Defining GIS – assessment of ScanGIS

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Abstract. Geographical Information Systems (GIS) are routinely used by public and private organisations and enterprises as well as lay persons. It is becoming an infrastructure and a preconditioning web implicitly embedded in our information society. Using a GIS is no longer a specialist endeavor. It is a daily activity of non-specialist, with or without being aware of it. This of courser changes the Worlds view of GIS. The question is if it should change the perspective of GIS scientists too. It is the intention of the present paper to investigate the way perspectives of GIS have changed since its emergence in Scandinavia in the mid-eighties. Changes in definitions will be highlighted; as well as possible links to positivism will be discussed. Finally a survey of ScanGIS activities in terms of abstracts of papers presented at conferences from 1985 to 2001 will be provided.

1. Introduction

GIS is a powerful instrument for handling, analysing, and presenting information about our physical environment. But it is a tool that is still in development both in technological terms and in relation to its use and implementation in planning and management of our society and environment, by private as well as public agencies. The challenge of supporting and guiding such a development cannot be taken up by technical considerations only. It calls for a broader scientific perspective. Accordingly, two questions can be raised; a) how can a 'full' scientific research-agenda for GIS be drafted, and b) for what reason should it be done.

GIS as a technology can be seen twofold: as an analytical device, specially configured to handle spatial information and/or as an information technology, as a (mass-) media that is. This makes it a complex science requiring not only natural scientific or technical knowledge, but also knowledge based on humanistic and social scientific epistemologies. There are (at least) two reasons for the constitution of GIS as a science broader than just facilitation of instruments for other fields of science: First, further development of a media or technology such as GIS requires internal self-consciousness and development of an independent, generic terminology and theoretic foundation. Second, internal awareness about fundamental shortcomings (e.g. related

to underlying methodologies) is important to enable communication about potential problems to the expected users outside the GIS-community.

Development is so fast that the experts are either directly part of the technological development or have to move very fast just to maintain an operational level. Only when the technological development approaches a phase of closure, the developers of the technology can start to focus on aspects related to the context of its use in society. Like the paved road or the traffic legislation could not be invented before the automobile was ready to drive. Accordingly, before the scientific discussions can start focussing on the contextual aspects of GIS, this stage of technological maturity is needed. Up through the nineties and at present this is about to happen - the present paper is an attempted contribution. On the other hand, if the technical development continues too far without thorough scrutiny of its societal implementation, the closure can lead to a sub-optimal situation where the technology itself and its surroundings are interlocked. Again, like in the case of the automobile and the paved road. Due to the massive investments in road infrastructure it will be very hard to come up with an affordable alternative to the car, despite of the obvious environmental problems related to it.

In the next chapter the paper the scene is set by an evaluation of definitions of GIS in a historic perspective from the mid 80'ties to present (2002). This way a contemporary definition, focusing not only on the technological capabilities and organisational settings, but also on its embedded communicative characteristics, is outlined. The necessity to incorporate scientific views of the different aspects introduced is highlighted. To enable an analysis of the kinds of knowledge constituting GIS, the following chapter introduces the three academic virtues provided by the Greek philosopher Aristotels. The next chapter presents a discussion of the long lasting debate of the problems related to the positivistic background of quantitative geography and hereby GIS. By a structured assessment of abstracts of scanGIS proceedings for the conferences 1985-2001 the following chapter evaluates ScanGIS activities to date in terms of the Aristolean virtues. Finally, some reflections and recommendations are given regarding possible future development of ScanGIS.

Parts of the paper are based on my non-published Ph.D.-thesis [19].

2. Defining GIS

Geographical Information Systems (GIS) are defined in a number of ways. In its most basic form, emphasising on instrumental issues, it refers to computer-based systems for automation, storage, retrieval, analysis, and presentation of geographically related information. Peter Bourrough defined GIS, in his now famous 1986 textbook, as *'a powerful set of tools for collection, storing, retrieval at will, transforming and displaying spatial data from the real world'* [4, p. 6]. Other definitions are elaborating on the organizational context in which GIS is used. Huxhold and Levinsohn [9, p. 5], defines GIS as '*a set of geographical information processing concepts and principles*

that define a broad model of the real world within which an organization functions.' Approaches to GIS as an information technology highlights communicative aspects, including considerations regarding messenger, message, and target group. From this perspective comes that *'A main objective of GIS is to allow the user of the system to interact vicariously with actual or possible phenomena of the real world'* [12, p. 1].

Maguire [11] lists 11 definitions of GIS, historically ranging from 1979 to 1989. They include both instrumentally/ data-orientated approaches and definitions involving issues related to the organization within which GIS functions. The tendency is that the latter are mostly represented by the newest entries of the list. From its early 90'th perspective McGuire [11] presents three distinct but overlapping views. Including a 'map view' (focusing on issues related to cartography), 'database view' (emphasizing on the importance of well-designed and implemented databases) and a ' spatial analysis view' (focusing on analysis and modeling in which GIS is seen more as a spatial information science than as a technology). Despite of the earlier recognition of definitions focusing on organizational aspects it is not justified in which of these three views it should be included.

In accordance with Maguires [11] 'spatial analysis view' (see above) Goodchild [8] suggests a research agenda for a scientific approach to handling geographical information, to a vast extend including GIS. The development of GIS up to 1992 had according to Goodchild [8] been driven by a) development of hard- and software technologies, b) the cheer need for problem-solving applications and c) the still increasing availability of data, including satellite images, digital elevation models, street maps etc. This type of development and its focus on 'spatial data-handling' will inevitably be addressing *'… what we do, but give no sense of why we do it'* (p. 31). To further approach this Goodchild [8] coins the term Geographical Information Science (GISc) by identifying two senses of the role of science in GIS. Namely the 'GIS-as-a-science-view' and a 'GIS-as-a-support-for-related-sciences-view'. If GIS as a field contain a legitimate set of scientific questions, they ought to be *generic rather than specific* to a particular field of application. That is, they should be relevant and usable in relation to question other than those they were originally developed for. If an identification of such science(s) is possible then it must be possible to answer questions like *'… what are their subfields, what are their questions, and what is their agenda?'* (p. 32). The second view - 'GIS as a toolbox for other sciences' – calls for an awareness of what we can do to *'… ensure that GIS… play their legitimate role in supporting those sciences for which geography plays a significant role'* (p. 32). Goodchilds paper [8] has played a tremendously important role in the self-awareness for scientists working within fields related to GIS. Despite of this, it is important in the context of the present paper to note that his approach at that stage was entirely evolving around issues related to the (quantitative) analytical capabilities of GIS.

During the nineties the awareness of the social aspects of GIS with the scientific community became more and more articulated. Sui and Goodchild [20] provide in a guest editorial called 'GIS as media' a very explicit example. They state that the *'… latest development in GIS have convinced us of the need for new conceptualizations … for what GIS actually is and will become in the near future'* and further that.*'… the*

complex relationship between GIS and society can be better understood if one conceives of GIS as new media' [20 p. 387]. The issue of GIS as a communicative means is seen twofold: a) As a main vehicle for communication – which would require more work to be carried out e.g. in the fields of different perceptions of different user-groups and – types, under different circumstances. And b) the increasing significance of the role of GIS in peoples lives and the way it influences the peoples perception of the World. Sui and Goodchild [20] acknowledges the work done within the realm of GISc related to basic concepts and metaphors, but they do state that the work until now has over-focused on discussing technically oriented syntax issues – including only *'… rules and grammas governing the relationship between signifiers'* (p. 389). Accordingly what is missing in the current literature is the cultural and philosophical view on GIS and communication.

Jonathan Raper [15] provides probably the fist and most comprehensive attempt to approach GISc in a manner covering both its technical/instrumental characteristics as well as its conceptual and contextual features. He states that *'… the research agenda in GISc must be driven by the need to spatially and temporally contextualise the ontology and epistemology employed…'.*

In line with Sui and Goodchild [20] I think that GIS as technology has come to a point in its development where its role as a (mass-) media is a profound feature. Especially when taking Internet-GIS into consideration. Therefore the most contemporary definition I can come up with could be something like *'GIS is a mass media centred on handling and communicating geographic information'.* A definition like that would enhance the necessity to address issues like message, target-group, political manipulation etc. – this way GIS will include reference to some kind of 'geo-journalism'.

The definitions referred to have taken GIS from its origin as a data- and instrumentally orientated technology to a phenomenon opening to the surrounding world. In the first phases this is addressed in terms of the way systems are implemented in human organisations, later by virtue of its capabilities as a media. As an illustration of this development one can look at the names of various GIS-software over time. The early, commercial products like Arc/Info and Intergraph both uses notions of data in their names. These products signal to work with lines, graphs and attributes. Later when the systems were providing a clearer address of the use and users of data, products was named e.g. ArcView and MapINFO to exhibit an ability to display and operationalise information. Some of the most resent products indicate by their names the media-perspective: E.g. Geomedia and MapGuide. Whereas a scientific agenda of the instrumentally orientated aspects of GIS has been proposed and generally accepted as GISc, a common research agenda for issues related to GIS as a media is still under development.

The definitions referred shouldn't be assessed normatively. It is not a matter of which is the right or correct one. It is not my goal here to state that one or the other definition appears to be the 'best' or most scientific. The interesting thing is what can be revealed about the motivation of the persons or professional groups proposing a

given definition as well as the (historic) development stage. None of the above definition can live without its predecessors. It doesn't make much sense to talk about a media without an implicit awareness of the organization behind, or the required technology. Who would discuss TV as a media neglecting the necessity of functionality and development of cameras, editing-equipment, microphones etc. Further on, the organizational and information-infrastructures obviously also must be addressed. A problem when continuously broadening definitions to include still more, is the possible loss of focus, leading to the need of clearer definitions and demarcations of sub-fields.

3. Classical virtues of GIS

GIS is not only constituted by virtue of its technical or operational background. It is also founded on underlying theories, norms, and the contexts of its use. These three issues or forms of knowledge – operation, theory (or basic laws), and context – reflect the Greek philosopher *Aristotle's three intellectual virtues; techne*, *episteme*, and *phronesis*. See for instance Flyvbjerg [6]. As an example, look at automobiles: *The mechanic represents techne*. He knows how to make the car and its components function. He knows what makes the engine and the gearbox work. *The driver operates based on phronetic virtue*. He or she knows how to operate the car, considering the condition of the road, the legislation, and the traffic. It includes constantly consideration of the technical possibilities of the vehicle, the goals, and the context. Neither the mechanic nor the driver would be able to change the basic design of an automobile or to discuss in general its performance in society. To make the engine run cleaner or less petrol-consuming. To make it safer and so on. That would require *the epistemic virtues of e.g. an engineer or designer*who has the understanding of the basic premises on which it operates.

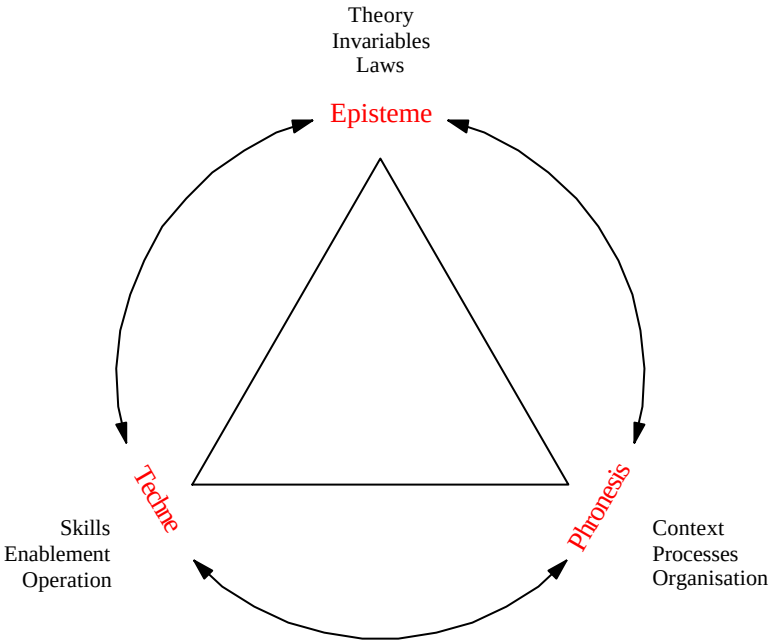

Fig. 1. Aristoteles' intellectual virtues.

Techne is the technical skills required to carry out practical tasks. It is orientated towards the making of a product. It is pragmatic and is aimed at the context in which it is implemented. Technical abilities are necessary to make things work but it cannot by itself set the scene, or asking the central questions. On the other hand, the possibility of doing things, creating concrete results, has a very strong appeal, both to the creator (the operator), the receiver, and the surrounding world. The bonds between GIS as an information technology or simply as a tool and the virtue techne seem obvious.

The *epistemic* virtue is dealing with universals. It is the (theoretic) truth that remains, invariable through space and time. Aristoles saw episteme with reference to metaphysics [5]. The basic building blocks of nature, represented as the Laws of Nature, was provided by the Gods. Later the (natural scientific) positivistic project came by to separate the metaphysic and the physical existence. Flyvbjerg [6] make a tie between the epistemic virtue and rationalism, arguing that *'..despite this ideal is dominating to day on important scientific areas of growth ... more and more are recognising the need of alternatives ... . The rationalistic turn has been so radical, that possible alternatives, which might have existed in earlier times, is lost of sight.'* [6, p. 70]. I will – in the present context - take the liberty to relinquish the definition

of episteme, to *include also other fundamental, theoretic kinds of knowledge* than only the purely rationalistic, law-seeking one.

The third virtue, *phronesis* is linked to context. It is the ability to consider values – what is good what is bad, what is efficient what is ineffective etc. Questions related to organisation, communication, as well as socical and political processes – its means and its ends - represents phronesis. In relation to GIS the phronetic virtue would require reflections regarding the way it is used, by whom, and to whom results will be presented.

Wright, *et al.* [22] takes up the discussion of whether GIS is a tool or a science. In their attempt to constitute GIS as a science, GIS is discussed in the light of 'GIS as a tool', 'GIS as toolmaking', and 'GIS as a science'. Without being referred explicitly as such, the three applies quit well to the three virtues of Aristoteles (tool = Techne, toolmaking = Phronesis, and science = Episteme). It appears that the big question is not so much whether GIS is a science or not, but rather what could constitute a scientific approach to it. It appears that if GIS is Information Technology, and Information is about the communication of 'data' between informers and receivers, it is hard not to recognise and assess GIS as a media [20]. The deveoplent of GISc [8] can be seens as an attempt to address the problems of operational GIS in a scientific light. I.e. to 'point an arrow' from *techne* towards *episteme*. As outlined earlier – with reference to Sui and Goodchild [8] - an assment of the is the generic – or scientific – issues related to the context of GIS in society is still missing. The missing arrow should point from *phronesis* towards *episteme*.

Non of Aristoteles three virtues are the 'correct' or most comprehensive form of knowledge. Obviously, research-activities will vary in degree of emphasis on each of the three virtues. There is a tendency that the more a study is orientated towards basic science the more outspoken is the address of a single of the three virtues. Au contraire, the further against applied science, the more it is a necessity to ensure a full coverage, including all three all together. The point is that when dealing with a complex field of profession like GIS it is necessary to include all three. Accordingly, it is a goal of the present paper is, dealing with definitions, to continuously address GIS in the light of these three virtues.

4. Points of dispute regarding the scientific background of GIS

GIS draws a lot of its basic theory and methodology from the traditions of quantitative geography. Accordingly, it is no wonder that some authors see the discipline of GIS as an attempt to revitalise the emphasis of the quantitative methods and hereby its positivist foundation. For a record of the debates regarding the accusations against GIS for being positivistic readers interested are advised to consult for instance [3], [12], or [17].

The geographical community is getting tired of the discussions pro and con the qualitative and quantitative approaches (incl. GIS). This situations leads to two types of reaction. a) an attempt to neglect the problem; e.g. the GIS-people are getting tired of being accused for being positivist or the qualitative researchers finds GIS complicated to use, and not leaving space for their way of thinking. Further, the operational success of GIS makes it kind of a caricature prototype of geography, at least in the eyes of non-geographers ([10] and [16]), which of course can be aggravating when fighting for funds, students, publicity etc. The other reaction is to b) investigate of the possible development that could lead to approach of the two sides. The present paper is an attempt from the GIS/quantitative side, to approach more open, non-rationalistic uses of GIS. Examples of the opposite – interests from the qualitative side to approach the quantitative – are given in e.g. [18], [1], and [17].

As a discipline GIS was initially seen purely as quantitative, technology- and data-driven. As stated by Sheppard [18, p 545] *"It is seemly self-evident that GIS is quantitative and empirist, given its computational roots in Boolean mathematics and its use for manipulating empirical spatial databases"*. Accordingly, it is no wonder that some authors see the discipline of GIS as an attempt to revitalise the emphasis of the quantitative methods and hereby its positivist foundation (e.g. [10] 1993). Further, due to the ascendance of GIS *"...to a position near the core of both planning and geography..."* Lake [10, p. 404] sees it as one of the reasons for the renewed vigour of the positivist assumptions of rational planning and applied geography. Finally he is addressing the developers of GIS to *"...relinquish their positivist assumptions"* (p. 405).

Addressing the problems of the possible positivist background of GIS is a general point of consideration for geographers and planners whether inside or outside the 'GIS-community'. Examples are [14], [3], [16], [17] and [18]. The title 'Speaking with the enemy? A conversation with Michael Goodchild' of [17] is a quite explicit expression of the awareness within the community of geographers of the existence of the problem.

This fear of planning and geography *being or becoming* GIS is responded uppon by the point that to many non-geographers GIS is the most visible and useful discipline of geography [16] and that it might jeopardise the identity of geographers if it is neglected or abandoned. Hence, *"..If geographers reject GIS then it could fundamentally affect the outsides world's perception of what geography is all about"* [14, p. 623]. As an ironic response Taylor and Overton [21, p. 1088] states that geographers will be *"left with a discipline defined by technique"* if GIS is seen too much as the core or prototype of geography.

A schism remains between the intensive use of GIS in applied geography and planning and the widespread critique of positivism - at least within the realm of theoretically inclined geographers and planners. This discussion includes reference to the tendency of GIS not only being a method or mechanism, but that it may *"transform the planning process itself by focusing attention on technical issues at the expense of political or ethical questions and by narrowing analytical attention to*

questions answerable via available technology" [10, p. 406]. This discrepancy between the theoretical and the applied GIS-approach to spatial problem-solving is central to the problem. Geertmann [7] has the same reflection regarding the different modes of operation of physical planners on one hand and GIS on the other. Behind both is the same consideration of whether GIS - as a machine and a process - is a fair representation of a reality, changing in time and space.

Among GIS-practitioners it is seen as an objective tool, a computer-based mediation of what has been well established professional traditions for a long time. The technology itself is regarded as neutral and coping with the analytical shortcomings is just a matter of further technical development. Only the measurable and quantifiable things and phenomena can be handled. Accordingly, analysis, model-design and verification of results can only take into account measurable data. This is seen - roughly speaking - as 'that's just the way the world is..'. This far there is not much doubt that this attitude has a strong positivist background. Looking at the way GIS is utilised for e.g. physical planning it is obvious that themes and data that is not 'suited' for GIS - or is just not available - are often simply neglected. This point ought to be - but is in fact rarely - considered when results are communicated.

Sheppard [18] strongly attempts to dismount GIS (and quantitative methods) from positivism and the problems related to it. First it is argued that since GIS is able to handle qualitative data – including images, video takes, sounds, texts etc. – its use and background cannot be entirely positivist. Secondly, since GIS can be used to handle and communicate imagined future situations (e.g. in terms of scenarios) the empiricism and objective linkage to positivist thinking is weakened.

The question is if the basic problems of the positivist approach and hereby the assumed foundation of GIS is so disabling that further development of GIS will not be fruitful without taking a step back to have a serious look behind the scene. The basic argument is that the important thing is not *"..what one is doing but on how one is doing it"* [10, p. 406]. I.e. if the consequences of the analytical concepts behind a certain method - in this case GIS - is unknown or undiscussed, not much can be gained by discussing or adjusting the method as it is implemented and used in practice. So, a simple 'conduct of ethics' for the use of GIS is not enough to avoid misuse and a wrong turn of development. Among the most prominent arguments raised are (mainly based on [10] and [21]): a) The data-background in question has to be measurable and quantifiable[1]. b) A method or a science like GIS, based on technological development, which again is a consequence of commercial and governmental strategies, cannot claimed political or social neutrality. c) When dealing with people as one obviously does in human geography and planning, subject and object are interlinked. Accordingly the GIS-analyst being a human being him- or herself will - aware or unaware - be influenced by the object and the related processes when analysing it. d) The basic approach to the world as constituted in terms of lawful regularities is incompatible with a respect of the individual human being of the

[1] So, you might be looking for the key you lost under the street-lamp – because that's where you can see – even though, you might have lost it somewhere in the dark.

society. e) GIS can be accused of merely being technology- and power-driven is questioned. Accordingly it can from an ethical position be asked if it is right at all to participate in the development of a technology eventually used in warfare? And again, can a technology developed for war be used in the name of peace. And finally f) since data is the ultimate background for GIS, it is claimed that data-rich regions of the world will be favoured as technology ascends.

GIS is a social construct [18]. The complex relationship between GIS and society can be understood if one conceives GIS also as a media [20]. In other media we accept to gain knowledge or be inspired or provoked, even though it is obvious that the information is formed and filtered by the organisation and technology behind the media. It is a matter of understanding the premises of the media and educating the users of the information coming out of it. Technology alters society. It alters planning too. As an obvious example it could be asked: who would claim that the invention of the telephone did not influence the mode of operation of public planning and government? And if it did, who would claim that it should not have. Central issues are; what is communicated how it is communicated, and what supporting information is communicated along with the message. If the results are presented as objective and if there could be no doubt about the fidelity of the value of the data and methods behind, the receiving person would be assumed to accept it as the truth, i.e. a true and valid representation of reality. On the other hand if the description and symbols presented includes the vagueness of the method and data the receiver will have to put more personal imagination into the use. Furthermore, if a number of possible consequences of a future development are presented simultaneously as scenarios the process of individual recognition can be made more open. The design of scenarios, especially taking the target group into account, becomes very important. Different groups requires different levels of detail, have different levels of professional background knowledge etc.

Geodata and results from GIS-analysis have classically been assessed in terms of accuracy of place, attribute, and time, leaving out the way information is used. It has been regarded as an issue the end-user alone had to deal with. The rising call for a more user-oriented development of GIS both in terms of methods, user interfaces and presentation of results demands the introduction of *communicative qualities* when assessing the quality of models, data etc. The way forward for further usefulness of GIS in planning should, rather than being technology-driven, be more user-orientated (see for instance [7]).

5. Assessing ScanGIS, - what is the agenda?

As I see it an agenda is a generalised notion of scope. This way the agenda of ScanGIS will include a description of the kinds of problems, topics and issues that is dealt with. There will always be an agenda. Implicitly or explicitly. In cases of rather open organisations - like ScanGIS - the agenda is not very clearly stated. There is nowhere it can be seen exactly what can be expected from ScanGIS activities. Never

the less we all have our ideas of what we will experience, e.g. when attending a ScanGIS conference. To assess this implicit agenda of ScanGIS, abstracts of all papers of its conferences through time were scrutinised individually and classified in accordance with the 'Aristotels scheme' outlined above. Each abstract was scored from 0 to 100 for its address of *techne*, *episteme*, and *phronesis* respectively. On that basis their position in the Aristotelian triangle was calculated. The position was overlaid with a grid. For each cell of the grid the percentage of each years production found in the cell was calculated. Figure II shows the result for the entire production from 1985 to 2001[2]. Figure 3 and figure 4 displays the results for the individual years.

The scoring was made by the author and not cross-checked by repetition or with classifications made by peers. Therefore they must be regarded as very subjective and only a representation of the authors impression. Moreover, the papers when read in full length might appear to include something different, than what was apparent from the abstract.

Table 1. Number of papers investigated. Abstracts for 1988 was not available.

Year	Venue	Number of papers
1985	Linköping, Sweden	16
1988	Hönefoss, Norway	-
1990	Helsingør, Denmark	26
1992	Espoo, Finland	25
1995	Trondheim, Norway	32
1997	Stockholm, Sweden	18
1999	Aalborg, Denmark	18
2001	Ås, Norway	19

[2] Unfortunately I was not able to locate a copy of the proceedings for ScanGIS 1988 at the time of writing this paper. Therefore it is not included in the assessment.

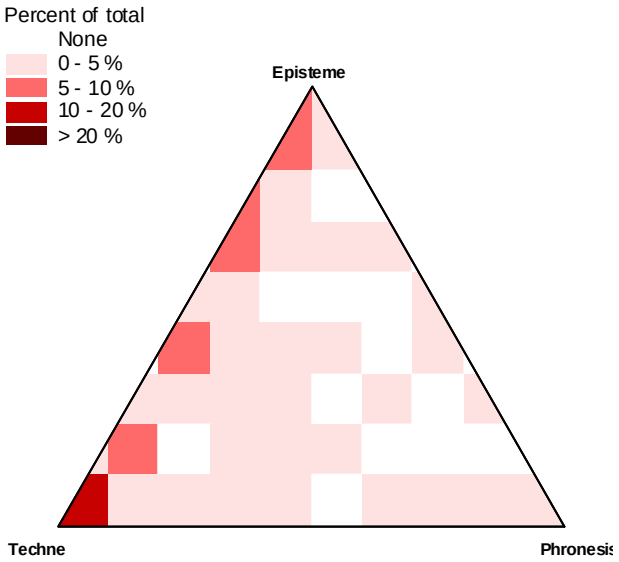

Fig. 2. Percentage of the total ScanGIS production for each cell of the Arestotelean triangle.

The overall conclusion – both looking at the entire period (figure 2) and at the assessments of the individual year (figures 3 and 4) – is that the main emphasis of the ScanGIS research agenda is on instrumental/scientific (techne/epistemic) approaches to GISc. This is well in accordance with the stages of development of the knowledge-base of the field the late 80'ties and early 90'ties, as laid out by e.g. [8]. Less effort was put into issues related to research related to the context of the use and implementation of GIS in society (phronesis).

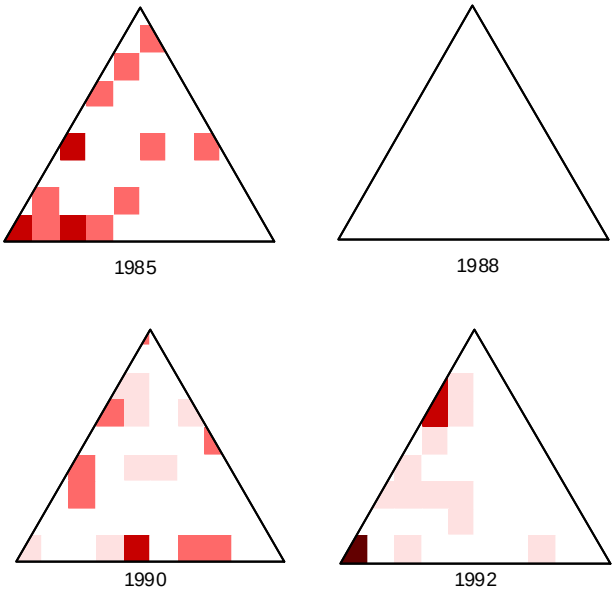

Fig. 3. Percentage of the ScanGIS production 1985-1992 for each cell of the Arestotelean triangle. The legend used is similar to the one of figure 2 above.

Looking at the individual years it appear that from the beginning in 1985 there was a fairly high percentage of papers aiming at inclusion of theoretic/scientific issues. At this time too, the scientific tendency was much on the technical/instrumental side. In the years to follow (excluding 1988, due to missing data) it seems like the wish to address scientific issues is fading (away from episteme). 1990 is special in the sense that there is a tendency of activities dragging slightly in the direction of contextual/phronetic issues. This is due to a relatively high number of papers addressing the implementation of GIS in concrete organizations. In the majority of cases this was done without attempts to synthesize generic information, that could be used in relation to other similar activities. Accordingly, these papers will appear along the button axis of the triangle, with little attention paid to epistemic issues. 1992 is back on the original track with an even more expressed highlight of the pure technically orientated issues.

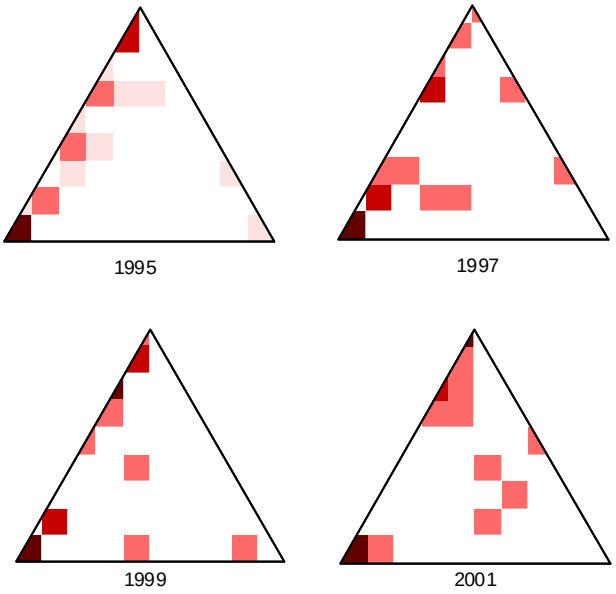

Fig. 4. Percentage of the ScanGIS production 1995-2001 for each cell of the Arestotelean triangle. The legend used is similar to the one of figure 2 above.

1995 and 1999 – and to a lesser extend 1997 – has a marked technical/scientific orientation. In 2001 there is a tendency that emphasis is moving in a direction of focus of context (phronesis) including some scientific perspectives. Issues like metadata, location-based services and dynamic (Internet-) maps are addressed in the light of structured assessments of end-users. One good example of this – probably unfairly leaving out others – is [1], where the practical problem of making metadata about geo-data understood appropriately leads to structured analysis of different user-segments.

6. Concluding remarks

If the Worlds perspective on GIS and GISc is changing in accordance with the definitions outlined, it could be asked if the scientific agenda in general and the activities of ScanGIS in specific should or ought to reflect this. Until now the ScanGIS agenda has had its main focus on instrumental/technical issues and the (natural) sciences related thereto. Less emphasis has been put on generic approaches to issues related to the context of the implementation and use, as well as communicative and cognitive aspects. Accordingly papers addressing the possible theories of generic aspects of these issues are almost absent. Contemporary definitions of and approaches to GISc have stretched beyond what is dealing solely

with data and their handling and analysis. Much more emphasis is now put in issues related to the way geographical information is presented and perceived by different user-groups. Even though a lot of applied experienced are reported these years, there is a need for a more systematic, generic and scientific approach. A more active contact to the scientific communities dealing with these issues seems – to this author - a necessity for a continued vital and inspiring life of ScanGIS.

Two basic questions – which I will leave open for now - can be raised:

1. Is the scientific/contextual approach to be a more highlighted feature in the ScanGIS agenda? And if so,
2. How should this be promoted and which (sub-) topics should it include?

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