

Reasserting Design Relevance in Cartography: Some Concepts

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Cartographers have always been concerned about the appearance of maps and how the display marries form with function. An appreciation of map design and the aesthetic underpins our fascination with how each and every mark works to create a display with a specific purpose. Yet debates about what constitutes design and what value it has in map-making persist. This is particularly acute in the modern map-making era as new tools, technology, data and approaches make map-making a simpler process in some respects, yet make designing high-quality maps difficult to master in others. In the first part of a two-part paper, we explore what we mean by map design and how we might evaluate it and apply it in a practical sense. We consider the value of aesthetics and also discuss the role of art in cartography taking account of some recent debates that we feel bring meaning to how we think about design. Our intent here is to reassert some of the key ideas about map design in cartography and to provide a reference for the second part of the paper where we present the results of a survey of cartographers. The survey was used to identify a collection of maps that exhibit excellence in design which we will showcase as exemplars.

Keywords: cartography, design, aesthetics

INTRODUCTION

Cartographers have always been concerned about the appearance of their maps and also have a tendency for being critical about the appearance of other people's maps (Kent, 2005). This trend seems to have increased as the number of professional cartographers has declined, GIS has become prevalent as a map-making tool and online web maps are now relatively easy to make by pretty much anyone. We face a situation where the pool of cartographic expertise has undoubtedly become smaller; it is possible that the need for high-quality maps has decreased and that ubiquitous map-making has lowered people's expectations. Criticism of map quality is prevalent in blogs and other un-policed platforms used to pass comment though, so clearly there is a ground for which sub-par cartography causes deep concern.

In this two-part paper, we aim to explore a little of why it is that cartographers are so passionate about the design and appearance of maps. This might go some way to explaining why some feel that they should act as map police and point out where someone else's work is not performing as an optimum communication device. Is this helpful or does it serve to isolate the profession whether they have fair comments or not? And why might people be reluctant to listen to expert advice or constructive criticism of their work? In short, we intend to shed light on some of the concepts that

cartographers know and understand and which drives their passion for design. We deal with this in part 1 of the paper.

In part 2 of the paper, we back up the concepts here by providing the results of a survey of cartographic experts that have led us to select a range of maps that we feel exhibit the best of cartographic design (Demaj and Field, 2012). Many lists have been compiled of the 'top ten' movies, albums, restaurants or any number of other facets of daily life, but rarely do cartographers state what they believe to be indicators of excellence in design. An exception is provided by Forrest (2003) though by self-admission his examples are very much a personal choice. Are they too busy criticising to tackle the issue in a more positive manner? Perhaps the problem has more to do with deciding on a top ten in a world that contains so many different types and styles of maps which are hard to assess side by side? Perhaps it may be that, ultimately, good design is partly subjective and every map will be seen in different ways by different people, so there is bound to be difficulty in creating an objective assessment? Perhaps it is because design is misunderstood and people mistake aesthetics and beauty as being a proxy for good design? We intend our surveyed examples to provide a point from which others might be able to reflect on their own work. Figure 1 provides a taster of the collection of surveyed maps that provide the focus for part 2 of this paper.

DEFINING DESIGN IN CARTOGRAPHY

No generally accepted formal definition of design exists (Ralph and Wand, 2009). Here, then, is the first problem cartographers face when trying to explain that a map is well designed or poorly designed. Without a clear definition of what cartographic design is or how it might be conceived, it is no wonder it is such a contentious issue. By definition, or lack of it, we face difficulties trying to describe how a map might exhibit good design. Informally, design as a noun refers to some sort of plan or set of conventions used in the construction of an object or a system. We apply design to the creation of furniture, cars, architecture, business processes and most other things. As a verb, 'to design' refers to the implementation of the plan. Ralph and Wand (2009, p. 109) do offer a formal definition as '(noun) a specification of an *object*, manifested by an *agent*, intended to accomplish *goals*, in a particular *environment*, using a set of primitive *components*, satisfying a set of *requirements*, subject to *constraints*; (verb, transitive) to create a design, in an *environment* (where the designer operates) [original emphasis]'. That seems to cover it!

So design is some sort of roadmap or approach that achieves a particular outcome and given that the process of making a map can be matched to these descriptors, then we are all, by definition, designers. Nowhere, though, is there a description of what makes a designer good or what makes one bad. Is it experience, intuition, skill, luck or a combination of those and many other dimensions? Can a novice map-maker design a great map. Yes. Can an experienced map maker following a sequential design process turn out a poor or uninspiring map...again, yes. Of course, when we reflect on many other areas of life, we exert our preferences in taste by exclaiming something 'looks good' or 'works really well'. Here then, we are making an emotional judgement on the aesthetic or functional dimensions of the object designed, the trade-offs and compromises that have been made and, by inference, attributing some sort of credit to the designer. Their design may have involved considerable effort and painstaking systematic application of principles or it may have been an accident of serendipity. Designers may follow a rational model which involves optimizing their work given known constraints and objectives as part of a clear plan (Newell and Simon, 1972) though in the absence of unknown goals or changing requirements and constraints, they may alternatively improvise the design process and rely on creativity to generate alternate designs. If the resulting object looks good and works well, then it constitutes good design on some level and that is when form and function work in harmony.

Design philosophies therefore exist either explicitly or implicitly to guide the principles that underpin how someone approaches a specific design task. Some philosophies guide the overall goal of a design such as KISS (Keep it Simple Stupid). A use- or user-centred design might focus on the use of the object or the needs, wants and limitations of the end user. Translating overarching philosophies into methods allow us to focus on exploring possibilities, redefining specifications and prototyping alternative solutions to improve the final object. Cartographic methods have often encouraged us to consider design and production (planning and executing) together, but design involves

identifying the cartographic problem and solution(s) and is in part a creative process. Production on the other hand is largely pre-planned, though its own processes may have a major impact on constraining the creative process.

Cartography, then, is a creative professional career where problem-solving is part of the production process. For non-professional map-makers, there is no expectation that they should know of the multifarious design philosophies or approaches to design and production, yet they are still able to produce a map given the available technology, data and the spark of an idea. Maps are every-day objects and, as such, the realm of cartography is being seriously challenged because so many modern-day maps (and particularly web maps) break accepted cartographic practice. Maps are being designed outside of formal boundaries and by new patterns of production. Is this a problem? One view might be that it is a healthy development that will undoubtedly yield new ways of illustrating information using map objects. Alternatively, one might question why people seem so intent on ignoring decades of work that has gone before which is there precisely to guide map makers. Is it laziness or ignorance not to acknowledge what has gone before or perhaps it is simply a lack of awareness and uncertainty?

The dominant theme in cartography for a number of decades was the communication of information (Keates, 1989; Kent, 2005). This remains relevant at its basic level since the cartographer's intent is to communicate something about the world by using a map and the language of cartographic symbology (Board, 1981). In many ways, information theory focused attention on the key ideas behind cartographic communication since it sought to isolate the key elements of a map and establish how they served the key function which is transmission of information. The argument goes that an awareness and control of the factors that inhibit transmission of information serves to give the map-maker a way to focus activities to meet the overall aim (Robinson and Petchenik, 1975). Ethics also plays a part in the transmission of information since a cartographer is entrusted with the choices of what to show and how to depict it. The message of a map can be fundamentally altered depending on who makes it and how it is made. Harley (1989) stressed that cartographers have a professional responsibility to question the world-view that they present on their maps and be cognisant of the impact of their choices. He went further by urging them to think of the consequences of their maps and prompt their social conscience to the point of accusing them of complacency (Harley, 1991). Monmonier (1991) suggests that a cartographic solution is a highly selective, authored view that might equally be consciously manipulated or based on 'ill-conceived design decisions about many factors, such as map scale, geographic scope, feature content, map title, classification of data, and the crispness or fuzziness of symbols representing uncertain features' (Monmonier, 1991, p. 3). Continuing the discussion, Monmonier suggests that it is impossible for a map reader to know whether the map-maker had a biased view when making the map or whether they were too lazy to explore alternative designs to offer a more coherent or complete picture of reality. Of course, this presupposes the map reader is aware that the map in front of them is in any way sub-par which,

of course, many will be unaware of so we are back to the assertion of Harley that the map-maker has an ethical responsibility given the possible shortcomings in the reader. It is worth repeating the basic tenets of ethics in cartography as Dent *et al.* (2009) outlines them because they are important values to hold when designing a map:

- always have a straightforward agenda, and have a defining purpose or goal for each map;
- always strive to know your audience (the map reader);
- do not intentionally lie with data;
- always show all relevant data whenever possible;
- data should not be discarded simply because they are contrary to the position held by the cartographer;
- at a given scale, strive for an accurate portrayal of the data;
- the cartographer should avoid plagiarizing: report all data sources;
- symbolisation should not be selected to bias the interpretation of the map;
- the mapped result should be able to be repeated by other cartographers; and
- attention be given to differing cultural values and principles.

EVALUATING CARTOGRAPHIC DESIGN

Evaluating a map is often difficult because the wide range of impacts on the design process can never be fully understood by the map reader. There may be perfectly good reasons why something is depicted in a particular way that might at first not seem particularly logical. Of course, it is up to the map-maker to keep this confusion to a minimum, but the map as an object should be the end product of the design process and the trials and tribulations of its construction hidden. Southworth and Southworth (1982) suggest the following range of guidelines that list the design characteristics of a successful map:

- a map should be suited to the needs of its users;
- a map should be easy to use;
- maps should be accurate, presenting information without error, distortions or misrepresentation;
- the language of the map should relate to the elements or qualities represented;
- a map should be clear, legible and attractive; and
- many maps would ideally permit interaction with the user permitting change, updating or personalization.

While useful, many map-makers would be unaware of this informal cartographic code of practice. These basic tenets drive the design process and have formed the cornerstone of cartographic training for decades, but in modern, democratized map-making, the guidelines are perhaps relevant but less visible or understood.

CREATIVITY IN CARTOGRAPHIC DESIGN

There is potential for lists of rigid rules to be seen as constraining the creative process in map design which might counter the desire for aesthetic appeal. Successful maps are not made by a single recipe and experience teaches a cartographer

that some recipes work well for them while others do not. Though following some basic rules can help with the process of design, true creativity is often associated with going beyond the boundaries of convention. This is perhaps where many modern maps cause cartographers such alarm, though we would contend that where some argue that they are being creative and pushing the boundaries to challenge assumptions, actually, it was more by accident than design because they were poorly equipped to realize what it was they were trying to show in the first place. Creativity might challenge assumptions, but in a cartographic sense, it is more commonly seen when someone sees patterns in data that were only revealed through their map. Creativity here, then, is the art of seeing something worth mapping and making it visible to a readership. It goes beyond simply making a map and expecting the reader to make sense of the patterns; it reveals the pattern and by so doing, illuminates some aspect of the data in a new or interesting way. Another way of applying creativity is to tackle a familiar subject in a different way. By taking a new direction or perception, we often reveal new insights and this, in turn, might help to clarify spatial patterns and relationships or reveal new connections between data. Certainly, some of the most evocative maps were designed by risk-takers who dared to try a completely new approach to a mapping task. These are more often than not maps that evoke a strong emotional response in people and in their own right set a new precedent in design. This sort of work is rare but makes cartography such an exciting area of creative design when you happen upon a new or visually stunning and effective representation of data. Whether a function of innovative, challenging design or following rules, a map will not be successful unless it meets user requirements. While pushing the boundaries in design often creates the most inspiring maps, they all share a clear sense of having been designed for a particular purpose and user group.

MAP AESTHETICS

Kent (2005) focuses on the role of aesthetics in cartography. He suggests that aesthetics has been largely ignored because of the assumptions that it neither influences the process of cartographic design (it remains a by-product) and that it exists independently from geographical information. Aesthetics is concerned with the nature and appreciation of beauty and has roots in the branch of philosophy that deals with artistic taste. Debate surrounds whether objects, or groups of objects, possess aesthetic properties or whether they are a function of subjective perception. Cartographers have tended to assert that maps can contain aesthetic properties and that this in part is why they succeed (Robinson *et al.*, 1995). This may be one area that has led to a marginalisation of cartography since if design is difficult to define and aesthetics even more so, then how can a map-maker hope to create a well-designed map that meets the needs of the users? It is true that beautiful maps are often those that are most appealing but at their basic level they are tools (Petchenik, 1985). There is, of course, no reason why we cannot make tools that are also beautiful to use (Kent, 2005) and Norman (2004) notes that attractive things make people feel good.

Technology has aggravated the issue of aesthetics and led to sterile designs. Powerful mapping software allows anyone to

easily create convincing maps and graphics with little understanding of their data, design philosophies or principles of mapping. It is certainly questionable how many of today's map-makers have even heard of, let alone consulted, Bertin's 'Semiology of Graphics' (Bertin, 1983, 2011) or Tufte's 'The Visual Display of Quantitative Information' (2006). Of course, the counter is that we now have greater openness and inclusivity and a greater range of map-making opportunities given the prevalence of freely available datasets. The words of John Wright (first published in 1944) still hold true though, regardless of technology:

An ugly map, with crude colours, careless line work, and disagreeable, poorly arranged lettering may be intrinsically as accurate as a beautiful map, but it is less likely to inspire confidence. (Wright, 1977, p. 23)

Karssen (1980) defines three main components of aesthetics: harmony, composition and clarity. Harmony relates to the extent to which the different map elements look good together (as a whole). Composition is the way in which different map elements are positioned and the different emphasis each has been given. Clarity deals with the ease of recognition of the map elements. When we enter the realm of what looks 'good' we are, in part entering the realm of subjectivity though if map-makers at least appreciate these basic ideas and use them as a guide then their maps should reflect them. How well these principles of aesthetics are applied is part intuition, part experience and part training. Map critique is actually the vocalisation of the application of aesthetics to a design solution with the goal to make it more harmonious, composed or clear.

Successful maps have at their core a clear, identifiable purpose, show correct information and are 'correct' graphically. These are fundamental cornerstones we can trace back to Robinson's seminal 'The look of maps' (1952, 2010). Additionally, Both Keates (1989) and Robinson *et al.* (1995) are clear that a successful map should be aesthetically pleasing and that visual efficiency creates clarity. If the goal in making a map is to create clarity of communication, then clarity itself will lead to an aesthetically pleasing object and a successful map will therefore require some aesthetic appeal to function.

APPLYING DESIGN IN A PRACTICAL SENSE

How we apply design through a process is most easily achieved by following a rational approach through sequential steps. Learning these steps is useful in shaping an understanding of the overall design process. There are, essentially, six main stages in designing anything: problem identification, preliminary ideas, design refinement, analysis, decision and implementation (Hanks *et al.* 1978), though, of course, they might not act or be applied independently of one another. In the first stage, need and the criteria to guide the overall design are identified. Here, we identify the map purpose and the intended audience and set limitations and deadlines. In the second step, we explore a range of ideas by brainstorming, developing alternative ideas and supporting creative thinking. In the third stage, we refine these ideas into a clear plan where ideas are selected or rejected. We

refine ideas to sharpen them and it is this from here on that drives the creation of models (prototypes) which will involve sketching right through to the development of a detailed version of the map. At this stage, we work out problems and test alternatives and where we might solicit independent views of the map to determine if it works. Changes are made throughout the decision and final stages and implementation before work is committed to a final product. Evaluation and modification is continuous and, crucially, each time this process is followed, our collective knowledge about what works or what does not work grows. Of course, this is equally true for experienced cartographers or amateur map-makers and helps us refine our own work.

Design is both indefinable and critical to the effectiveness of a map. This is not particularly helpful particularly when trying to encourage novice map-makers (or even lazy experienced cartographers!) to consider the importance of design in their own work. Design is certainly a dynamic activity (Dent *et al.*, 2009) which in part explains the problems of defining it. Perhaps we should adopt the simple definition that 'map design is the aggregate of all the thought processes that cartographers go through' (Dent *et al.*, 2009, p. 19). It involves all of the major decision-making objectives such as choice of projection, scale, typography, colour, symbology and so on, and as a designer, we seek synthesis: all features of a product must combine to satisfy all the characteristics we expect it to possess with an acceptable relative importance for as long as we wish, bearing in mind the resources available to make and use it (Mayhall, 1979, p. 90). This last point is particularly intriguing given the predilection of rapid publication supported by large datasets and easy-to-use mapping tools. The idea that a 'quick and dirty' map is useful and revealing is often cited as a reason for spending minimal time on a map. However, they are usually less than optimally designed, so we would contend that by developing an appreciation for and applying some ideas from map design, it would leave the map-makers in a better position to make effective use of limited time. Being under pressure of a deadline or facing technological limitations should not be an excuse for the inappropriate application of basic design principles. For a number of years, GIS software was poorly equipped to support good design, though this is no longer an issue. It is also true that online mapping tools have taken time to mature and this technological progress has only recently provided a medium for authoring high-quality products. Technology, then, no longer limits opportunity in design terms.

Map design revolves around the need to satisfy a particular communication goal to someone. By first knowing the nature of the problem, what the map is going to show and who it serves is crucial to how we proceed. The precision with which this is considered is also important as a clear, tight focus will help eliminate noise from the design process. Ultimately, every manipulation of the marks on the map is planned so that the end result will yield a structured visual whole that serves the map's purpose (Dent *et al.*, 2009). Map design is a complex intellectual and visual activity. A cartographer makes good use of the sciences of communication, geography and psychology when creating

a map and applies them through an appreciation of the use of the language of graphics.

THE ART IN OR OF CARTOGRAPHY

Cartography has always been described as an art, science and technology. For decades, this seems to have been a suitable catch all and cartographers have often placed themselves firmly at one of the points of that particular equilateral triangle (Figure 2). It would seem sensible for those whose pursuit is in the study and appreciation of map projections, for instance, to place themselves somewhere along the bottom axis. And what of map design? Many would tend towards placing design near to the 'art' apex but is that really where it should go? As we have tried to expound in this paper, we would contend it should be placed in the centre. It is not a purely artistic dimension of cartography – neither is it entirely to do with aesthetics and the look and feel of the map (what we might call the affective objective). It is as much about the science of cognition and the effective use of technology at your disposal. Actually, being playful, a designer would place map design at the *visual centre* of the diagram (Figure 2).

The debate about art in cartography has come to the fore recently as a number of people have questioned the value of seeing art as a component of cartography. Huffman (2011) suggests that cartography is a form of art rather than being a component of it and this, we feel, has some merit when we consider design. Art, then, is what cartography is made of and it follows that design is something that encompasses the entire gamut of the mapping process. It is impossible to divorce design from either the science of map-making or the technology you use. Huffman contends that while a lot of science goes into map-making (through the use of digital tools, algorithms, projections, colour spaces, etc.), it does not necessarily follow that cartography is a science as well as an art. As an example, many of what we might see as purely artistic endeavours (painting, sculpture) also use tools based in science...yet they are not in any way regarded as such. So

why is cartography still seen as much as a science as an art? It is true that cartographers use tools and data developed through scientific experimentation and research but so do other arts. So the art of cartography is in the way in which the cartographer applies the scientific tools of the trade and this is what we assert is the process of design towards the creation of an object for someone. The art of cartography is in the doing.

In the same way that this paper was largely prompted by a perception on our part of reluctance by some to consider design as a crucial part of good cartography, Huffman suggests that what is missing from a lot of cartography is humanity. Because cartography (and design) is fundamentally a human activity, it is incumbent on us to apply design. Machines cannot do this job for us and what we see in so many of the poorer maps that surround us is a failure to apply design by relying on the defaults offered by the machine in front of us. For most of human history, maps have been in most or in part made by hand. The marks made on a map have been deliberate and made by choice, not by a computer, which means that thought and choice has been applied. Map-making, then, is about decision-making in order to evoke a response from the map reader, not simply the loading of data into a piece of software and hitting the 'make map' button. Maps were made to build understanding, to offer a judgement or, perhaps, to create an emotional response. Machines do not do this. Humans do, yet so much of the cartographic process is now either fully or semi-automated that it acts as a design bypass. So now we have some sort of human-machine hybrid; we tend to see more and more unappealing maps or maps that suffer basic errors of design and construction. Worse, they offer very little in the way of aesthetic appeal or possess a graphical hook for our emotional response. Even worse, as Carl Steinitz once said 'far too much of what we see today goes round and round or up and down without actually saying very much and, worse, it's often accompanied by music' (Steinitz, 2010). Far too many maps do not make us think about anything because the humanity has been removed from the design and production process as more maps are made without humans or made without humans who know or who are willing to explicitly exert some design influence. Huffman ends by noting that 'there is no art without creative intention...there is no cartography without a human creator'.

The art of cartography and the art of the cartographer are therefore about purposeful design (Woodruff, 2011). Cartography is much more than simply visuals and aesthetics, it is about every step of the design process that goes into creating a map and as Woodruff (2011) asserts, 'It's about careful thought behind the design of a map, not just any work (automated or otherwise) that results in a map'. The ability to understand and apply design effectively is part of what distinguishes a cartographer from a map-maker and with that knowledge and expertise, comes a responsibility to enthuse others of the fundamental value of design.

SUMMARY

In this paper, we have reasserted the relevance of design in map-making and focused on the concepts that underpin the application of design in a practical sense. We have also

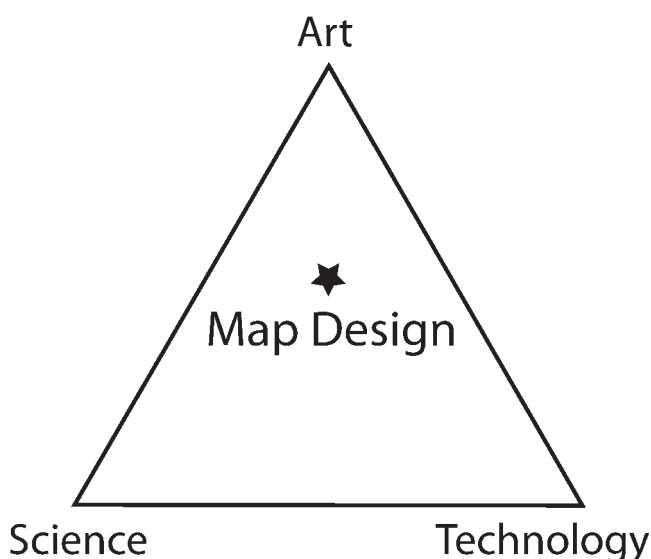


Figure 2. Map design in cartography

explored a little of the debates that exist in terms of defining design, the scope and place of aesthetics and the notion of humanity in map-making. To summarize, we would like to reassert the work of William Balchin and Alice Coleman who, in their classic paper (Balchin and Coleman, 1966) coined the term 'graphicacy' as an intellectual skill necessary for the communication of relationships which cannot be successfully communicated by words or mathematical notation alone. As human beings, we learn the skills or articulacy, numeracy and literacy at school, but rarely do we learn the medium of visual communication. Cartographers do learn this in a formal sense and learn how to apply it effectively. Most contemporary map-makers do not, so it is no surprise that, visually, many maps fail in some way or other and as Huffman (2011) notes, cartography is a very human activity that requires our intellectual input. Balchin and Coleman's ideas about graphicacy have as much (if not more) relevance in the modern mapping landscape than ever before given the plethora of map-makers and the rise of map-making. Learning by example, it seems to us, is a good way to appreciate the importance of design as a component of graphicacy in map-making. This is the focus of part two of this paper (Demaj and Field, 2012).

BIOGRAPHICAL NOTES



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DISCLAIMER

The thoughts and ideas expressed in this paper do not necessarily represent the positions, strategies or opinions of Esri.

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