MULTILINGUAL PLANETARY MAPS FOR NON-PROFESSIONAL AUDIENCE: VISUALIZATION AND NOMENCLATURE[25]

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Introduction

A considerable part of all published Planetary maps are produced for non-professional audience. The map-understanding and map-interpretation of the general public is usually not very good even for tourist maps, and this is also the case for planetary maps, where they find even less information that can be easy to decode (understand): even thought the information are there, for the map readers they are undecipherable.

We have produced several wall-, world atlas- and online planetary maps for non professional audience. Using these maps we have initiated a survey among amateur astronomers, university and high school students, asking them about what they understood form the different test maps. Part of the result are presented in this paper, which tells that planetary maps need a special attention in both nomenclature and its visual representations in order to make it more easily and effectively interpreted or decoded by the those who are not familiar with terrestrial planetary surface features.

Prerequisites for creating a new generation of planetary maps for general (non scientific) use.

(1) There is a need for a clear guide or database of the landform types of the Solar System. This is a prerequisite for all maps, since for the generalization and symbols used in the map, we must previously know what groups and types of features will appear on the map. Such database should contain landforms listed by their geology, morphology and IAU names. There is also need for a catalogue of the historic (or diachronic) terminology in planetary science: during the decades the terms applied for certain features changed, or the same name is used differently.

(2) The readers find a completely alien world on the map. Many of the surface forms has no Earth parallels, thus we can't have experience to imagine them. The used symbols and the generalization should help readers properly identify the features. Since such landforms don't appear on Earth maps, we have to find new symbols for them. A map readable for the „general user" should contain geologic, stratigraphic, albedo, morphologic and topographic and historic (landings) information to make the map better interpretable and understandable. Most maps are very small scale maps. This can only show a limited variety of features, however, the most „interesting" features are of relatively small size. Here carefully selected cutouts and/or generalization can help to highlight the location of these landforms (in the case of Mars: landslides, layered crater deposits, DDS's, small valleys, calderas etc).

(3) Names of extraterrestrial features have almost the same historic complexity as terrestrial ones. „Planetary nomenclature, like terrestrial nomenclature, is used to uniquely identify a feature on the surface of a planet or satellite so that the feature can be *easily located, described, and discussed*." (Gazetteer... 1, 2003) While this goal is achieved in scientific discussions, for public education or popular science the present day international form of planetary names is not suitable. The IAU nomenclature is in Latin language which is not understandable for large part of the map readers. Most editors and popular writers do use a national language variant of these names (in books, articles, Atlases). Since there is no standardized national transformation rule for guiding this effort, they try their best, and this way produce multiple translated /transcribed /transliterated variants for the same feature name. (N.B. The translation may seem unnecessary for the reader who understand a Indo-European language, since even though the names are not the same words as the ones in their language, they are familiar and relatively easy to find out their meaning [Mons - Mount or Planitia - Plains]. This is not the case for several other European and most of not European languages, where the Latin names are meaningless.)

In the case of maps for non-professional or young audience, I propose - to some extent in contrast to the UNGEN (United Nations Group of Experts on Geographical Names) efforts on a *single* standardization of geographical names - to use standardized national language variants of the Latin terminology, with which it would be much easier (or, this makes possible) to get answer to the map readers' question "What's there" – this way achieving the aims of IAU mentioned above, but extending the target audience to non professionals. In this paper I will discuss this topic in detail.

Moon: a first test map

A new map of the Moon *(fig. 2.)* has been produced based on the multilingual series' lunar map, and was used as test map, with names that were uniformly transformed to Hungarian: the specifics were all retained while the generics were all translated. This way we have tried to use transformation rules that has *no exceptions*, in order to produce a nomenclature from which the originals can be easily re-established. It was shown to amateur astronomers who use lunar names on a daily basis in their observation work. The results were negative, in two ways: one part of the group disliked the translation, saying that we should have used the traditional forms (Kárpátok instead of Carpatus-hegység), while the other part of the group argued that both Latin and Hungarian (endo/exo/nym) should be used, but the form that has no tradition, should be avoided. So we tried to keep as many as possible from the Latin forms, but also keeping the widely used traditionally translated or endonym forms. A compromise would be to use the standardized translation of Montes (hegység)

[25] The Multilingual map series were supported by ICA Comission on Planetary Cartography. I am grateful for the help of Prof. Kira Shingareva who initiated the multilingual map series. The publication of the map was supported by the Hungarian Space Office.

plus the Hungarian exo(endo)nym of the Carpathians (Kárpátok), together: Kárpátok-hegység, thus making difference between the terrestrial and extraterrestrial feature (in the former no generic is used).

Fig. 1. Multilingual map of the Moon supported by ICA Commission on Planetary Cartography. (Hargitai, 2003.) The large features are written in large letters in its IAU (Latin) form, and are translated to six other languages (traditional use) in smaller letters. The map is also multiscriptual, since Russian spacecraft and crater names are written in Cyrillic letters (most readers in the target audience can read them). Smaller features has not been translated. The map is intended to be used in the Central European countries.

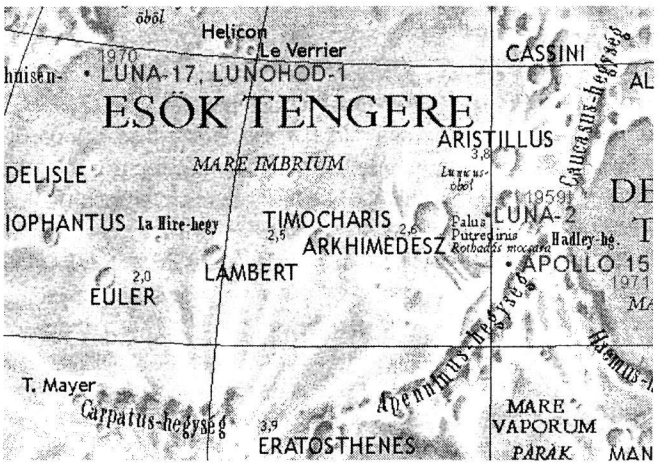

Fig. 2. The test map of the Moon (Földrajzi Világatlasz, 2003), based on the map shown above. Here the local exonym is shown in large letters, while the IAU Latin form is in smaller ones. The names of features other then Mare or Palus are only shown in an experimental standardized way, e.g. the specific part always the same as in IAU, but the generic part is always translated. This method appeared to be unsatisfactory for astronomers in the case of those features that already has traditionally used exonyms (Carpatus Montes: Kárpátok), but works with oher features. All originally Cyrillic written names are transcribed to Hungarian according to the rules of the Hungarian Academy of Sciences, while the widely used Greek personal names are also transcribed according to these rules– the less known names are kept in their Latinized IAU form.

Changes in the nomenclature As place names of Earth changes, because of history, place names change on other planets, too – because of standardization, history and – more importantly – scientific considerations. Planetary nomenclature has been cleared and standardized by IAU. During the discovery (mapping) of a celestial body, new names (naming rules) and – if needed – terms are created (2005: Titan is expected to go through this process). If a more detailed image shows that a feature was misinterpreted, its generic element is changed (example: Anala Corona -> Anala Mons) Other features' names are dropped because they turned out to be only part of an other feature or to be not existent in the revision of the images. We are aware of the fact that not only the names, but also the methods of transforming geographical names change in time or there can be parallel schools which use different methods, as it is the case in Hungary. Now it seems to us that there is a need for "Hungarian-sounding" names in contrast to "alien-sounding" ones but this might be only the latest (or local) fashion we live in, even if we can argue for the using of this method.

Case study - Hungary. In Hungary, the rules for how to write planetary feature names are not established. For major planetary bodies, the previous chaos was cleared by the rules that stated that planet names should be written according to their pronunciation, which corresponds to their Greek forms' transcription (Saturn->Szaturnusz). However, there was no rules set for minor planets and planetary features names. Now names of minor planets are written in the official IAU form, i.e. in the Latinized form. This paper does not discuss minor planet names, only planetary features names.

Mars: a second test map

We have produced a second test map, using the topographic map of Mars. We have given to versions of this map to students: in one of the maps the nomenclature appeared in the original Latin form (fig. 3.), while in the other we have created a translated nomenclature, where all generic elements were made understandable for the Hungarian readers (fig. 4.). We asked what the readers understood from the map and what they don't, and we asked them to describe the "geography of Mars" using the maps.

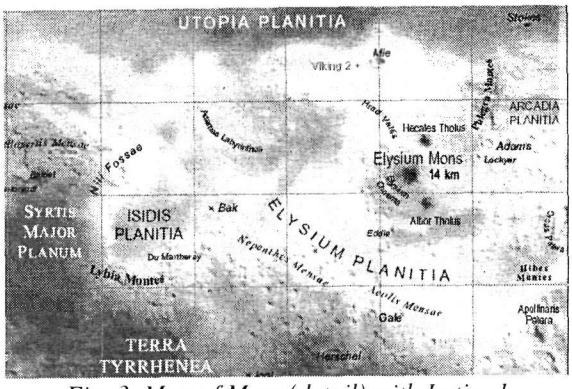

Fig. 3. Map of Mars (detail) with Latin 1

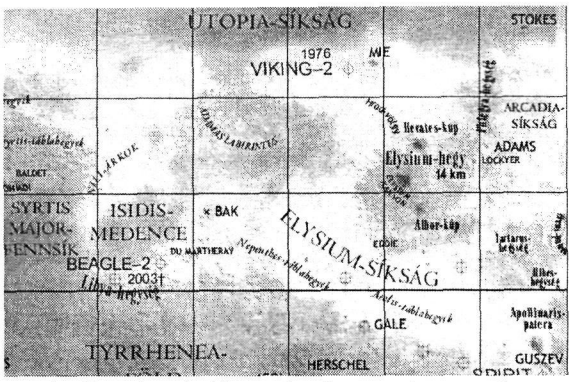

Fig. 4. Map of Mars (the same detail as above) with translated nomenclature and some additional information

Results of the survey

We have asked c. 100 18-22 years old highschool or university students. A part of the questions were related to background knowledge. It prooved that they have a better knowlegde of the Moon and Mars that we previously thought.

Problems with the map reading

- It was unclear for the map readers what the crater names were referring to. Since they have no descriptive element included in their names, it must be clear from rthe map that they are the names of craters.
- Why are the lunar basins called seas/maria once they did not contain water - they asked.
- The rays around lunar young craters remained an enigma for the readers, since nothing explained their nature while they were clearly visible.
- Many missed mountain peak height data for both Mars and the Moon. Such data can be extracted from MOLA data or lunar laser altimeter or shadow measurement data. Such height data is usually not included in planetary maps or even scientific maps and publications - while most map readers would need it. They also asked for the depth data of individual basins.
- Lunar lava and martian channels and valleys of various types, along with other linear features are usually not appearing on planetary maps, only if their topography is deep enough to appear in the topographic maps. (On one map [Hartmann, 2003] the position of one such channel, Marte Vallis is explained in detail in the caption, saying that unfortunately it can not appear in the topo map - this is one example when more creative mapping would need in such cases)
- Many told that the large number of names and landing sites were new for them.
- They wanted to know how the features are named; what materials are the features composed of; how they were created; what is the 0 m level in the absence of a sea; where is life etc.
- Many told that the bluish colors are misleading; since it is the color of water. They suggested to use a brownish color instead.
- Many missed the location of ice on Mars (and Moon). The caps, as in other topo maps, were depicted in the color corresponding to their appropriate topographic level. They asked for using bluish white instead.
- Where is the Face on Mars, one asked. It shows that they do want to know the positions of the features appearing in popular press.
- Many told that they were surprised that such height differences exist on Mars.

Corrections

Using the suggestions from the survey, we have modified our maps (Fig. 5.).

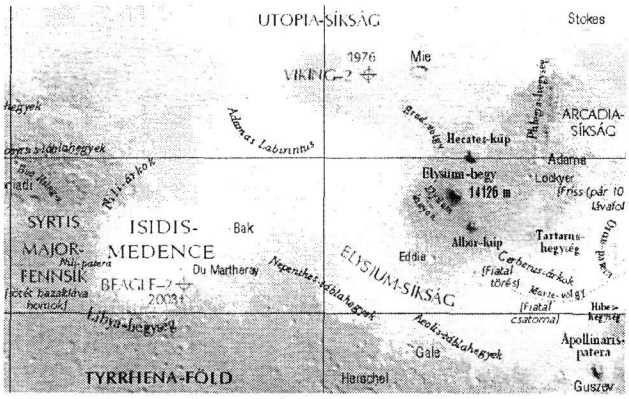

Fig. 5. Map of Mars (the same detail as above) corrected, updated and commented version

- We have changed the colors of basins into lighter yellowish-magenta instead of darker blue
- We have shown the linear features with lines similar to terrestrial rivers; but with dotted line and yellowish color
- We have shown informally named features (Face on Mars, Happy Face crater, Inca City, Cobra Head) with their short explanations on the map
- We have put short explanatory texts to the appropriate locations, where a special phenomena or feature type can be found. We have found it clearer that to find out new symbols, but that could be an other way. (Such are: locations of dust devils, yound lava flows, old cratered terrains, network walleys, dunes etc).
-We have shown exact heigh data for the highest peaks

This map is not considered as final product, since new symbols and deatiles are put onto it continousely. For instance, it is a problem how to show the albedo variations - we are inclined to use the geographic symbol/pattern of deserts.

Additional information

We are working on finding out new symbols and areal visualization textures for planetary features. For this work first we have catalogued the volcanic, aeolian erosional, biogenic, crustal, tectonic, fluvial, karst, mass movement, impact feature types (landforms) of terrestrial planetary bodies. Symbols can be based on the Planetary Geology Feature symbols used by USGS (USGS, 2003), but they have to be modified to fit the needs of the general public.

Such map would be a composite map of several thematic "layers": it would contain albedo features, topography, selected landscape features (especially the important, but too small ones) would be indicated only by generalized symbols, while others would look realistic. It would show the man made objects found on the surface (in intact or broken form), and it would show selected "hot spots" or "candidate scientific tourist attractions". The visualization of the planetary body can also use planetary shadow technique (where, if the planet is shown as two hemispheres, the planet would be displayed with limb darkening.) We are now working on such new visualization features on the new edition of our multilingual Venus wall map.

Extraterrestrial geographic names

IAU Rules on extraterrestrial geographic names (detail): "Individual names chosen for each body should be expressed in the language of origin. Transliteration for various alphabets should be given, but there will be no translation from one language to another. ... Diacritical marks are a necessary part of a name and will be used. ... The number of names chosen for each body should be kept to a minimum, and their placement governed by the requirements of the scientific community." (Gazetteer... 2, 2003)

Specific element *(proper name)* **– Names are labels.**

"The main function of geographical names is to serve as label, and as such, its semantic meaning, even if evident, is of less consequence than its role as a designation or tag." (Kadmon, 2000)

Meaning : Since naming is artificial (or, bureaucratic) process, there is no connection between the proper name and the feature. Except when sometimes there can be: in nicknames or traditional names. Or they can be generally related to the body itself (scientist who studied that body).

The meaning can be transparent (readily understandable) or opaque. Now usually both element of Extraterrestrial names are opaque for all readers who haven't learned Latin. However, for some traditional names both elements are translated, but in spite of this, the name is still remains opaque or, worst, it has **false generic,** which does not describe the feature, and also false specific considering its meaning (Sea of Rains). Here the geologic term would be better understandable (Imbrium Basin), but this has a slightly different meaning and is against the traditional name. While for the science the meaning itself is of secondary or no importance, for the general public, the meaning or its historic connections can be more important (or interesting). This argues **for** the restoration of the original meaning in local language, while if we consider the label function, this argues against any attempt of translation or even transcription / transliteration of the names. Exceptions: if the specific element contains compass points.

Not-official specifics or names: Astronaut-named features and "named stones" on Mars are somewhat "off" the nomenclature, since it neither follows the IAU rules of naming features, nor the terms used for lunar features. But, in fact, it is the only case, when the features get their name by natural naming; therefore the names may be related to the named object and also those who named it. Since these are all given by Americans, the terms are using English (Mountain, Massif) and the specific element is taken from American culture and in English (Snoopy, Family Mountain, North Massif). Here, probably the same rules can be used as in the Earth maps – which rules let open the question whether to translate one or two elements of the name. Not official, but widely used names on the Moon are Cap Banat, Great Wall, Cobra head, on Mars: Inka City, Happy Face crater, Giant's Footsteps etc.. Since most observers do use these names, it is clear that a map should also display these „naturally created", but not official names. These should be given in the target language – here the meaning is more important than the labeling function –, not in an artificially latinized form. In some cases the same feature has Soviet and American (IAU) names parallelly. Such are some catenae on the far side of the moon, where both names are shown on the maps.

Descriptive elements (*generic element, generic term or – in IAU definitions – descriptor term*) Usually currently used IAU descriptive elements are true (as far as our current knowledge makes it possible); they are intentionally false only for some traditionally named lunar features (Lacus, Mare, Palus, Sinus). The translation of both elements in this case is traditional, however, this makes lunar nomenclature also false in the target language. Such names on Mars had existed but has been renamed. A forced but more transparent method would be to add a true generic element: Sea of Rains Basin. In the case of many IAU terms, they are very broadly used, for different features. In the translation, many different translation can be used for the same Latin term: Planitia, for example, can mean (impact) basins and plains as well. In some cases the generic Latin term has earth parallel term, in other cases it can be directly translated from Latin, in the last case it can be kept in the original form, but transcribed to the target language.

However, in many cases the descriptor term does not reflect to the true geology: Farrum, farra is defined as "Pancake-like structure, or a row of such structures" – while the same can be named also as Tholus, tholi (on Io). The same way tholi and paterae are usually volcanic calderas, while calderas on high volcanoes are not named, they are Mons, montes, just as mesas, massifs on Io are or larger impact basin rims on the Moon, while smaller craters hight rims are not named. Corona, coronae are "Ovoid-shaped features" on Venus and Miranda, but Venusian coronae had and has also many names arachnoid, nova that are only used in geology. A unusual part of planetary nomenclature is the Moon, where – in contrast with its former nomenclature and the current Martian nomenclature – there are no regional names assigned for the highland regions: no terrae on the Moon. Thus, the highest hierarchic level is missing on this part of the moon (most of the far side). Large scale features are not well defined on other planets as well: „The boundaries of many large features (such as terrae, regiones, planitiae, and plana) are not topographically or geomorphically distinct; the coordinates of these features are identified from an arbitrarily chosen center point. Boundaries (and thus coordinates) may be determined more accurately from geochemical and geophysical data obtained by future missions." (Gazetteer… 3, 2003) May be this will help define lunar regional named features as well. NB: Undersea features names - the same internationally standardized artificial forms - are usually translated to the target language, both its generic and specific elements. Here I propose to keep the labeling function (avoiding more chaos) of the specific element, which, as for its meaning, usually has little relation with the feature itself (no Blue Mountain on Mars), while the generic element (term) should be made transparent, since it does have a close connection with the feature.

Local versions – Endonyms Local names for local features. Some extraterrestrial names are based on (named after) terrestrial geographical features, but of course are not endonyms. They usually use their latinized or "international" (i.e. English) form. Even Greek personal names or Gods are latinized. An example for an exception is Io, where, instead of a Latin form, IAU used the English exonym of many geographic names (Danube, Ionian (sea)). It makes more difficult to find out which version to use. As label, it should be the English one, but as a name, for many languages, it has an endonym. If the terrestrial "donor" feature is located in the area of the target language, they usually traditionally use that form (local endonyms of the Carpathians instead of Carpatus Montes). It is an open question whether to extend the rule of using the endonyms or exonyms for other toponyms that has no tradition but is of the same kind as the case of the Carpathians, or not (example: Danube Planum on Io).

Exonyms Name used in a specific language for a geographical feature outside the area where the language has official status. Most extraterrestrial names are neither endo-, or exonyms: they are standardized, artificial international names. However, some names have become exonymes for most languages during the last centuries. Such are the maria of the moon and the most prominent features of Mars (here exonyms are in fact historic or mythological exonyms). These can be kept in its traditional form, where all elements are translated (on the Moon), or, replaced with the standard not-translating method (on the Moon then it would become Imbrium Basin, which 1, sounds alien for most astronomers, 2, are used for the unfilled basin in geology 3, but is best fit into a standardized nomenclature.) (See paragraph on test map.)

Classical names - a poetic argument The so called Classical albedo features (Mars, Mercury) which has been used – although differently – well before the IAU, and are used extensively by amateur astronomers – brings up an another question: should we use the local (exonym?) versions of these mythological names (in many cases, only transcripted or transliterated: i.e. with more accents) or we'd better drop the traditional mythical form and we consider these names again as labels and keep the latinized form. The negative point in it is that this way many names became opaque while applying only slight changes, the original "poetic" meaning – that had an important role in popularizing Mars in the 19th Century – can be restored. Schiaparelli established the "rule" of giving mythological names to landforms, which became very popular and, may be more importantly, easily remembered by the educated people of that century.. He simply copied the Greek map of the Mediterranean. At that time it was also a common practice to name and show names on the map in

Latin form: Mare Gemanicum etc. So, at that time, his Latin nomenclature perfectly fit into the terrestrial nomenclature system and were all transparent to their readers. Our goal is that at least partly, this "sense" of names be re-established in their modern form. (of course, for scientific purposes, the original IAU nomenclature should be used even in articles in local papers or books).

Transformation without translation Here two opportunities are available:

1, Transcription: phonetic transformation of a name. (for non-roman alphabets). Usually the original form can not be restored from the transcribed one.

2, Transliteration: letter by letter transformation, when the original form can be restored from the transcribed. While international *single romanization methods* (Russian, Chinese Pinyin) makes international trading, international scientific discussions and mapmaking much easier (or, making it possible), these names 1, do not fit to the various languages, 2, look alien to many (contain letters that are not used in some languages) and 3, usually are hard (or impossible) to pronounce to those who are not familiar with the romanization principles (e.g. to most people) – not because they could not pronounce the sound, but because they don't know how to read/interpret a given letter.

Most languages has their own transliteration or transcription rules from non-roman alphabets which do fit to the given language. I propose that – for locally and not internationally used products – at least for the most frequently used names, on the maps and texts, we do show the forms created by using local rules in addition to the international ones. In Hungary, some terrestrial maps use the international romanization while others use the local method developed by the Hungarian Academy of Sciences, so the question remains a question even for terrestrial maps.

Orthography

All extraterrestrial geographic name follow the Latin (and English) tradition: they are composite names, but element starting with capital letters and written separately (except for craters and ephemeric features, where no generic is used). However, geographic names in some languages have different rules. Hungarian, for example, uses a hyphen between the two element, and the generic term is written without initial capital letter. So, the local language rules should be applied in "nationalizing" extraterrestrial maps.

Bilingual or biscriptural maps – Extraterrestrial allonyms

Allonyms (Alternative names – several toponym for the same feature) can be shown in a multi- or bilingual gazetteer and/or multilingual / multiscriptual maps. For maps, space is a limiting factor, so only the most prominent features should be written in two languages/scripts (one is the target language, the other is the international form). Craters, fortunately, have no generic element. In the case of craters originally bearing of Cyrillic names, on the test map I always showed the original Cyrillic form (but this can only be done if the target audience can read that alphabet).

Future nomenclature

Even now several scientific paper can discuss unnamed features, identified by their coordinates. For the yet unvisited worlds the presently known albedo features are – in most cases – not named (Titan, Pluto, Charon). In the future probably many new feature will be named, new terms will be used and new planetary bodies get their nomenclature system. Especially after such discoveries, new names come out easily and fast (as were the case when discovering the far side of the Moon). With new landings, rover missions, naturally created names will appear in great number. There will be an urgent need for transforming all these names to other languages, in a controlled, or standardized way, for the press and popular papers.

Conclusions

In the case of publishing planetary maps for non-scientific audience, it is proposed to use common (latinized or internationally romanized) specifics (without translation) and separate (translated or transcribed/transliterated) generics for different languages, as in the case of many undersea features, except for traditionally used names containing the target languages endonyms or exonyms of terrestrial features and frequently used, well known personal names that has a traditional transcripted/transliterated form, where the local rules can be applied. The specific elements are not translated, except for those lunar features that has a traditionally translated variant (in mountain names and in all names that has false generic.). Diacritical marks are always given according to the source language. It is also recommended to show– as available space makes it possible – a bilingual (international and local) nomenclature on planetary maps, especially in the case of translated names (with lunar false generics and other translated names (compass points).

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