BAD GLOBES & BETTER GLOBES – MULTILINGUAL CATEGORIZATION OF CARTOGRAPHIC CONCEPTS EXEMPLIFIED BY "MAP" AND "GLOBE" IN ENGLISH, GERMAN AND SPANISH

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Abstract

Whereas analogue globes have been mentioned in cartographic literature just marginally during the last decades, the term *globe* is enjoying increasing popularity when tagged as *virtual* and *digital*. However, every attempt to precise the concept of *virtual/digital globes* and to integrate these terms into existing typologies of cartographic representation forms faces us with various inconsistencies. Intending even multilingual definitions yet multiplies these discrepancies. The consequences of such lack of compatibility are manifold and affect cartographic communication both internally in regard of its technical terminology and externally regarding communicational aims as to the user's geospatial information. Against this background, our paper purposes to outline a general principle for cartographic typologies by use of the example of the two basic level categories *map* and *globe*. The method we will apply is borrowed from cognitive scientific theories and implies prototypical, fuzzy categorization principles. These principles show cultural- and language-specific varieties, for which reason they were surveyed empirically within a multilingual study. The results of this survey confirm the theoretical assumptions: Particular stimuli are taken as better, i.e. more prototypical examples of *maps* and *globes* than others. However, the evaluations of the stimuli are language-dependent; the concept *map*, for example, has different connotations in English, German or Spanish. Furthermore, our empirical data allows a more detailed definition of the concept of *virtual/digital globes* and its integration into a modern user-centred typology of cartographic representations.

1. Introduction

Since at least 2000 years, globes have been used to model the Earth three-dimensionally as a spherical body. Despite this long tradition, only marginal attention has been paid to the globe by cartographers during the last century; in cartographic textbooks (Raisz 1962; Robinson et al. 1987; Robinson et al. 1995; Hake et al. 2002), globes are hardly taken into consideration, or even entirely neglected. This non-consideration has been argued due to “many practical disadvantages. They are expensive to make, difficult to reproduce, cumbersome to handle, awkward to store, and difficult to measure and draw on” (Robinson et al. 1995, p. 60). For these reasons, cartographers paid (and still pay) attention mainly to world maps when attempting to visualize reality on a global scale level. However, this relation between globes and maps has apparently changed completely during the last few years as software programs like Google Earth (GE) or Nasa World Wind – in technical literature (Butler 2006; Schöning et al. 2008) frequently described as *virtual* or *digital globes* – have been downloaded more than 500 million times since the products' launch (Google Press Center 2009; SourceForge, Inc. 2009).

Such abrupt changing importance of globes challenges cartography's scientific self conception, for which reason it needs to be scrutinized critically: Are virtual globes really more suitable to communicate information on spatial reality? Examining recent data on usage statistics shows that most users apply GE to solve large-scale tasks, e.g. to look at their house or to locate businesses (Schöning et al. 2008). But from a traditional cartographic viewpoint, large scale visualization is clearly beyond the representational scope of globes, which begs the question: Are applications like GE actually globes, or rather bad than better globes? To frame an answer on these questions about concepts and reference of *digital globes*, it might be helpful to start with a critical analyses of traditional typologies of cartographic visualizations; because given that digital cartography emanated from analogue cartography both theoretically and methodically, and given the concept *digital map* is based on the analogue map, it is logically consequent to build an understanding of non-analogue globes on an analogue globe conception.

2. Scientific typologies of cartographic representation forms

Cartographic literature offers a great many of typologies on the subject's representation forms. Owing to limited publication space, we won't discuss this multitude of classifications in the following lines, but rather try to give a well-balanced overview by considering some basic categorization approaches in a multilingual context.

2.1 Typologies in textbook science – exemplified according to Hake et al. (2002)

Beginning with an examination of the German cartography textbook from Hake et al. (2002) allows us, to give a representative review of classifications in the German-speaking countries (see fig. 1). When analyzing figure 1, it becomes conspicuous that the map, defined as an orthogonal (looking straight down) projection onto a plane (Hake

et al. 2002; Robinson et al. 1995), plays a central role in cartography. In contrast, globes, which are classified as *map related representation*, only have secondary importance in this typology. We can define them as spherical models that represent entire celestial bodies without considerable distortions (Hake et al. 2002; Riedl 2000).

(We translate here and subsequently: English: map = German: Karte = Spanish: mapa; English: globe = German: Globus = Spanish: globo; (Vasiliev et al. 1990; Robinson et al. 1987; Bollmann & Koch 2005)).

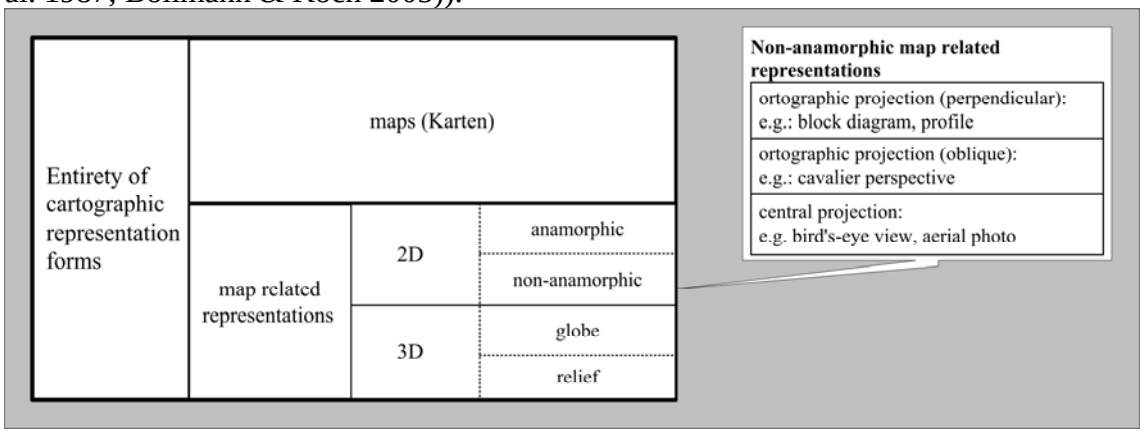

Figure 1: Traditional typology of cartographic representation forms (Hake et al. 2002)

Although the typology shown above is clearly rooted in a pre-digital, analogue tradition, its thorough conception allows applying it to non-analogue products as well, provided that the potential duality of form and content is kept in mind. Finally, we can add that both significance and concept of *map* in the framework of this typology are in agreement with textbooks of the Hispano- and Anglosphere (e.g. Raisz 1962; Robinson et al. 1987) on the main lines. This agreement holds true for the concept *globe* as well.

2.2 Typologies in frontier science

From a scientific historical point of view, it is quite comprehensible that cartography puts its main focus on the map. Likewise it is understandable that cartographic textbooks, which are – like almost all textbooks – essentially and necessarily conservative (Kuhn 1996), tend to maintain traditional terminology. However, this focus seems questionable in consideration of the technological state of the art and meets with increasing criticism from cartographers. This criticism is expressed i.a. in alternative proposals to classify cartographic products at the speed of time (see fig. 2).

Comparing the two typologies proposed in figure 2, we find two basically different categorization strategies: On the one hand, Moellering (2007) argues for an Aristotelic discrete concept by setting clear boundaries between the various cartographic representation forms. Insofar, it complies with the traditional viewpoint outlined above.

MacEachren (2004), on the other hand, advances a Wittgensteinian prototypical

approach, replacing the aforementioned clear boundaries by a widespread spectrum of representational alternatives. This spectrum is organized around a central concept of a prototypical map, while all other cartographic products are related to this prototype biaxially according to scale and abstractness: “Combining the ideas of a prototypic scale and abstractness for maps gives us a map category space within which a variety of spatial depictions can exist.” (MacEachren 2004, p.161). Consequently, all representation forms are to be understood as more or less prototypical *maps*, depending on their more or less central position within the *map* category space.

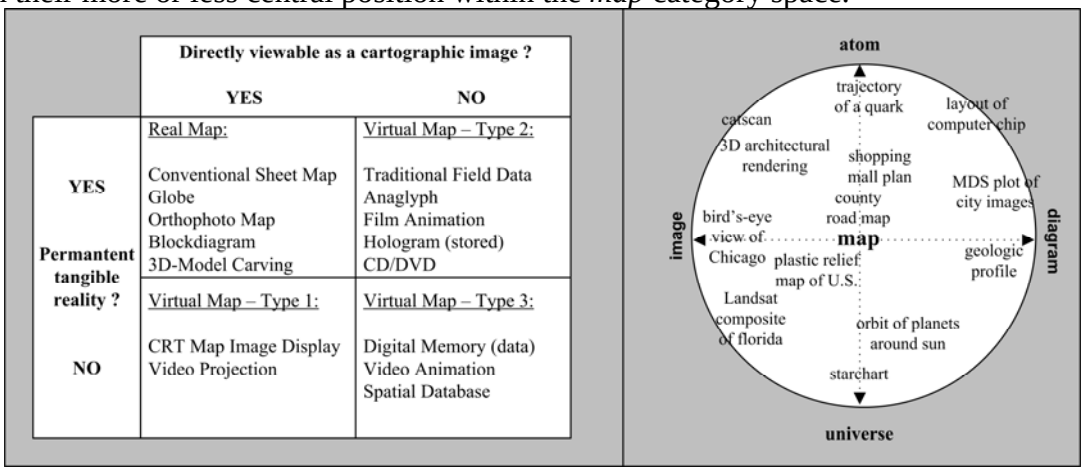

Figure 2: Alternative typological approaches in modern cartography (Moellering 2007, left; MacEachren 2004, right)

Despite of these fundamental differences, the two typologies share an important detail: the map is no longer considered as the most relevant cartographic product but rather as a superordinate concept that comprises all cartographic visualization forms. Accordingly, all map related representations of figure 1 fall into this ample *map* category, for which reason e.g. Moellering classifies *globe* as subtype of *real map* (see fig. 2, left).

The alternative typologies presented here (fig. 2), seem to be driven by a twofold motivation: Motive 1 is a growing desire to integrate non-analogue products into cartography's terminological repertoire. However, this argument could be countered by the question of whether a re-classification is justified by digital technological development. As stated above, we would like to argue against such need of terminological innovation and rather encourage to extend and adapt traditional, pre-digital vocabulary (see fig. 1) and its underlying theoretical and methodical knowledge as far as possible. Motive 2, supported mainly be MacEachren, is the reflection of cognitive scientific research results that speak for rather fuzzy than clearly defined categories with central, prototypical and peripheral, less prototypical category members.

To sum up, we have found general agreement on the map's central importance to cartographic research in the course of the previous text. However, it remains unclear, what this central concept *map* exactly means and comprises, neither within nor between linguistic communities. Instead, we have seen three different approaches on classifying

the subject's domain: Firstly, according to a popular viewpoint on applications like GE, these so-called *digital globes* are used in a wide scale spectrum, comprising both small-scale and large-scale visualization. As a consequence, since such digital globes serve as city maps as well as continent maps or globes (in a traditional sense), they become a superordinate concept covering nearly all cartographic representation forms of figure 1. Secondly, a traditional approach, presented in chapter 2.1, distinguishes between *map* and *globe* as two different, well-defined models (see fig. 1). Thirdly, recent typologies suggest using *map* as superordinate concept (see fig. 2).

A method of resolution for this contradictory conceptualization of *map* and *globe* may be found in the empirical-based argumentation of MacEachren who accounts for the usage of these terms *by* the user as a precondition for successful communication *with* the user: “The fact that map is a fuzzy and radial, rather than a precisely defined, category is important because what a viewer interprets a display to be will influence her expectations about the display and how she interacts with it.” (MacEachren 2004, p.161) In this spirit, we will try to examine the connotations by English-, German- and Spanish speakers regarding the concepts *map* and *globe* to obtain a better understood concept formulation, also in consideration of possible terminological discrepancies between these tongues. Our limitation on three languages is of pragmatical nature: Data of the Anglosphere is already available, while German and Spanish are spoken by the authors and their professional environments. However, we plan to investigate more languages and hope to encourage similar studies by authors of other linguistic contexts.

3. Non-scientific typologies of cartographic representation forms

3.1 Typologies by English speakers – what is a map?

The empirical data of English speakers processed by MacEachren (see fig. 2, right) originates in two surveys undertaken by Downs and Liben (1987) and Vasiliev et al. (1990). In both studies, a series of cartographic representation forms (e.g. topographic and earth maps, aerial photos) was displayed to the subjects. Each stimulus was accompanied by the question whether the probands thought it was a map. Both studies used a similar methodology while differing from each other regarding age patterns and the total number of stimuli. The results are widely consistent: There are, on the one hand, stimuli that received a high map-ness score, i.e. a majority of subjects agreed with the proposed denomination. Such prototypical maps are, for example, political world maps. On the other hand, certain stimuli (e.g. a horizontal perspective like a city skyline) were rejected consistently. However, the following two aspects have been disregarded by both studies: (1) Are the same stimuli evaluated in the same way by members of different linguistic communities? (2) Whether and how are the connotations of analogue and non-analogue globes related to the concept *map*?

3.2 Typologies by German and Spanish speakers

To answer these two questions, about 150 geography students from the universities of Guadalajara (Mexico) and Vienna (Austria) were interviewed within an online survey using the same methodical approach as Downs and Liben: 21 stimuli were presented to the subjects while asking them (in their native language) to say for each stimulus: (a) whether they thought it was a map, (b) whether they were not sure if it was a map or not or (c) whether they thought it was not a map. Furthermore, in case of unsureness (b) or rejection (c) subjects could specify an alternative denomination for each stimulus. The sample of stimuli differed slightly from the two aforementioned studies, since we did not aim at a pure reproduction of existing data. Rather, we did not just focus on the *map* concept itself but also on the map in differentiation from the *globe* concept. According to this, we added to the prototypical stimuli proven by Downs and Liben (1987) and Vasiliev et al. (1990 a number of state of the art products (e.g. Google Maps, GE, spherical displays). Particular attention was paid to the globe in all its manifestations, (i.e.: analogue globes; tactile hyperglobes; so-called virtual globes). These types of globes were incorporated into the study in overall or detail views.

3.2.1 What is a map? - Was ist eine Karte?

Discussing the German speakers' results, we can identify, *firstly*, a few prototypical members of the category *map*, which were evaluated positively (answer (a)) by more than 90% of the Viennese students (e.g. city-/topographic-/road- and small scale maps of the Earth or its continents). *Secondly*, a series of less prototypical maps can be distinguished according to an agreement (answer (a)) on the part of 50-90%, whereby the photographic nature of the stimulus might be responsible for this decreasing acceptance (e.g. in case of Google Maps with a satellite image overlay). *Thirdly*, those examples that showed a globe in an overall view (e.g. an entire analogue globe or the GE start screen), were consistently rejected as *maps* by more than two thirds of the viewers (answer (c)). The majority of these subjects proposed "globe" as a more appropriate alternative denomination. *Fourthly*, stimuli that displayed just a detail instead of the entire globe evoked mixed patterns of positive and negative evaluations. As long as the globe's horizon was visible, more than 50% did not interpret these examples as *map*, while a missing horizon elicited a twofold respond: On the one hand, detail views with graphic overlays were accepted as *map* (e.g. a detail of an analogue globe) by more than 50%. On the other hand, neither *map* nor *globe* seemed to be an accurate denomination of photographic overlay detail views (e.g. a large-scale scene of GE): many subjects proposed "aerial photo" or "satellite image" as alternatives.

3.2.2 Spanish – What is a map? (¿Qué es un mapa?)

Like Austrian students, also the Spanish speaking subjects showed a prototypical understanding of *map*. However, this prototype of the Spanish speakers seems to be conceptualized in a more constricted way, comprising just small-scale visualizations.

Only maps of the Earth or its continents were accepted as *map* by more than 90% of the subjects. City maps and topographic maps, which received high map-ness scores in the German sample were accepted just peripherally as *map*, for which reason numerous probands proposed alternative labels, e.g. "*carta* topográfica" or "croquis" and "plano" (instead of "city *map*"). As a consequence of this constricted prototype, the peripheral members of the German *map* concept are even more peripheral within the Spanish *map* category. While more than 50% of the Austrian students accepted a satellite overlay scene from Google Maps as *map*, the majority of the Mexican students rejected the very same stimuli; "satellite image" was proposed as an alternative name. Like for the German speakers, the category *globe* can also be clearly distinguished from *map* within the Spanish speaking sample. For more than 50% of the probands, a globe in an overall view falls outside the *map* concept. However, in contrast to the Austrians, Mexican students did not propose "globe" as an alternative denomination for the GE start screen, but rather preferred the name "satellite image" for this display. Finally, the detail view stimuli of analogue and non-analogue globes generated the same pattern of results in both linguistic communities: a graphic overlay detail was accepted as *map*, while a photo-graphic overlay detail (e.g. from GE) was preferable labelled as "aerial photo".

4. An integrative model of cartographic typologies

Our excursus to non-scientific conceptualizations in English, German and Spanish has been provoked by terminological discrepancies regarding the definition of *map* and the map's integration into cartographic typologies (chapter 2). In the light of the presented data, both the traditional approach of Hake et al. and the prototypical *map* category proposed by MacEachren seem to be valid. The former is supported by our data insofar as subjects do not only use one single *map* concept, but apply a series of concepts rather parallelly than hierarchically. These alternatives allow the user to reject representations as *map* and to propose alternatives. Such differentiated conceptualization is underpinned by our own data (e.g. by using the example of the globe) as well as by the results of Vasiliev et al., which suggest e.g. that 3D-objects and models are evaluated as less map-like than 2D-models. The latter approach by MacEachren is supported by the same data insofar as different models in fact evoked mixed patterns of acceptance and rejection, which argues for a radial categorization (fig. 2, right). As both typologizing strategies comply with the same data, we can integrate the typologies themselves as well. An integration strategy for this purpose is already contained in the categorization theories used by MacEachren (e.g. Lakoff 1990). Though these theories argue for fuzzy category boundaries, they do not ask for a reduction to a single category in the way that MacEachren proposes, but rather allow to distinguish different categories both vertically (from the general to the specific) and horizontally (from prototypical to less prototypical). Both aspects will be illustrated by way of example.

4.1 Organizing cartographic representation forms into a taxonomic hierarchy

Like most entities, cartographic models can be classified from the most general to the

most specific category in taxonomic form. Cognitive research has shown that the elements of such taxonomy are not equivalent: “There is (…) a level of categorization which is cognitively and linguistically more salient than the others. This is the basic level of categorization – the level at which (...) people normally conceptualize and name things. It is at the basic level that people conceptualize things as perceptual and functional gestalts.” (Taylor 2003). In case of cartographic categorization, *map* seems to be part of the basic level. Further basic level concepts are suggested by the proposed alternatives in the above cited surveys, e.g. *globe*, *satellite image*. Working up this taxonomy, we can suggest the traditional classification of *cartographic representation forms* as superordinate categorization; working down, the basic level members (e.g. globe) can be differentiated in more detail, e.g. into “analogue globes” and “non-analogue globes”.

4.2 Basic level categorization

One major consequence of a prototypically organized, multi-level typology is that the various levels of the taxonomy again are structured in a rather fuzzy than clear cut way. Hence, there are more or less prototypical maps or globes for example. Furthermore, this fuzziness does not only affect the members of a particular categorization level but also the boundaries between these members. Results of the aforementioned survey, for example, show that both *map* and *globe* are characterized by prototypical examples. Between these prototypes, however, a continuous transition was observed, since more and more-detailed views of a globe received increasing map-ness scores (see fig. 3).

4.3 Multiple categorizations of cartographic concepts in multilingual contexts

We now have tried to integrate the typological conflicts that have been disclosed in chapter 2 into an usage-centred, empirical-based approach. However, the model we have drafted is still rather a fragmentary approach than a completely elaborated answer. For instance, the comparison of *map* and *globe* that we have sketched in figure 3 seems to be shortened as long as other basic level members remain unconsidered. We would have to ask, for example, whether the fuzzy transition area between *map* and *globe* (see fig. 3, objects 4 and 5) is already a prototypical part of a third category, e.g. *satellite image*. This challenge, though worthwhile, has to remain unsolved here in consideration of the given publication space. More important for the moment is a brief consideration of a linguistic hurdle, namely that number and conceptualization of cartographic categories apparently vary in dependence of the particular language. Although we have just focussed on the map within the limited scope of our survey, it became clear that the different linguistic communities operate with different categorical extents and different prototype comprehensions. The German “Karte”, for example, comprises more subordinated concepts than the Spanish “mapa”. Similar effects are to be expected on all levels of cartographic information, e.g. concerning the meaning of single signatures in a large-scale hiking map.

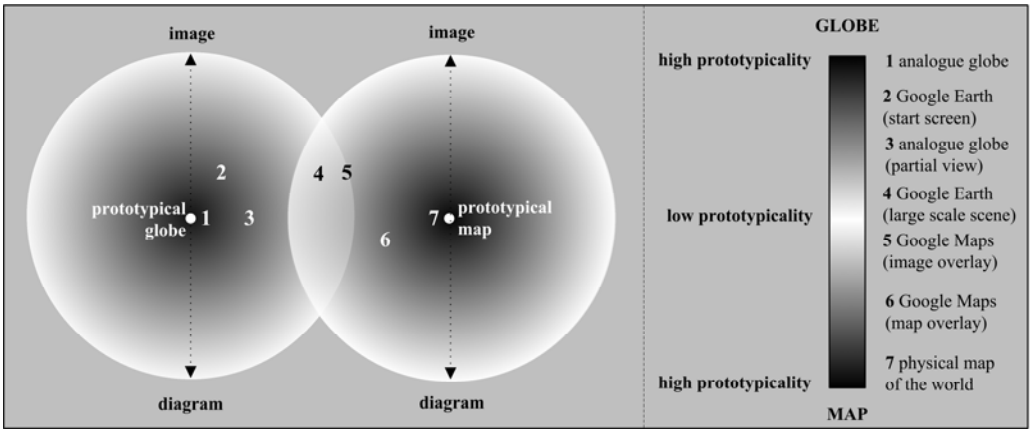

Figure 3: Prototypical conceptualization of cartographic representation forms at the basic level: examples of *globe* and *map* in a fuzzy categorization space

Consequently, these differences need to be analysed systematically and considered for communication both within cartographers and with cartographic products' users (e.g. for translations or international map series): “Words such as ‘map’, ‘Karte’, and ‘plano’ are not technical terms, to be redefined by the cartographic community; they ‘belong’ to the native speakers of English, German, and Spanish, respectively. Rather than attempt to extend the ‘natural’ definitions of these terms, we should instead take them for what they are (...).” (Vasiliev et al. 1990, p.122)

5. Epilogue - Bad Globes, Better Globes and Hyperglobes

To conclude this article, we will now apply the undertaken analysis of cartographic concepts and their empirical foundation to the questions we have posed at the beginning – Is it correct to name applications like GE “virtual globes”? The answer hereunto given by the probands within the above mentioned surveys seems to be clear: Firstly, GE is a globe. Secondly, GE is not a globe. Or more precisely: GE is a globe, but not only. Or even more precisely: GE is accepted as *globe*, when the entire Earth body is perceivable by the user, while GE is accepted as *map*, when large-scale visualization constrains an overview of the entire spherical model. And finally: GE is also a globe, but hardly used as such.

Is it, then, meaningful to label GE as *virtual* or *digital globe*? We do not think so for the following reasons: As we have seen above, labelling GE as *globe* is problematic, because GE does not comply entirely with the prototypical *globe* category. But, vice versa, the *globe* concept does not entirely comply with GE either, since this software comprises a whole series of cartographic representation forms, from large-scale to small-scale and from 2D to 3D visualizations. Within this series, the globe is just one part, namely the smallest-scaled one. Hence the different visualization parameters can be modified arbitrarily by the user in order to obtain an appropriate perspective for each particular visualization task, the alternative denominations *Earthbrowser* or *Geobrowser* may offer suitable categorization labels for applications like GE or Nasa World Wind. Just as web browsers allow scanning the world-wide web, Earthbrowsers facilitate to

search through multifaceted geodata. Impending convergence of these browsing tools, in terms of a web-wide world (Butler 2006), is already foreseeable.

However, it is not only the aforementioned terminological incompatibility that argues against a general denomination of GE as *digital globe*. Also the conceptual shortening, which is immanent to an equation of the two terms, is problematical, since it remains unclear whether the attribute *digital* refers to the globe's information content or to the globe's body. How, then, should we describe the case, where digital data is projected onto a material globe body? These questions indicate that the duality of content and form, which is inherent to every cartographic product, cannot be covered by one single term. This point of criticism carries even more weight since cartography already offers alternative and completely elaborated structural models: Already in 2000, Riedl presented a *hyperglobe* concept that, although compatible to the traditional *globe* concept, comprises all currently used examples of non-analogue globes as well as possible future developments. The term *hyperglobe* is distinguished from analogue globes in a threefold way, according to the characteristics of *globe body*, *image* and *visualization space*: (1) “virtual hyperglobes” (image: digital; globe-body: immaterial; space: virtual); (2) “tactile hyperglobes” (image: digital; globe-body: material; space: real); (3) “hologlobes” (image: digital; globe-body: immaterial; space: real). *Non-analogue globe* concepts like GE (start screen) seamlessly fit into this typology when categorized as *virtual hyperglobes*. Therefore, we can finally define: GE software is an *earthbrowser* that allows, among many other spatial perspectives, to visualize and perceive the entire Earth in its spherical form in terms of a *virtual hyperglobe*.

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