniques for the intended objectives (Schneider, 1982). In order to assess the reliability of such measure, its correlation with AREA was computed. Because the Mercator projection does not present distortions in size around the Equator, the Mercator Weights of countries of these latitudes should be proportionally equivalent to their areas. Across all 170 countries, MSIZ and AREA correlated at .91. The correlation increased to .95 when countries whose

vertical midpoint was above the absolute latitude of 55 degrees were eliminated. For those within the strip limited by 15 degrees (hence next to the Equator line), the coefficient raised to .999, showing the adequacy of the Mercator Weights for the intended purposes (all coefficients significant at $p<.05$).

The location of countries on the world map was extracted from a typical Eurocentric Mercator World Map (Gabelli, 1990), assumed as the subjects' major, or sole, source of map influence. Two measurements were taken in such way as to account for the horizontal (MHOR) and vertical (MVER) disposition of countries on the map.

The physical distance between a country's capital and Brasília (capital of subjects' home country) was represented in both models (MDIS and GDIS). This measure assumes that the larger the distance, the lesser included that nation would be. The amount of the country's coastline was also included for both models (MCST and GCST).

Once a variable was considered appropriate to enter the process of model construction (data available for all 170 nations), its correlation with the dependent variable (DV) was calculated using the SPSS Correlation procedure (Norusis, 1990). This operation was particularly

Table 2. Candidate variables, their bivariate correlations with the dependent variable(NUC46) and causal levels(a-d).

Name	r_{NUC46}	Definition
		MAP Set (causal level: a)
MCST	.12	% of Coastline on Mercator World Map
MDIS	-.15*	Distance from Brasília on Mercator map(cm)
MHOR	-.29*	Distance from left edge of world map (cm)
MSIZ	.47*	Weight of country on Mercator map (grams)
MVER	.10	Distance from bottom edge of Merc. map(cm)
		GEO Set (causal level: a)
AREA	.54*	Country area (squared km)
GCST	.18*	% of country coastline
GDIS	-.20*	Globe distance from Brasília(km)
		General Set (causal levels: b - d)
INDP	.27*	b) Years from independence to 1990
POP	.25*	b) Population of the country
CHRI	.23*	c) % of Christians in the population
GDP	.54*	c) Gross Domestic Product
IBER	.35*	c) Country speaks Portuguese or Spanish
ISLM	-.24*	c) % of Muslims in the population
KWH	.53*	c) Kilowatt-hour produced per year(mill.)
LTCY	.37*	c) % of country's literacy
MORT	-.29*	c) Infant mortality rate, by 1000 births
TEL	.51*	c) Number of telephones in the country
FSP	.57*	d) Citations in *Folha de São Paulo*, 1989
WCUP	.48*	d) Football World Cup participation index
WAR2	.73*	d) Importance of country in the board game

* Significance level of $p < .05$.

important in the case of several indicators for the same category. "Religion" was one such case. Each great religion was represented by the percentage of followers in the country's population. The only two religious groups which had sufficient correlations with NUC46 were Percentage of Christians and Percentage of Muslims (see Table 2). They were kept for later stages of analysis, while the others (Orthodox, Judaism, Hinduism and Buddhism) with correlations close to zero were discarded.

"Language" presented a similar situation. The coding system used was simply "1" for the predominant occurrence of the language in the country or "0" otherwise. The combination of Portuguese and Spanish, under the name of "Iberian," presented the highest correlation with the DV, and was chosen to enter the models. The correlations of other languages with NUC46 non significant.

Some dimensions had only one candidate measure, in which case it was maintained in the set regardless of its correlation with NUC46. Bivariate correlations were employed at this stage as a pre-model criterion for the elimination of irrelevant variables, justified as a simplification of the process in terms of the model's parsimony and high intercorrelation. Under the risk of mispecification of the models by omission of a relevant

variable, however, dubious candidates were always included in the model construction stage.

Indicators of development status were taken from different points of view: economic (GDP), communications (TEL), educational (LTCY), and health (MORT)[9]. The potential influence of population (POP) was considered, as well as the country's history (INDP).

"Current events", or the presence of the country in the news, was taken from *Folha de São Paulo*, one of the major Brazilian newspapers. This paper was considered as a representative of the Brazilian media in general. The number of citations of each country was obtained for the years of 1988, 1989 and 1990. NUC46 (sketch maps drawn in the first semester of 1990) correlated best with the year of 1989 [10], so this was the variable used in the study.

Energy consumption also seemed to be an important candidate. However, I could find no source with complete data for the whole set of 170 nations and the measure applied instead was the country's "production" of electricity (KWH).

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[9] LTCY assumed a positive relationship with the dependent variable, whereas MORT a negative (or inverse) one, given the nature of the data.

[10] Even though correlation differences were small, such result corroborated the suggestion about the short span current events' influence would have on the manifest knowledge of nations (Kong, 1988).

It is a well-known fact that Brazilians have a special passion for *futebol* (soccer) and master that sport well [11]. Thus, supposing the students' cognitive maps of the world would be influenced by such specific cultural aspects, a quantitative index of countries' participation in the World Cup was created, taking into consideration the involvement of countries in cups played, games played in cups, games against the Brazilian team and cups won. Despite the small number of countries represented in this soccer index (50, or 29%), the correlation with NUC46 was impressive.

Following suggestions from previous research (Bosowski, 1981; MacCabe, in progress) and personal intuition, I assembled an index of presence+importance of countries in the "RISK"-like Brazilian strategy board game named *WAR II, um super jogo de estratégia* (WARII, a super game of strategy). The values in the index (WAR2) expressed the presence of countries' names and borders on the board and extra points were given to the strategic centers (countries of greater importance for success in the game)[12]. The total number of countries depicted in the game is also proportionally small (38 out of 170, or

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[11] Brazil is the only country to have succeed four times at the World Cup.

[12] Two previous editions of the game did not offer the strategic centers and their similar indexes presented a lower correlation with NUC46.

22%), and such a variable presented the highest correlation with the DV. Of course, there is no assumption of direct causality connecting the game to nations' inclusion on the sketch maps, even though such a process may have partially occurred in the case of some subjects. The measure is employed just as a surrogate for important dimensions not accounted for by other variables in the study (geo-political and military world balance of power).

The two rival sets of variables--Map and Geo--were combined with the general common set, creating two composite collections of variables. These were then submitted to the SPSS factor analysis procedure (Norusis, 1990), in search of common factors that could aggregate the candidate variables and reasonably explain the inclusions of nations on the sketch maps. This strategy of data reduction, however, did not work well for the purposes of the study for a series of reasons: (1) dichotomous variables (like IBER) are not recommended for factor analysis (Kim & Mueller, 1978); (2) variables well correlated with NUC46 were not completely accounted for by common factors of parsimonious extractions, as in the case of WAR2 and WCUP that had less than 50% of their variance included in the factors extracted, leaving important

portions as unique factors (Appendix D presents an example of factor loadings for the Geo Model); (3) regression models constructed with such factors had a large residual variance of NUC46 left unexplained, and hardly justifiable outliers; and (4) the relationship between raw variables and factors extracted did not present a clearly interpretable pattern (see Appendix D, for an example), unless the number of factors was so augmented that it would make the procedure pointless.

The objective of this investigation was the explanation of the variance of the dependent variable (NUC46). Factor analysis, on the other hand, is concerned about pulling together as much as possible of the common variance of the variables submitted to it, without any regard to the relationship between those variables and the (for its terms "non-existent") DV. Thus, factor analysis was used only as a heuristic tool, to better understand the linear associations among the variables analyzed, as suggested by Kim & Mueller (1978).

More or less unexpectedly, the indicators of economic power (GDP), communications capabilities (TEL), energy production (KWH) and current events (FSP) were clustered together at the highest levels of intercorrelation for all factor analytic trials (see Appendix D for an example).

To avoid problems of high multicollinearity in the regression models, the variable with better correlation with NUC46--FSP--was retained and the others discarded.[13]

Other groups of variables were also clustered, even though at lower levels. The two remaining indicators of development: LTCY (educational) and MORT (health) presented an inverse relationship, as did CHRI and ISLM. Other pairs that caused multicollinearity concerns were: MDIS (map distance) and MHOR (map horizontal position), POP (population) and INDP (years of independence). Those pairs were closely watched during the multiple regression stages, to avoid interference of high intercorrelation. It is noteworthy that the clustering of those variables occurred basically within the same proposed levels of causal precedence, reinforcing the meaning of such a type of classification.

Appendix E and F present the correlation matrix of the Geo Model and Map Model respectively, with all the variables submitted to multiple regression analyses.

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[13] The risk of high intercorrelation affecting the reliability of the parameter estimates justified their exclusion. Furthermore, a limited stepwise regression analysis, using only those four variables to explain NUC46, showed that FSP was retained and the others did not enter the model (significance of F to enter =.10).

Multiple regression models

The variables chosen for each model (13 in the Geo, and 15 in the Map) were submitted to multiple regression analysis according to the strategy explained in the Method section using the SPSS Regression procedure (Norusis, 1990).

The Geo Model. The variables removed from this model before the multiple regression analysis were Population (POP), Percentage of Christians (CHRI), Percentage of Muslims (ISLM) and Mortality Rate (MORT). Others were initially brought into the model (INDP, GCST and WCUP), but each accounted for less than 2% of the unexplained variance left by all other variables in the equation (.10< pr <.13), and hence, their regression coefficients did not reach the significance level of $p<.05$. Therefore, they were removed from the final equation, but are reported here for the benefit of future studies eventually based on similar research design.

The six variables selected for the Geo Model are presented in Table 3. The six stages of hierarchical-stepwise selection are presented at the top of the table, where the variables are listed in their entering order into the model. The coefficients of multiple correlation (Mult. R), determination (R^2) and the F ratios presented

Table 3. Final regression equation of the Geo Model.

	Hierarchical-Stepwise Stages			
	Mult. R	**R^2**	**F ratio**	**p**
1. AREA	.54	.29	68.75	.000
2. GDIS	.59	.34	43.83	.000
3. LTCY	.67	.44	43.89	.000
4. IBER	.72	.52	43.81	.000
5. WAR2	.83	.70	75.35	.000
6. FSP	.85	.73	72.86	.000

NUC46 = + .14 + .233 AREA - .105 GDIS + .135 LTCY + .225 IBER + .456 WAR2 + .213 FSP [a]

	pr^2 *	**sr^2 ***	**F ratio**	**p**
WAR2	33.6	13.7	82.59	.000
IBER	12.3	4.0	23.22	.000
AREA	12.3	3.6	22.66	.000
FSP	10.2	3.2	19.01	.000
LTCY	5.8	1.7	9.70	.002
GDIS	3.2	0.8	5.16	.024

	Sum of Squares	**df**	**Mean Square**
Model	52103.53	6	8683.92
Error	19428.26	163	119.19

Note. Model's adjusted R^2= .72; Standard Error= 10.92
[a] Coefficients in equation are Beta weights
* sr^2=squared semipartial r; pr^2=squared partial r

in that section of the table refer to the whole model at each stage. The two variables of the first level of causal precedence (AREA and GDIS) account for 34% of the DV's variance. The variables of the third level (LTCY and IBER) add 18% to it (total of 52%), and the final level of causal precedence (nations' world relations, WAR2 and FSP) increases another 21%. Thus the final equation of the Geo Model explains 73% of the variance of NUC46.

In the center of the table the final equation is shown with the regression coefficients (beta weights) for each variable. The orientation of the relationships of all variables with the DV followed the expected directions, that is, the only variable with a negative sign was GDIS, which expressed the anticipated inverse relationship of Globe Distance (from Brasília) with NUC46's inclusions.

The next section of the table shows the six variables again, now ordered by their relative importance in the final equation. Such ranking was established based on their effect size, or the proportion of unexplained variance each variable could account for, after the effect of other variables had been partialled out (squared partial correlation coefficients, pr^2). A slightly different result, the squared semipartial correlation

coefficient (sr^2), expresses the increase in R^2 that the variable would be capable of, after the others had done their job. As those values decrease towards the bottom of the columns, so do the coefficients' F ratios and their significance levels. Certainly the most striking feature of those figures is the relative importance of WAR2. Even after AREA, IBER, FSP, LTCY and GDIS had accounted for what they could of the DV's variance, WAR2 holds enough information to exclusively explain one third of the remaining unexplained variance. On the other hand, GDIS would exclusively explain a little more than 3% of the unexplained variance or, in semipartial correlation terms, it would add less than 1% to the variance accounted for by the others. GDIS has the least important contribution to the equation, and this is the reason for its borderline significance level.

Despite its lower level of importance, GDIS' inverse relationship with the DV was nevertheless powerful enough to justify its maintenance in the equation after IBER had entered it. Iberian languages (Portuguese and Spanish) are mostly concentrated on Latin American countries and five others in Africa, exactly those close to Brazil (what caused the bivariate correlation of -.45 between IBER and GDIS, as shown in Appendix E). Therefore, the two

variables overlap a little, and IBER can also be thought of as an indicator of closeness to Brazil for those nations. In other words, if GDIS survived in the equation, it was probably due to the influence of the inclusion on the sketch maps of nations that do not speak either Portuguese or Spanish (e.g., Anglo-Saxon American and European nations sketched, but Oceanians not).

The bottom block of Table 3 contains information relative to the analysis of variance of the model that originated the model's F ratio of 72.86. Another important feature of a multiple regression model, its standard error, is presented in the note to the table.

The integrated action of the six indicators of countries' characteristics explains 73% of the variation found in inclusion of nations by the Brazilian students, leaving 27% unexplained. The R^2, however, is a limited information index about the goodness of fit of the equation (Achen, 1982). A better way to assess the model's fit is to plot the observed data (NUC46) against the predicted (regression model).

Figure 7 presents such a regression plot for the Geo Model. The abbreviations of countries' names mark their respective positions on the X-Y space and the resulting pattern is clearly a clustering of a direct linear

relationship, emphasized by the regression line. There is a distinct concentration of data points around zero and very low values, which should not be surprising considering the many low values of the DV (the "tail of the forgotten", in Figure 1). In fact, the interesting aspect about such a dense cloud is that DV's data are mirrored in the independent variables, so that all those regression points are plotted next to the bottom-left corner.

Data points thrown further out in the regression space suggest that there are more positive outliers than negative. Indeed, 11 nations are found at or beyond two standard deviations from the regression line, 2 below (CHI and ICE) and 9 above (AUS, CAN, CHL, GNL, GYA, ITA, JAP, PAR, SUR)[14]. Two standard deviations, however, are strictly within the expected distribution and do not actually define outliers. The limit of three standard deviations was then used in the calculations, and only 3 authentic outliers were found: Guyana, Paraguay and Surinam, all positive and from South America.

Paraguay is well known (some would add "infamously") all over Brazil due to the convenience of illegal consumer imports that country has provided to many Brazilians for

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[14] It is noteworthy that Australia, Canada, Chile, Greenland, Italy and Japan have large portions of coastline. Had GCST entered the model, maybe these nations would be closer to the regression line.

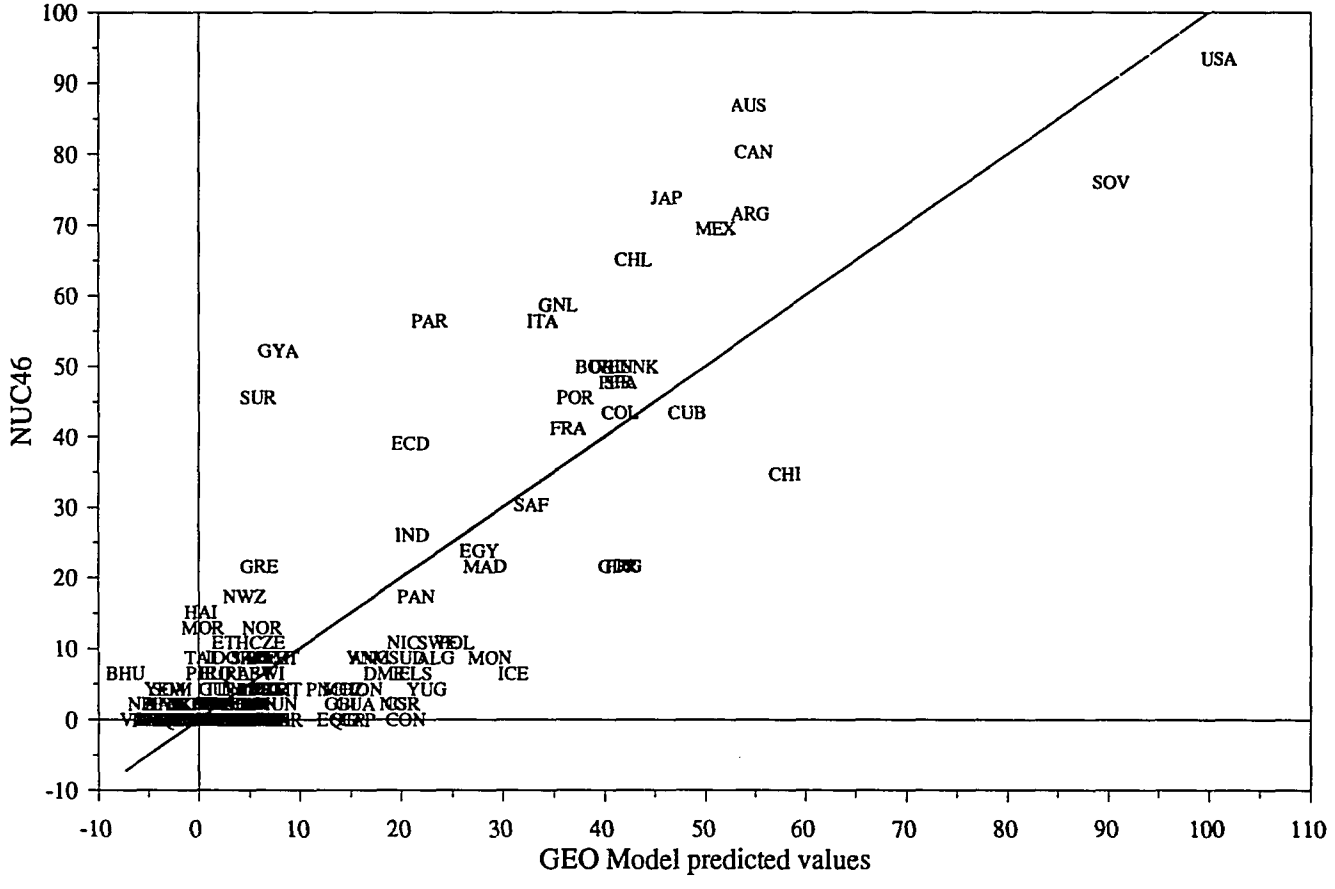

Figure 7. Regression plot of NUC46 on Geo Model

decades, especially during the years Brazil was closed to most foreign products. This type of knowledge Brazilians developed about Paraguay is hardly accountable by the kind of formally quantifiable dimensions with which this study has dealt.

Guyana and Surinam are the only two nations in South America that do not speak Spanish or Portuguese, and therefore, have not been predicted by IBER's action in the model. At the same time they are well known by Brazilians who, in many instances at school, are required to cite by heart all the nations that border Brazil. Their inclusions by the Brazilian students hardly had to do with their AREA or with citations in FSP. Moreover, both countries are absent from the board game WAR2.

Thus, the occurrence of the three outliers seemed justifiable, given the variables used in the model, and were considered as a concrete limitation of it.

High multicollinearity in the model was also examined. One of the tests used to assess it was the measure of tolerance (Cohen & Cohen, 1983; Norusis, 1990), which shows the proportion of a variable's variance not associated with the other independent variables in the equation. WAR2 showed a tolerance of .66, the smallest value in the set, meaning that only 34% of the variable's

variance was somehow shared with the others. The threat of high intercorrelation was, therefore, definitively cast off.

A histogram of the residual values was generated and their distribution was reasonably close to the expected normal curve, thus the specific regression assumption was considered satisfied. At the same time, a scatterplot of the residual values by the predicted failed to suggest a discernible pattern of any remaining linear relationships. The residuals were also plotted against what was left of the variance of each variable in the model, as well as the variables not entered into the model and, again, no visible tendencies of additional linear relationships were detected in the partial regression plots.

A slight indication of non-linear relationships was detected, though. As a cautionary measure, quadratic and cubic terms of the most likely candidates--AREA and FSP--were submitted to a new hierarchical-stepwise regression selection. A different final equation emerged with eight variables: AREA -AREA squared -GDIS +IBER +WAR2 +FSP -FSP squared +FSP cubic. The explanatory power of such an equation, however, was just 1% better (R^2= .74) and its standard error practically the same (SE= 10.70). The examination of all associated plots showed some

improvement in the appearance of the partial regression plots of AREA and FSP, but not much else. The non-linear effects found were then interpreted as mostly related to the fitting of influential points at the extreme values in the data set, such as nations of very large AREA, or highly cited in FSP (which also meant, in the case, nations with high economic power). Besides, the difficulty of constructing a theoretical link of that order, with very limited overall consequences in the model, led me to disregard such an equation as a feasible model.

A last cautionary measure seemed appropriate. WAR2 was an index created for the investigation, without better knowledge of the distribution of the phenomenon it represented. Concerned with the associated multiple regression assumptions, and considering the importance such an index had reached in the model, I decided to simplify it, making it technically more appropriate for the statistical procedure. The countries were attributed just a "1" for their mere presence on the board of the game, and all the absent ones were, as before, given a "0". This dichotomous variable brought the model two R^2 units down, made GCST non-significant, increased residuals' apparent non-linearity and added Australia and

Japan as positive outliers. Potential inadequacies relative to the type of measurement of WAR2 was made of were then considered irrelevant for the purposes of the investigation.

The confirmatory stage of the Geo Model's multiple regression analysis involved the other half-sample, NUC47. The same final equation was used to explain the inclusions of that sub-group of the Brazilian students. The overall impression was of a mirror-like multiple regression equation. The equation's R^2 was one unit higher (.74) and the standard error similarly .40 higher (11.32). The F ratio of the confirmatory equation was slightly more powerful too (77.54 >72.86).

The main noticeable difference was in the relative contribution of each variable. IBER, AREA, FSP and LTCY had practically the same effect size as the exploratory equation, while WAR2 increased its pr^2 from 33.6 to 39.7. Such higher contribution possibly took its toll of GDIS, which dropped from a pr^2 of 3.2 in the exploratory equation to 1.2 in the confirmatory. Squared partial correlation coefficients below 2% of explanatory power were borderline in terms of significance level, and GDIS did, in fact, become non-significant in the confirmatory equation. This fact, however, was taken only as an

additional alert on the reduced importance of GDIS in the model, given the special meaning of significance tests in the study.

The Map Model. The main difference of this model in relation to the Geo Model is that measures extracted from a typical Eurocentric Mercator World Map (Gabelli, 1990) replaced the physical geography indicators (MSIZ, MDIS and MCST, instead of, respectively, AREA, GDIS and GCST). Additionally, this model offered the opportunity of three exclusive variables: the horizontal and vertical position of countries on the map (MHOR, and MVER, respectively) and the interaction term (MSZCST) of Map Size (MSIZ, the Mercator Weights) and Map Coastline (MCST), as previously explained.

The variables removed from this model before the multiple regression analysis were Proportion of Coastline on the World Map (MCST), Interaction Term of MSIZ and MCST (MSZCST), Population (POP), Percentage of Muslims (ISLM) and Mortality Rate (MORT). Two others were initially brought into the model but their regression coefficients proved not significant enough: Percentage of Christians and Literacy. CHRI accounted exclusively for only 2.2% of the error term left by the other variables and LTCY for

1.4%. Their removal from the regression equation did not change the value of the model's R^2.

Out of the 15 submitted to selection, 9 variables comprised the model presented in Table 4. The four map indicators in the equation could account for 41% of the DV's variation. INDP and IBER added 9% to it and the last level of causal precedence raised the model's explanatory power to 76%.

The model's shrunken R^2 is slightly smaller (.74), the standard error got close to 10% and the final proportion between model's and residual's sums of squares provides the regression equation an F ratio of 55.06.

Even though the final equation showed most of the relationships between the DV and the independent variables according to the expected orientations (see bivariate correlations, in Appendix F), there were two surprises. Both MDIS and MVER were loaded with reversed signs. MDIS had a negative bivariate correlation of -.15 with NUC46 and was entered the regression equation with a positive regression coefficient. To understand this fact it is necessary to consider the role of MHOR, which was entered before MDIS. MHOR (measured from the left edge of the map) and MDIS (measured from Brasília) were highly correlated (r=.93), because the great majority of countries appear to

Table 4. Final regression equation of the Map Model.

	Hierarchical-Stepwise Stages			
	Mult. R	**R^2**	**F ratio**	**p**
1. MSIZ	.47	.22	47.67	.000
2. MHOR	.55	.30	36.21	.000
3. MDIS	.61	.37	32.74	.000
4. MVER	.64	.41	29.16	.000
5. INDP	.69	.48	30.10	.000
6. IBER	.71	.50	27.29	.000
7. WAR2	.84	.70	55.11	.000
8. FSP	.86	.74	56.63	.000
9. WCUP	.87	.76	55.06	.000

NUC46 = + 35.48 + .28 MSIZ - .51 MHOR + .38 MDIS - .23 MVER + .10 INDP + .12 IBER + .42 WAR2 + .17 FSP + .16 WCUP [a]

	pr^2	**sr^2**	**F ratio**	**p**
WAR2	31.4	10.9	73.09	.00
MSIZ	19.4	5.8	38.65	.00
MVER	10.2	2.9	18.87	.00
MHOR	8.4	2.3	14.26	.00
FSP	7.3	2.0	12.80	.00
WCUP	6.8	1.7	11.86	.00
MDIS	5.3	1.5	9.16	.00
IBER	3.6	0.8	5.82	.02
INDP	3.2	0.8	5.52	.02

	Sum of Squares	**df**	**Mean Square**
Model	54071.97	9	6008.00
Error	17459.82	160	109.12

Note. Model's adjusted R^2= .74, Standard Error= 10.45

[a] Coefficients in equation are Beta weights

the right hand side of Brazil (Eastwards) on the standard map.[15] To better understand the combined action of those variables their partial bivariate correlations with NUC46 were computed, controlling for each other. After the correlation between NUC46 and MDIS was partialled out, MHOR's relationship with the DV improved from r= -.29 to r= -.40. On the other hand, partialling out the relationship between the DV and MHOR, the correlation NUC46-MDIS changed from r= -.15 to r= +.33. The plot of the DV's relationship with MHOR resembled an underlined letter "V", with a stronger left "arm." The underscore can be thought of as the majority of nations spread out horizontally on the map and with low values in NUC46. The Brazilian students included most of the African, Asian and Oceanic nations at low levels, which made this "underscore" heavier on the right hand side. The right arm of the "V" was caused by the high frequencies of nations such as Soviet Union, Japan, China, and few others of the right section of the world map. The "stronger" left arm was provoked by the high frequencies of the American nations, an effect powerful enough to cause the loading of MHOR in the equation with a negative sign. MDIS came into the equation with a positive sign, then,

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[15] This would not be the case if MDIS were taken for a country in a different position on such map as, for example, somewhere around the Indian Ocean.

only to justify that weaker and unattended right arm of the "V". Hence, they were entered the equation as practically different variables, despite their previous high bivariate correlation.

The negative orientation of MVER is most likely consequence of the combined action of MHOR and MDIS as described above. Its low and non-significant positive bivariate correlation with NUC46 (r=.10) must have been changed by the action of those other two to a negative regression coefficient.

The analysis of the relative importance of the variables in the Map Model highlighted the contribution of each block of causal precedence. The group of "cultural" variables (IBER and INDP) could not exclusively account for more than 7% (3.6 + 3.2) of the error term's variance, possibly because the first block (MSIZ, MVER, MHOR and MDIS) has overshadowed its contribution, explaining 43%. The group of world relations (WAR2, FSP and WCUP) takes care of the other 45.5% of the residual's variance, most of which under the action of WAR2 (31%).

Taken from the perspective of additions to the DV's variance already explained by the other variables in the equation (sr^2), the picture is not different. While WAR2

alone was capable of adding 11% to the R^2, IBER and INDP together would reach less than 2%.

The regression plot of the observed frequencies by the predicted data (model) may be seen in Figure 8. The general aspect of such a plot is very similar to the other model's (Figure 7). However, several data points are over the regression line (e.g., USA, URU, CUB, EGY, ETH), a fact not observed before. CAN, CHL and GNL are closer to the line, probably as a result of the presence of MSIZ in the equation. The greater proximity of ITA and GDR to the line is possibly due to the variable WCUP, since both countries have had extensive participation in Football World Cups.

The search for outliers (at or beyond three SDs) indicated: AUS, GYA, PAR and SUR. Guyana, Paraguay and Surinam probably were at such position for the same reasons presented for the previous model. The presence of Australia requires another interpretation, though. That country is highly measured in MSIZ and is present in WAR2, but those two variables were not powerful enough to bring AUS closer to the line, perhaps because it has low values in FSP and WCUP.[16] Besides, neither MCST nor MSZCST (the

[16] Examining the plot of the Geo Model, one can see that Australia is basically at the same position in that plot too.

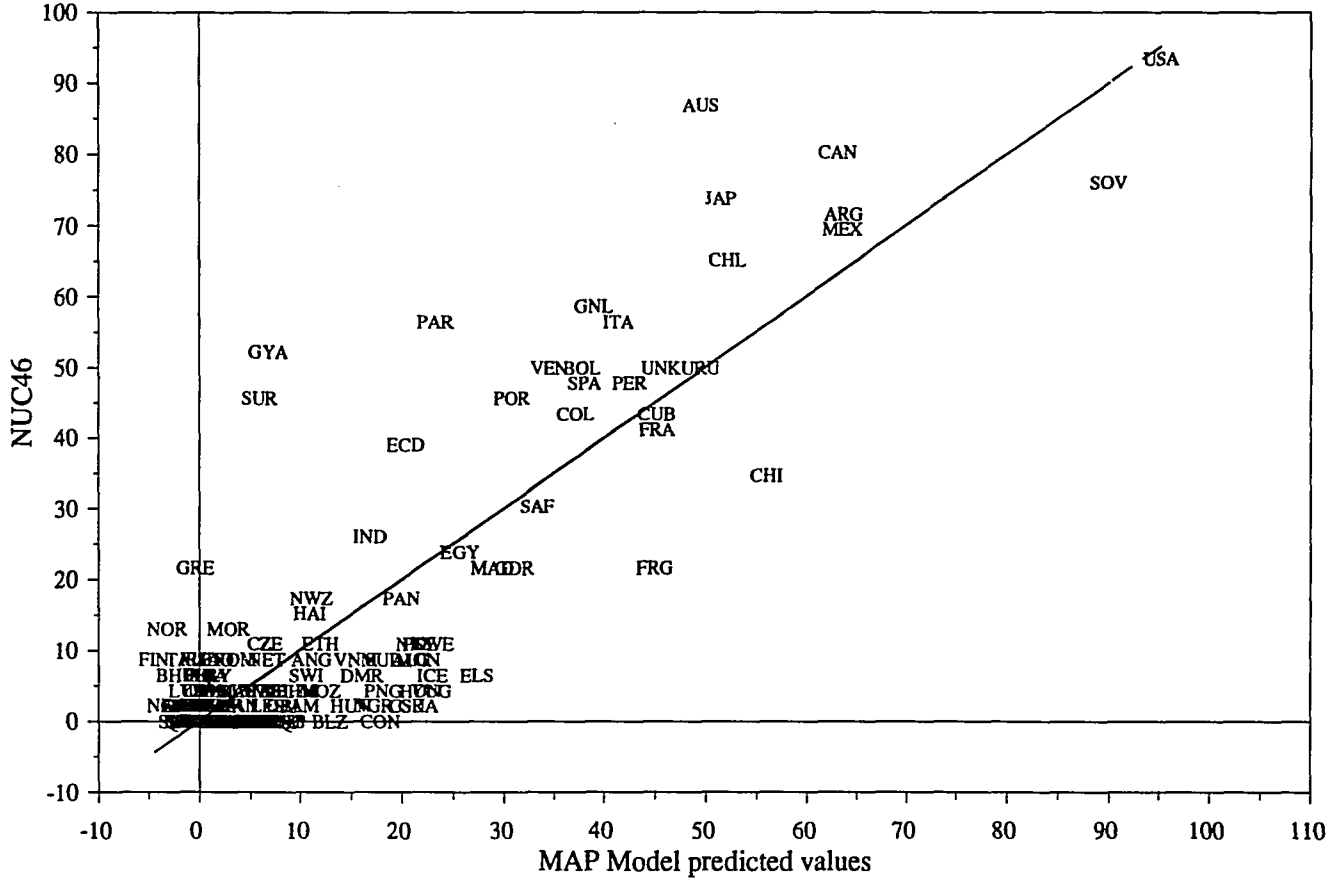

Figure 8. Regression plot of NUC46 on Map Model

interaction term) had been chosen for the equation. Had they been included in the model and countries like AUS, GNL, ITA and GRE on the positive side, and CHI and FRG on the negative, could have been closer to the regression line. The Brazilian students may have shown some special interest in Australia as well, as I had the opportunity of informally observing some Brazilians.

Plots of the residual values failed to suggest any linear tendency in the data and the histogram of its distribution was closer to the normal distribution than the previous model's. Partial regression plots with all variables, in the model and out of it, did not indicate any observable linear pattern either. There were, however, as in the previous model, indications of non-linear effects. Even looking at Figure 8's plot it is possible to visualize those effects. The nations in the middle section of the plot may suggest that there are more regression points above the line. When all such points were counted, though, the results indicated 56 points above the line, 41 close to it and 73 below the line values, which meant that the cloud of low values had expressively more points under the line than above it. Taking that information into account, it is easy to imagine a regression curve in the shape of an "S", tilted

to the right hand side, passing across the low values cluster, covering the points above the line in the middle section and trying to account for SOV and USA, on the top right corner. In fact, a quadratic account of the same regression plot showed no improvement over the linear counterpart, but the cubic element was capable of adding four R^2 units, reaching 80% of explanatory power. Such non-linear effects were not easily brought into the model, because there was no theoretical justification.

Higher order terms were created for MSIZ and FSP and the variables selected were MSIZ -MSIZ squared -MHOR -MVER +LTCY +IBER +WAR2 +FSP -FSP squared +FSP cubic. This equation generated a residual plot (residual by predicted) out of which a cubic regression could only reach R^2= .098, thus eliminating that curvilinear effect. The regression of NUC46's observed values on this equation, however, showed a slight increase of just 2% (R^2= .78), in relation to the linear equation, besides consuming one more variable (total of 10) to get that effect. Outliers were essentially the same: AUS, GYA and SUR on the positive side and CHI on the negative. Influential points were again considered as the main cause for such non-linear effects and the nations most benefited in the regression plot were SOV and CAN. Both were brought practically over

the regression line, the Soviet Union on the upper side and Canada on the lower side, reversing their positions from the linear solution. Even though such a solution involving power terms is reported here, the lack of a theoretical support for it led me to disregard it.

The available multicollinearity tests (in SPSS) were used and the only variables to show alarming tolerance levels were MHOR and MDIS, as expected. The regression of each independent variable on the others was also performed, as recommended in the literature for such cases (Lewis-Beck, 1980) and the same two variables were the only ones to show effects of intercorrelation.[17] Such indications were, nevertheless, disregarded considering that both variables had almost opposite roles in the model, as explained in the interpretation of their coefficients' signs.

WAR2 and WCUP (indexes specially created for this investigation) were replaced by their dichotomous equivalents resulting in a minimal decrease in R^2, from .76 to .74, accompanied by a proportional decrease in the value of model's F ratio. All the variables chosen for the final equation were the same and only the significance

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[17] Each variable obtained the following R^2s: MHOR (.92), MDIS (.90), MVER (.44), IBER (.41), WAR2 (.38), FSP (.36), WCUP (.30), MSIZ (.27), and INDP (.14).

of IBER (the other dichotomous variable) was affected by the change.

A confirmatory test of the Map Model was then performed, using NUC47's observed data. The overall explanatory power of the confirmatory equation was the same (R^2= .76, SE= 11.04, F ratio= 55.74) and the balance of such explanatory power among the variables showed a decrease in the effect size (pr^2) of two variables: MDIS (from 5.3% to 1.96) and MVER (from 10.2% to 2.3%), making both non-significant. This confirmatory equation also generated 4 positive outliers, with India replacing Australia. To verify if the prominence of India could be attributable to differences between the two random sub-samples, NUC46's and NUC47's percentages of inclusion were plotted. The nations showing greater differences between the two samples were USA and AUS with slightly greater values in NUC46, and IND, GDR and FDR with greater values in NUC47. All the four outliers (GYA, IND, PAR and SUR) were closer to the regression mean values than in the exploratory equation. Thus the Map Model was considered corroborated by the procedure.

Using data from the PVW Project, frequencies of inclusion of a Brazilian sample from the city of Belo Horizonte (n= 38) were regressed on the predicted values

of the two models.[18] The Geo Model generated an R^2 of .62, with standard error of 9.51, and three positive outliers. The Map Model also reached an R^2 of .62, standard error of 9.57 and four positive outliers. The great novelty among the outliers of both regressions was the presence of United Kingdom, which was not an outlier in NUC's data. The predicted values of both Geo and Map models under-predict United Kingdom's inclusion by the Belo Horizonte sample. This may be due to some associated event at that time (e.g., the Falklands-Malvinas conflict had occurred a few years before, with the indirect involvement of Brazil[19]), not accounted for by the independent variables used in the present study. Whatever being the reason for that outlier, both models seem to show proof of consistency of their explanatory power through time, considering that Belo Horizonte's data was collected four years before NUC's.

Comparison of Models. On the basis of the results shown in tables 3 (Geo Model), 4 (Map Model) and respective regression plots (Figures 7 and 8), the two alternative explanations were compared. Both models

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[18] Just the predicted values were used in such comparisons, not the full multiple regression analysis.

[19] Besides the fact that UNK was in war with Brazil's next door neighbor, there has been the episode of an UK Vulcan bomber that allegedly invaded the air space of Brazil, having been escorted by Brazilian fighters to an Air Force base in Rio de Janeiro next to a civilian airport, what possibly added extra doses of emotion to the popular reaction to the war in neighboring lands.

account for approximately three quarters of the variation of the dependent variable (Geo= 73%, Map= 76%), leaving the other quarter unexplained. Their analyses of variance show that the Map Model has a larger Sum of Squares, but also consumes more degrees of freedom. Hence the F ratio of the Geo (72.86) ended up being the best of the two. The regression plots seemed to favor the Map Model, even though both models presented outliers following the same pattern, and at the same range of dispersion (between 3 and 4 positive SDs). The confirmatory stage of both models replicated the basic structures found in the exploratory stages, with one variable turned non-significant in the Geo Model (GDIS) and two in the Map Model (MDIS and MVER). When applied to the students of Belo Horizonte (PVWP's data), the predicted values of both models accounted for 62% of that group's variance.

A final and overall comparison of the explanatory power of the two models was performed through a hierarchically nested models approach. An inclusive model was built with all the variables of both models (total of 12 variables). The R^2 of such model was .7599. Applying the F ratio comparison, the Geo Model was considered significantly different from the inclusive model, inasmuch as the Map Model's difference from the inclusive was non-

significant[20]. Therefore, the less parsimonious solution of the Map Model, with nine variables, was compensated by its advantage of 3 R^2 units over the Geo Model, which had six variables. In other words, the variables exclusive to the Geo Model (AREA, GDIS, LTCY) did not add significant explanatory power to the inclusive model, whereas the variables exclusive to the Map Model (MSIZ, MDIS, MHOR, MVER, INDP, WCUP) had a significant impact.

[20] In such analysis, the best among the models being compared is the one closest to the inclusive.

Discussion and Conclusions

This study addressed some descriptive aspects of the frequency of inclusions of nations on the sketch maps of Brazilian students, though it was mainly designed to provide a new understanding of how quantitative characteristics of world countries mutually interact to explain group inclusions of nations. For the latter purpose, two explanatory models were conceived--Map and Geo--to add interpretive power to the multiple regression analysis. It seems appropriate to address each of these objectives in turn, as the latter build on the former.

Neither the positive skeweness of the Brazilian sample's data distribution nor its dispersion of values were substantially different from other national samples examined, or even from the world overall sample. Bivariate correlations among such groups were positive and moderate to high. Such a concentration in the low percentage levels of world nations' knowledge ("tail of the forgotten") indicates that such collective representations of the world are typically limited to a proportionally small set of nations. This seems to be a generalized characteristic of this type of cognitive representation, and it is possibly a consequence of cultural and ideological forces acting towards the apparent irrelevance of world nations' knowledge for

people's immediate life. Primary and secondary socialization practices--educational processes included--are probably mediating the transmission and maintenance of undifferentiated (or distinctive) world views common in the culture, as the Israeli and Saudi Arabian samples' data seem to suggest. Further enrichment of this conclusion may be attained by the extension of such analysis to a larger set of samples of the PVW Project, and to similar studies of cognitive representations of the world.

A suggestion was then advanced about shared and parochial views of the world, based on the graphical plots of data from each national sample in comparison with the world sample (Figures 3 to 6). The shared or universal section of cognitive representations of the world would be mainly formed by the top included nations and those at "the tail of the forgotten," whereas the parochial portion would be mostly visible in the outliers of the middle section of the graph. This graphical procedure may constitute an important analytical tool for such a large enterprise as the PVW Project, having to deal with a huge mass of data in search of expressive tendencies. A quick visual inspection of this analytical graph (rather easily generated) may suggest possible reasons for the

parochialism represented by the positive outlying nations, or their anti-image (the negative outliers). At the same time, it may reveal what nations the different national groups converge upon, offering indications of potential motives for such universalities.

Based on those possible reasons for parochial and shared views, and using information from the literature, a set of variables was selected to be part of the explanatory regression models. Specificities of this investigation, however, led to the exclusion of variables that may eventually prove to be important predictors in the explanation of other samples' inclusions. This is the reason why such occurrences were carefully reported in the previous sections.[21] Omission of a relevant variable is always annoying, but it may cause particularly serious damage in such early stages of theory construction.

An important distinction should be made between the world countries' dimensions (or characteristics, traits) chosen for this investigation and their measurements used in the analyses. The results accomplished refer to the

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[21] The proportion of coastline (GCST/MCST) may be such a case. Even though I initially expected much of it, it never entered the regression models, nor showed expressive bivariate correlation with NUC's inclusions. Due to a series of reasons, the Brazilian students' inclusions were "continentally" based, whereas other samples--oceanic nations, for instance--may present more of an "islandic" perspective. Similarly, population may present multiple regression effects for samples of places concerned with population issues, in which case size (AREA/MSIZ) might not eclipse POP's explanatory power.

type of score employed and not necessarily to the phenomenon they have tried to represent. For example, "Religion" was measured through the percentage of followers of the belief in the country, but could possibly have been expressed through other measurements. Similarly, "Educational Level" was represented by the "Percentage of literacy in the country" (LTCY), though other means might eventually be used to express such a trait.

Another important aspect of the role of a variable in a multiple regression analysis is the possibility of multiple meanings of the variable. In the case of the present study such cases did occur. IBER certainly held meanings beyond the realm of the cultural influence of languages. The historic circumstances of the formation of the American countries, especially in Central and South America and, on the other hand, the global spread of Portugal's and Spain's culture through navigation, conquest and colonization defined a spatial distribution of the two languages in a pattern easily confounded with geographical proximity to Brazil, as represented by the other variables in the study, MDIS/GDIS. Had the construction of the model followed another order--in which IBER would enter first in the equation--it is likely that

neither MDIS nor GDIS would have entered the model. Such mixed roles would not happen, for instance, with data collected from Portuguese speaking people in East Timor or Macao.

The crossed meanings of MHOR and MDIS, already mentioned in the results section, are another example of this situation of change of the originally intended meaning of a variable. Four complementary evaluative procedures have contributed to this analysis: the bivariate correlations among all variables in the model, their factor analysis, the partial correlations among specifically chosen groups, and their sequential inclusion (or exclusion) by multiple regression selective procedures.

In the case of some variables--at the first levels of causal precedence--the assumption of causality was straightforward (e.g., MSIZ/AREA, MDIS/GDIS, INDP, POP). However, as far as more complex variables are concerned, the supposition was not that each one of them necessarily and directly affected each subject's inclusion of nations on the sketch maps. Instead, it was assumed that those variables were measurable forms of underlying constructs or processes (in some cases more general dimensions, but not necessarily so). For example, in the case of "current

events" FSP/89 was taken as a representative of all media action in Brazil then, including radios, TV stations, magazines, newspapers and the like, despite the obvious imprecision of the measure to represent the set. Yet in terms of FSP's role in the models, it is important to assert that its "fusion" with variables indicative of energy production (KWH), and economic (GDP) and communications (TEL) power, would not necessarily occur for other national samples.

The final equation of both models (Tables 3 and 4) and the proportional presence in them of the levels of causal precedence show that Brazilian students possess a cognitive representation of the world heavily influenced by very basic characteristics of world nations (e.g., their size) and by their geo-political and economic importance in the scenario of world international relations. Cultural aspects seem not to be a major issue of their world view, as analyzed here. From the cultural variables, the Map Model retained INDP and IBER, and the Geo Model kept LTCY and IBER. IBER's role is somewhat confounded with the indicators of spatial proximity to Brazil (which belong to the first level), as already analyzed here. INDP exclusive contribution is only 3.2% (Table 4) and LTCY's is only 5.8% (Table 3). One might

want to add to this group the (culturally loaded) Soccer Index (WCUP), whose effect size--only registered in the Map Model--was 6.8%, even though this variable did not belong to the typically cultural levels of causal precedence.

The Brazilian students' profile of world images seems to explain the supremacy of the Map Model over the Geo Model, even though there is no comparative analysis from other samples' data. It seems that the Brazilians' representation of the world is map derived because it attains to the universality of the most salient nations in size and power, and its parochialism is basically defined by its neighbors. A sample showing higher levels of inclusion would have included nations for reasons of culture, history, and so on, possibly exhibiting less map dependency on its world view.

The intended rivalry of the two models of the study did not occur as expected. The models were conceived "in theory" and on an *a priori* basis, before correlations were available and prior to the selection of variables. AREA and MSIZ were just slightly different in their respective correlations with the DV. In fact, partial correlation analysis of both with the DV clearly favored AREA, therefore against my initial and naive expectations

favoring MSIZ. GCST was initially included in the Geo Model, but later discarded, whereas MCST was never chosen for the Map Model, facts that leveled both as irrelevant contributions. The interaction term created differentially in the Map Model (MSZCST) was not retained, after MSIZ's contribution had been partialled out.

MDIS and its rival, GDIS, were very similar, though this similarity may not hold true for the analysis of other national samples. Brazil occupies a position approximately central on a typical Eurocentric Mercator World Map, both horizontally and vertically. Such positioning causes the two variables to be almost equivalent (r= .92). If the map distances had been taken from a home land located at the periphery of such map as, for example, in the case of New Zealand or Canada's British Columbia, the map distances for certain nations could have shown values proportionally very different from their global distances. The effect of such differences in terms of their respective explanatory power is unknown so far.

The remaining difference between the models, then, relied on the variables MHOR and MVER, exclusive components of the Map Model. Their participation--along with MDIS--in the Map Model resulted in a complex

situation already examined. Such combined action, plus their influence on the remaining independent variables in the Model, certainly contributed to the Map Model being considered as statistically better than the Geo Model (nested models' comparison).

WAR2 resulted as a fine predictor within the context of both models (in fact, it was markedly the best in both), though another awkward element in the design of the study. It was classified within the general set (Table 2), whose basic characteristic was the abstract (non-map derived) nature of the determinants. WAR2, however, contains strong characteristics of a map-like variable. The board of the game **is** a world map, that displays (therefore conforms) the geo-political and military importance of the world countries depicted on it. The game is an ideological statement about world countries. It celebrates--hyper-ritualizes, in the sense of Goffman's concept--the importance of 38 countries and "refuses to comment" on the others, therefore forgotten. How would an adolescent from Paraguay feel when playing such game, considering that her/his country is not depicted on the board? Or, for that matter, how would people from the 45 countries of Africa react to not being present in the game? In any event, the variable is telling us that the

geo-political situation of a world country is not only a good differential (because of the partialling out of other variable's variance with the DV) predictor of its inclusion on the sketch maps, but also considerably better than any other kind of indicator, at least in terms of the Brazilian group analyzed. WAR2 is a variable-synthesis of the ideal model sought after in the study, a combination of data accounting for the world importance of the country, associated with the form of its visual display.

In summary, the multiple regression analysis has shown that the DV's and IV's extremes of the data distributions are somehow related. The most included nations seem to be the hegemonically most salient world countries. On the other hand, the cloud of low values in Figures 7 and 8 has exhibited evidence that low levels of inclusion are "justified" by countries' characteristics. The middle range of inclusions seems to be much more influential for the fitness of regression values to the measured data. Not by chance, it was in that region of the plots that the outliers were found.

Given the above, it is likely that the type of parochialism of a sample's world view will be decisive for both the goodness of fit of the model and its chances of explaining the sample's inclusions. This statement

obviously assumes that the group's specificity can be paralleled by quantitatively expressed variables, which may not be the case.

In this investigation graphical analytical procedures were used in conjunction with multiple regression and correlational techniques to better understand the inclusions of nations on the sketch maps of Brazilian students. It would be interesting to see this multi-method approach extended to include other techniques. For instance, cluster analysis applied to the nations' inclusions may provide new and interesting insights about potential hidden causes, hence enriching future explanatory models.

Improved multiple regression models--with the same and/or other variables--could also be used to analyze results from other instruments applied to the study of cognitive maps of the world. By means of convergent and discriminant validity studies, such an approach could progress towards the construct validity of that theoretical notion.

The current models were built exclusively upon the environmental end of the basic relationship under study, that is, characteristics of world nations, and about 75% of the total variance was accounted. Improvements in

current knowledge could probably be gained by regression models applied to groups of nations, or regions of the world, such as the continents. The variables retained in these new regression equations, their proportional contribution to the prediction of those nations' inclusions, and the analysis of the outliers would possibly add interesting differential results. As previously mentioned, the extension of the paradigm to other sites studied by the PVW Project would also cast new and important differential lights upon the present conclusions. Considering that the data reported here--as for all the information contained in the PVWP data base--is relative to the pre-90's world, new insights could be generated by comparisons with data to be collected in the 90's world.

Future research on the theme of cognitive maps of the world should also include the person's end of the relationship, that is the individual's cognitive and affective systems, involving perception, evaluation, storage, retrieval and acted upon information about nations of the world, plus socio-ideological values incorporated, through group processes, on the subjects' representation of the world. Relevant characteristics of the subjects and indicators of the way groups socially

represent other nations may prove fruitful. The residual variance observed here, equivalent to approximately one-fourth of the total variation, is possibly due, not only to idiosyncratic knowledge of nations, but also to cultural views or group attitudes regarding other nations and peoples. There certainly are affective and ideological determinants of the mental representations of the world that may influence the level of their inclusion on an instrument of assessment such as the sketch map. A recent article in a popular Brazilian weekly magazine illustrates the point (Grinbaum, 1996). This extensive survey on how the Brazilian sees him/herself indicated, among other issues, that the cultural legacy of Europeans and Indians (Brazilian Native Americans) is seen as an influence more positive than negative, whereas Africans' and Asians' influence is considered more negative than positive. This national attitude toward those peoples is possibly reflected in the fact that some European nations were present on the sketch maps, whereas Asia and Africa, along with Oceania, were the least included. Moreover, within the confines of the theme, the affective factor of the individual may very well be the ideological issue at the group level, given its socially determined nature, as illustrated by Goffman's notion of hyper-ritualization.

Appendix A: Subjects instructions

After checking for the existence of maps on the walls of the classroom, and making sure every subject had the necessary material, the exercise givers read the following instructions to the subjects. In case of any question or doubt, the instructions were repeated, the exercise would start and the administrators of the exercise would walk through the room, registering any fact that seemed important to be reported. The exact wording of the text follows the standard utilized in the Parochial Views of the World (Saarinen, 1988) and was translated into Portuguese by the author:

> "Draw a sketch map of the world on this sheet of paper (81/2 x 11 inches, or the closest local equivalent). Label all the countries and any other features you think are of interest or importance. Do not worry if your map is not perfect. Just do the best that you can. I am sure you will find this an interesting exercise once you get started. Take about 20 to 30 minutes to complete the task". (p. 117)

Appendix B: 172 original nations and the percentages of their inclusion by the Brazilian sample.

World Nations	Abbr.	NUC*
Afghanistan	AFG	6.5
Albania	ALB	4.3
Algeria	ALG	7.5
Andorra	ADO	0.0
Angola	ANG	9.7
Antigua and Barbuda	ATB	0.0
Argentina	ARG	73.1
Australia	AUS	81.7
Austria	AST	7.5
Bahamas	BHM	2.2
Bahrain	BAH	0.0
Bangladesh	BAN	1.1
Barbados	BAR	0.0
Belgium	BEL	4.3
Belize	BLZ	1.1
Benin	BEN	0.0
Bhutan	BHU	6.5
Bolivia	BOL	47.3
Botswana	BOT	0.0
Brazil	BRA	95.7
Brunei	BRU	0.0
Bulgaria	BUL	4.3
Burkina	BKF	0.0
Burma (Myanmar)	BRM	0.0
Burundi	BUR	0.0
Cameroon	CMR	3.2
Canada	CAN	83.9

Cape Verde	CAP	2.2
Central African Republic	CAR	0.0
Chad	CHA	0.0
Chile	CHL	64.5
China	CHI	44.1
Colombia	COL	48.4
Comoros	COM	0.0
Congo	CON	1.1
Costa Rica	CSR	4.3
Cuba	CUB	44.1
Cyprus	CYP	2.2
Czechoslovakia	CZE	10.8
Denmark	DEN	4.3
Djibouti	DJI	0.0
Dominica	DOM	0.0
Dominican Republic	DMR	4.3
Ecuador	ECD	34.4
Egypt	EGY	30.1
El Salvador	ELS	7.5
Equatorial Guinea	EQG	0.0
Ethiopia	ETH	9.7
Federal Republic of Germany (West)	FRG	32.3
Fiji	FIJ	0.0
Finland	FIN	8.6
France	FRA	46.2
Gabon	GAB	1.1
Gambia	GAM	0.0
German Democratic Republic (East)	GDR	32.3
Ghana	GHA	0.0
Greece	GRE	23.7
Greenland	GNL	66.7

Grenada	GRN	0.0
Guatemala	GUA	4.3
Guinea	GUI	3.2
Guinea-Bissau	GBI	5.4
Guyana	GYA	47.3
Haiti	HAI	8.6
Honduras	HON	7.5
Hong Kong	HKO	3.2
Hungary	HUN	2.2
Iceland	ICE	7.5
India	IND	43.0
Indonesia	IDO	5.4
Iran	IRA	10.8
Iraq	IRQ	10.8
Ireland	IRE	12.9
Israel	ISR	5.4
Italy	ITA	57.0
Ivory Coast	IVC	1.1
Jamaica	JAM	2.2
Japan	JAP	73.1
Jordan	JOR	1.1
Kampuchea(Cambodia)	KAM	2.2
Kenya	KEN	2.2
Kiribati	KIR	0.0
Kuwait	KUW	1.1
Laos	LAO	1.1
Lebanon	LEB	1.1
Lesotho	LES	1.1
Liberia	LBR	0.0
Libya	LBY	6.5
Liechtenstein	LIC	0.0

Luxembourg	LUX	2.2
Madagascar	MAD	20.4
Malawi	MLW	1.1
Malaysia	MLY	2.2
Maldives	MLD	0.0
Mali	MLI	0.0
Malta	MLT	0.0
Mauritania	MRT	0.0
Mauritius	MRI	0.0
Mexico	MEX	69.9
Monaco	MNC	1.1
Mongolia	MON	10.8
Morocco	MOR	14.0
Mozambique	MOZ	7.5
Namibia	NMB	4.3
Nauru	NAU	0.0
Nepal	NEP	4.3
Netherlands	NET	12.9
New Zealand	NWZ	16.1
Nicaragua	NIC	9.7
Niger	NIG	1.1
Nigeria	NGR	2.2
North Korea	NKR	6.5
Norway	NOR	17.2
Oman	OMN	0.0
Pakistan	PAK	4.3
Panama	PAN	20.4
Papua New Guinea	PNG	5.4
Paraguay	PAR	59.1
Peru	PER	51.6
Philippines	PHL	6.5

Poland	POL	15.1
Portugal	POR	53.8
Qatar	QAT	0.0
Romania	ROM	7.5
Rwanda	RWA	0.0
Santa Lucia	SLU	0.0
San Marino	SMR	0.0
Sao Tome and Principe	STP	2.2
Saint Vincent & the Grenadines	SVG	0.0
Saudi Arabia	SAU	16.1
Senegal	SEN	0.0
Seychelles	SEY	0.0
Sierra Leone	SLE	1.1
Singapore	SIN	0.0
Solomon Islands	SMI	0.0
Somalia	SOM	3.2
South Africa	SAF	35.5
South Korea	SKR	6.5
South Yemen	SYM	1.1
Soviet Union	SOV	76.3
Spain	SPA	53.8
Sri Lanka	SRL	2.2
Sudan	SUD	8.6
Surinam	SUR	46.2
Swaziland	SWA	0.0
Sweden	SWE	14.0
Switzerland	SWI	10.8
Syria	SYR	0.0
Taiwan	TAI	4.3
Tanzania	TAN	3.2
Thailand	THI	2.2

Togo	TOG	1.1
Tonga	TON	0.0
Trinidad and Tobago	TRT	3.2
Tunisia	TUN	2.2
Turkey	TUR	7.5
Tuvalu	TUV	0.0
Uganda	UGA	1.1
United Arab Emirates	UAE	0.0
United Kingdom	UNK	52.7
United States	USA	89.2
Uruguay	URU	57.0
Vanuatu	VAN	0.0
Vatican	VAT	0.0
Venezuela	VEN	46.2
Vietnam	VNM	7.5
Western Samoa	WSM	0.0
Yemen	YEM	3.2
Yugoslavia	YUG	2.2
Zaire	ZAR	3.2
Zambia	ZAM	0.0
Zimbabwe	ZIM	2.2

Note. Following the standards of the PVW Project, Greenland and Hong-Kong were included among the world nations, despite not being autonomous states in 1990.

* NUC= Percentages of inclusion of the Brazilian sample from the cities of Natal, Uberlândia, and Curitiba (n= 93).

Appendix C: Variables analyzed and their sources.

Name	Definition
AREA	Area of the country (km^2) (1)
CHRI	Percentage of Christians in population (1,2,3)
FSP	Citations in *Folha de São Paulo*, in 1989 (5)
GCST	Percentage of coastline (1)
GDIS	Direct line(globe) distance from Brasília(km) (4)
GDP	Gross Domestic Product(mill. of dollars) (1,2,3)
IBER	(Iberian) Country speaks Portuguese or Spanish (6)
INDP	Years from independence to 1990 (1,2,3)
ISLM	Percentage of Muslims in population (1,2,3)
KWH	Kilowatt-hour produced per year(mill.) (1,2,3)
LTCY	Country's literacy (%) (1,2,3)
MCST	Percentage of Coastline on Mercator World Map (6)
MDIS	Distance from Brasília on Mercator Map(cm) (6)
MHOR	Distance from left edge of World map(cm) (6)
MORT	Infant mortality rate, by 1000 births (1,2,3)
MSIZ	Country's Mercator weight(grams) (6)
MVER	Distance from bottom edge of World map(cm) (6)
NUC	Inclusion of nations by Brazilian sample(n= 93)(6)
NUC46	First random sub-sample of NUC (n= 46) (6)
NUC47	Second random sub-sample of NUC (n= 47) (6)
POP	Population of the nation (1)
TEL	Number of telephones in the nation (1,2,3)
WCUP	Country participation in Football World Cup (6)
WAR2	Importance rate of country in the board game (6)

Sources of data:

(1) World Factbook 1990 (US Central Intelligence Agency, 1990).

(2) Almanaque Abril 1989 (Nucci & Santos, 1989).

(3) Almanaque Abril 1991 (Nucci & Camargo, 1991).

(4) Direct-line distances, international edition (Fitzpatrick & Modlin, 1986).

(5) *Relatório de citações na Folha de São Paulo para os anos 1988, 1989 e 1990* (DataFolha, 1993).

(6) Measurements by the author.

Appendix D: Factor loadings of Geo Model

	Factors					
Variables	1	2	3	4	5	6
TEL	1.03			-.14		
GDP	.95			.11		
FSP	.92				.14	
KWH	.87			.29		
MORT		.89			-.28	
LTCY		-.71	.17		.23	.16
GCST		-.56			-.11	-.11
CHRI		-.31	.80	-.12		
GDIS		-.25	-.61		-.14	.26
IBER		.12	.56		.12	
ISLM		.33	-.56		.13	-.28
AREA	.20			.80		
WAR2	.10	-.12		.37	.33	.21
WCUP		-.12			.68	
INDP						.57
POP		.11		.45		.52

Note. The method of extraction used was Unweighted Least Squares, followed by Direct Oblimin rotation, based on the criterion of number of factors equal to 6. The smallest eigenvalue was .85 (the criterion of minimum eigenvalues equal to 1.0 had generated a much more complex structure of 4 factors); values inferior to .10 omitted from the table.

APPENDIX E. Matrix of bivariate correlations of the Geo Model

	NUC46	AREA	GCST	GDIS	CHRI	FSP	IBER	INDP	ISLM	LTCY	MORT	POP	WAR2
AREA	.54**	-											
GCST	.14*	.04	-										
GDIS	-.20**	.06	.19**	-									
CHRI	.23**	-.09	.22**	-.41**	-								
FSP	.57**	.45**	.05	-.06	.14*	-							
IBER	.35**	-.04	.02	-.45**	.38**	.06	-						
INDP	.27**	.16*	-.05	.12	.02	.23**	.02	-					
ISLM	-.24**	-.02	-.16*	.11	-.66**	-.15*	-.25**	-.14*	-				
LTCY	.37**	.11	.31**	-.01	.49**	.26**	.08	.22**	-.59**	-			
MORT	-.29**	-.06	-.48**	-.09	-.41**	-.24**	.01	-.19**	.39**	-.81**	-		
POP	.25**	.50**	-.01	.22**	-.17**	.25**	-.06	.38**	-.02	.00	-.01	-	
WAR2	.73**	.46**	.13*	.01	.11	.44**	.14*	.28**	-.19**	.30**	-.23**	.37**	-
WCUP	.48**	.13*	-.06	-.15*	.26**	.40**	.19**	.15*	-.21**	.38**	-.35**	.04	.41**
	NUC46	AREA	GCST	GDIS	CHRI	FSP	IBER	INDP	ISLM	LTCY	MORT	POP	WAR2

*p<.05, one tailed. **p<.01, one tailed.

APPENDIX F. Matrix of bivariate correlations of the Map Model

	NUC46	MCST	MDIS	MHOR	MSIZ	MVER	CHRI	FSP	IBER	INDP	ISLM	LTCY	MORT	POP	WAR2
MCST	.12	-													
MDIS	-.15*	.30**	-												
MHOR	-.29**	.16*	.93**	-											
MSIZ	.47**	.07	.04	-.00	-										
MVER	.10	-.02	.03	-.13*	.30**	-									
CHRI	.23**	.21**	-.21**	-.38**	-.05	-.03	-								
FSP	.57**	.04	-.05	-.18**	.35**	.24**	.14*	-							
IBER	.35**	.03	-.41**	-.47**	-.05	-.25**	.38**	.06	-						
INDP	.27**	-.05	.10	.05	.08	.21**	.02	.23**	.02	-					
ISLM	-.24**	-.15*	-.01	.12	-.06	.01	-.66**	-.15*	-.25**	-.14*	-				
LTCY	.37**	.30**	.08	-.12*	.15*	.33**	.49**	.26**	.08	.22**	-.59**	-			
MORT	-.29**	-.47**	-.17**	.05	-.11*	-.39**	-.41**	-.24**	.01	-.19**	.39**	-.81**	-		
POP	.25**	-.01	.17*	.14*	.30**	.13*	-.17**	.25**	-.06	.38**	-.02	.00	-.01	-	
WAR2	.73**	.11	.03	-.09	.37**	.21**	.11	.44**	.14*	.28**	-.19**	.30**	-.23**	.37**	-
WCUP	.48**	-.08	-.13*	-.20**	.12	.24**	.26**	.40**	.19**	.15*	-.21**	.38**	-.35**	.04	.41**
	NUC46	MCST	MDIS	MHOR	MSIZ	MVER	CHRI	FSP	IBER	INDP	ISLM	LTCY	MORT	POP	WAR2

*p<.05, one tailed. **p<.01, one tailed.

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