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What Kind of Space is Cyberspace?[1]

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> **Space** *n.* the three-dimensional medium in which all physical things exist. (*Chambers Pocket Dictionary*, 1992.)

Abstract

With the advent and growth of electronic communication, the word "cyberspace" has entered into everyday parlance. But what does this word signify? I begin by sketching an equivalence between physical space and cyberspace, showing that they share the concepts of place, distance, size and route in common. With this mutual framework in place, I go on to examine various theories—substantival, relational, Einsteinian and Kantian—concerning the nature of physical space. We see that, while cyberspace shares some of the properties of physical space isolated by each of these theories, still it cannot be subsumed under any one theory. We also see that cyberspace exhibits several novel properties, projecting it far beyond the scope of any existing theory and setting it apart as an exciting new spatial medium.

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Introduction

Cyberspace. This word has stormed into our language and invaded our collective consciousness like no other. As the technology improves and ownership of home computers increases, we competently navigate our way around cyberspace, downloading information, reading and writing to newsgroups, and receiving and sending emails.

Cyberspace represents the new medium of communication, electronic communication, which is fast outmoding, or even replacing, more traditional methods of communication. We often send emails in place of paper letters, we leave electronic messages on bulletin boards rather than pinning slips of card to wooden notice boards,

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and more and more frequently we are able to read texts on-line—in e-journals, for instance—rather than on good old-fashioned wood pulp. The physical objects of traditional communication (letters, books and so on) are being superseded by new electronic objects. And, just as physical objects exist in physical space, so these cyber objects exist in cyberspace.

This paper explores aspects of the new spatial relationship between cyber objects and cyberspace. Are physical space and cyberspace roughly equivalent concepts? Can we relate traditional philosophical arguments about physical space to cyberspace? And do these arguments tell us anything about the nature of cyberspace?

What is Cyberspace?

> Cyberspace: a consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts … A graphic representation of data abstracted from the banks of every computer in the human system. (William Gibson quoted in Cotton and Oliver, 1994, p.54.)

These words, written by science fiction writer William Gibson, introduced the concept of cyberspace into the English language. But what does cyberspace mean for all of us today—in reality?

There are in fact two spurs of cyberspace. On the one hand, we have virtual reality—a 3-D cyberspatial environment which humans can 'enter' and 'move through', interacting with both the computer and other human beings, as depicted in films like *The Lawnmower Man* and *Disclosure*. On the other hand, we have the slightly less dramatic, but more utilitarian, world of networks of computers linked via cables and routers (similar to telephone connections) which enable us to communicate, store and

retrieve information. By far the largest and most well known of these is the Internet—originally used for email, ftp (file transfer), bulletin boards and newsgroups, and telnet (remote computer access), and now even more of a household name courtesy of the World Wide Web, which allows simple stress-free navigation of the network. This second spur of cyberspace encompasses not only the connections between computers, but also the browser and email software which transmits information, plus the internal space of the microchip and other electronic storage technologies—the places in which information actually resides.

I want, in this paper, to concentrate on the second sense of cyberspace—the notion of a worldwide network of linked computers. This is for two reasons. Virtual reality is still very much in its infancy—the technology remains crude; interaction between participants is limited; and virtual reality machines have not yet become a part of our common culture. The use of networked computers, of email and the Web, however, has become a fixture of the Western world's day-to-day life. As Robert Everett-Green (1996, p.2) puts it, "For many of those involved in these exchanges—and for millions more who have no experience of computer networks—cyberspace and the Internet have become nearly synonymous terms." Something this successful surely merits closer examination.

Are Space and Cyberspace Equivalent?

The notion of physical space saturates our ordinary everyday lives. It is a basic concept which underlies our understanding of the world around us, the entities within it and our own and other people's movements through it. And, to enlarge on this understanding, we often ask questions like: Where is the nearest post office? How much further to the pub? Will this gift fit in that box? How do I get from here to the

nearest supermarket? These kinds of questions express different facets of our common conception of space.

I suggest that we can isolate at least four facets, or sub-concepts, which go towards making up our macro-concept of physical space. These are:

- Place
- Distance
- Size
- Route

The sub-concept of *place* involves us in asking "where-type" questions. We want to know where things are situated in relation to ourselves and to other things so that we can find them, avoid them or include them in our mental map of an area. With the sub-concept of *distance*, we ask "how far-type" questions. How far something is from something else becomes important when we want to make a journey—should we go by foot or in the car; should we allow ten minutes or half an hour to get there? *Size* concentrates on "how big-type" questions. These involve dimensions—how much fits into my backpack becomes important when packing for a trip abroad. And with *route*, we ask "navigation-type" questions. To successfully arrive in London from Edinburgh, we need to know which roads connect the two cities and how—does the west coast or the east coast road provide the most direct route?

Cyberspace is also a concept which underlies our understanding—this time of the world of electronic communication, the entities which populate it and our movements through it. We need only cast a glance at the terms which have entered into modern parlance to convince ourselves that we treat cyberspace as an essentially *spatial*

medium (as the word itself suggests), and so on a par with physical space. We visit websites, we zoom along the information superhighway, we enter chat rooms when participating in IRC (Internet Relay Chat) and Microsoft advertising executives try to reel us in with the slogan "Where do you want to go today?" ™

Cyberspace, like physical space, comprises (at least) the four sub-concepts: place, distance, size and route. And the formula remains the same as for physical space. *Place* prompts us to ask "where-type" questions. On which server is a particular website located? To which email address should we send our message? And the chat room of IRC represents a cyber place. Such ways of speaking reflect the importance of locating specific targets in cyberspace. *Distance* has us asking "how far-type" questions. How many hops between how many different computers will it take for information to reach the desired destination? In this way we can calculate how long it might take for a corporate website or a personal homepage to reach our screens—calculations which become important for people with dial-up connections from home, where time really is money.[2] With *size* we ask "how big-type" questions. We might wonder how extensive a website is, meaning how much information it contains and how many links to other sites it includes. Size is also a relevant factor for ftp – how large a file is will (partially) determine how long it takes to download from the host computer to your own. And finally, *route* involves "navigation-type" issues. My email lands up in someone else's mailbox by following a specified route or set of connections, while Web browsers enable us to reach out from our own computers and explore the electronic universe, as we follow links, moving from site to site.

It appears, then, that space and cyberspace can count as roughly equivalent conceptual entities, at least in the sense of sharing the four common sub-concepts of place, distance, size and route.

Substantival (Absolute) vs. Relational Theories of Space

Philosophy has traditionally understood questions about the nature of space in terms of the dichotomy between substantivalism (or absolutism) and relationalism, with Newton and Leibniz as the two key proponents. The crux of the matter is this: does something exist over and above spatial relationships between entities, something in which those entities inhere (i.e. absolute space)? Or does our concept of space amount to nothing more than those entities and the spatial relationships between them? Paul Teller (1991, p.363) states the dichotomy well:

> Is it [space] a substance, a collection of particulars ("points," or "regions"), existing independently, and providing an objective framework of spatial reference ("substantivalism")? Or should we say that substantival space is an illusion, there being nothing more than the spatial relations holding between physical objects or events ("relationalism")?

Newton (quoted in Lacey, 1970, p.318) clearly states his substantivalism in the *Principia*:

> Absolute space, in its own nature, without relation to anything external, remains always similar and immovable. Relative space is some moveable dimension or measure of the absolute spaces; which our senses determine by its position to bodies, and which is commonly taken for immovable space; such is the dimension of a subterraneous, an aerial or celestial space, determined by its position in respect of the earth. Absolute and relative space are the same in figure and magnitude; but they do not remain always numerically the same.

And Leibniz makes an equally clear case for his relationalism in his third letter to Clarke (Alexander, 1956, pp.25-26):

> … I hold space to be something merely relative… I hold it to be an order of coexistences, as time is an order of successions. For space denotes in terms of possibility, an order of things which exist at the same time, considered as existing together; without enquiring into their manner of existing. And when many things are seen together, one perceives that order of things among themselves.

Some of the points of difference between Newton's substantivalism and Leibniz's relationalism most relevant to the concept of cyberspace discussed in this paper can be summed up thus:

1. Substantivalists believe that there are two kinds of irreducible spatial entity—purely spatial positions or places in absolute space, and physical entities which do or can occupy those positions or places. Relationalists believe that the *only* spatial entities are physical objects.[3]
2. Even if there were no physical objects, space would still exist; but physical objects cannot exist without space (they need a place in which to exist), according to substantivalism. Since space simply comprises physical objects and the relations between them, the annihilation of all physical objects would mean the annihilation of space, according to relationalism.
3. From the substantival point of view, space neither affects nor is affected by (enters into causal relations with) physical objects. For the relationalist, all physical objects can enter into causal relations.

What might Newton and Leibniz have said about cyberspace? Assuming that both would have accepted my arguments for the rough conceptual equivalence of space and cyberspace, the question becomes: can we describe cyberspace as either substantival or relational? More specifically: can cyberspace exist as an independent entity over and above those entities which it accommodates?

Cyberspace, as we have already discussed, comprises networks of linked computers, the actual space at issue being the storage in which information resides, the cable network through which that information is transmitted, plus the software which enables transmission. What, then, count as the physical objects which fill cyberspace? Again, as we have already seen, information in its many forms—email messages, websites, files, notices on bulletin boards—all of these comprise the cyber objects of cyberspace. With this basic framework in place, we can begin to determine whether cyberspace might be absolute or relational:

1. Are there one or two types of irreducible cyberspatial entity? Are there absolute positions in cyberspace over and above the cyber objects which occupy those positions? The answer looks like being affirmative. Even if we have no emails when we log on, still there exists the potential for emails to be stored—a type of 'place' in cyberspace represented by so many bytes of free storage. A computer with the requisite software to host an internet site, but with no content on that site, provides a second example. An absolute position in cyberspace exists, simply waiting to be filled with information. Likewise for information on the move—at any one point in time we could theoretically[4] point out the 'place' in a network through which a specific piece of information was passing—and that 'place'

would exist whether or not information was passing through it at the time of our inspection.

2. Can cyberspace exist in the absence of cyber objects? What would be left if all cyber objects were annihilated? Computer storage would remain. We would still have the *potential* to store cyber objects. So too would the connecting cables remain, even though they weren't occupied in transmitting information. The *potential* to transmit does not disappear along with the information. Can cyber objects exist in the absence of cyberspace? The answer here seems to be a resounding no. If we destroyed all computer storage along with all cable connections, we would thereby destroy all cyber objects. Electronic information is intimately tied up with the cyberspatial medium and can neither exist nor be transmitted in its absence. In summary: cyber objects depend on cyberspace, but cyberspace does not depend on cyber objects.

3. Does cyberspace enter into causal relations with cyber objects? Yes, certainly. Cyberspace is the medium of cyber objects and is responsible for their existence (see point 2 above). This is so in two ways. Firstly, cyberspace (the enabling software plus cable connections) allows for the transmission of electronic information from point A to point B; it facilitates the appearance of cyber objects on our computer screens. Secondly, when we access a cyber object, a specific website for example, that object is retrieved from storage, sent through cyberspace and reinterpreted so that it appears on our screens as the author originally intended—cyberspace allows for the de- and reconstruction of cyber objects.

So can we describe cyberspace as either absolute or relational? The arguments above do not provide us with a conclusive answer, although the weight of evidence seems to slightly favour an absolute interpretation. Cyberspace shares two important features of substantival space: (a) two types of irreducible cyberspatial entities exist (cyber objects and places within cyberspace) and (b) cyberspace can exist in the absence of all information, but cyber objects depend on cyberspace for their existence. Regarding causality, however, it seems that we must go over to the relationalist's side, holding that cyberspace *does* enter into causal relations with cyber objects. Perhaps it isn't so surprising that we are forced to disagree with the substantivalist here, though. Newton argues that absolute space is a physical reality, yet he insists that it neither affects nor is affected by the objects within it. This sounds like a contradiction in terms, since causal power constitutes one of science's primary means of determining whether or not something is real. Take ghosts, for example. On some world views, ghosts are said to exist, but the scientific method finds no evidence that such spirits enter into causal relations with the material world and so, on a scientific world view at least, ghosts are simply not real, they do not exist. It looks, then, as if the difficulty is with Newton's conception of absolute space, rather than with the suggestion that cyberspace might be absolute. Perhaps his position requires some reconstruction regarding causality in order to be fully convincing.

Einsteinian Space-Time

With Einstein's Special Theory of Relativity, conceptions of space, and also time, took on a new meaning. The Special Theory relies on two basic postulates: (1) All observers, whatever their state of motion relative to a light source, measure the same speed for light; and (2) The laws of physics are the same for all inertial frames. And, as Einstein showed, certain relativistic effects flow directly from these two postulates.

Specifically, the Special Theory introduces the importance of *observer dependence* into our understanding of space and time. Einstein states (1952, pp. 9-10) that we must "entirely shun the vague word "space", of which…we cannot form the slightest conception" and replace it by "motion relative to a practically rigid body of reference" (or "system of coordinates"). By way of illustration, he uses the example of someone throwing a stone from the window of a uniformly moving train. To an observer on the train, it looks as though the stone falls in a straight line. To an observer on the embankment, it looks as if it falls in a parabolic curve. He concludes (*ibid*., p.10): "The stone traverses a straight line relative to a system of coordinates rigidly attached to the carriage, but relative to a system of coordinates rigidly attached to the ground … it describes a parabola." And so there is "no such thing as an independently existing trajectory." It's all in the eye of the observer.

Perhaps most famously, Einstein showed that our notion of absolute simultaneity (the idea that two events judged simultaneous by one observer will be judged simultaneous by all) is mistaken. If two flashes of lightning strike the railway track at two points, A and B, an observer on the embankment may see them as simultaneous. However, to an observer on the train, travelling towards the light coming from B and riding ahead of the beam coming from A, it will appear that flash B occurred *before* flash A. Einstein concludes (*ibid*., p.26): "Every reference body … has its own particular time; unless we are told the reference body to which the statement of time refers, there is no meaning in the time of an event."

Importantly, Einstein's work shows us not only that space and time are, in a fundamental sense, observer dependent, but also that space and time must be treated *together*, rather than as two separate mediums. The notion of a purely spatial

separation between events is ambiguous since any such distance will be measured differently by observers in different states of motion and, likewise, the time elapsed between two events will also depend on the observer's state of motion. The universe in fact represents a continuum with both spatial and temporal dimensions—space-time—according to Einstein. This insight prompted the mathematician Minkowski to make the well-known pronouncement that: "Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union between the two will preserve an independent reality." [5]

How can Einsteinian space-time contribute to our understanding of cyberspace? Well, up until now, I have been treating cyberspace as independent of any temporal dimension and have analysed cyberspace in terms of the four *spatial* components: place, distance, size and route. Yet time, I contend, plays a fundamental role in our understanding of cyberspace. And the importance of time comes to the fore in relation to *distance*.

Recall that I claimed that distance has us asking "how far-type" questions. In terms of cyberspace and cyber objects, this translates into talk about how many transmissions between how many different computers will be necessary in order for us to receive the information we require—for a particular website to reach us, for example. Recall also that I emphasised that "how-far type" questions become important in relation to cyberspace when we are concerned with *time*—when the amount of time it takes for a site to reach us is directly proportional to the size of our next phone bill, for instance.

Now, there is an important sense in which geographical and cyber distance are *not* equivalent: time taken to traverse geographical distance involves a direct measure of

how many miles place A is from place B, but time taken to traverse cyber distance does not. Let's illustrate with an example. London is closer to Paris than to Montreal. Let's say Paris is roughly 200 miles away from London, whereas Montreal is roughly 3000 miles away. Knowledge of the distance involved allows me to make a direct calculation of how long it will take to get from London to Paris versus how long it will take to get from London to Montreal—I simply divide the number of miles to be travelled by speed of travel per hour. If I am travelling in a plane at 400 mph, then it will take me 30 minutes to arrive in Paris and 7 hours and 30 minutes to arrive in Montreal.[6] Yet performing a similar calculation based on measures of geographical miles and speed of travel of electronic information will not give an accurate reflection of how long it will take that information to travel through cyberspace. This is because information does not pass directly from the host to the destination computer—it must pass through a number of intermediate computers before landing up on your screen. And the number of intermediate computers involved does not necessarily reflect the geographical distance involved. For instance, it can often prove quicker for me in Britain to access a website in the USA than to access a site in Europe, even though Europe is geographically much closer to me. Our conceptions of cyber distances therefore rely much more heavily on comparisons between time taken for information to arrive than on comparisons between geographical distance travelled.

So, to properly reflect our understanding of distances in cyberspace, it looks as if we need to take a leaf out of the Einsteinian book and treat (cyber)space and time together. Two internet enthusiasts who are trying to access a site which is at an equal geographical distance from both of them may well find that it takes differing lengths of time for the information to reach each of them. Hence, the notion of a purely spatial

separation between cyber places is ambiguous since any such distance involves an understanding of the temporal as well as the spatial dimensions of cyberspace.[7]

Of course, this fundamental difference between physical distance and cyber distance largely reflects a metaphysical difference between physical space and cyberspace, namely, physical space (if it exists) is infinite and not of our making, whereas cyberspace is finite and is of our making. This means that we can make calculations of distance in physical space based on the most direct route possible or as the crow flies, regardless of whether there actually are roads or flight paths following that route. Yet in cyberspace there can be no notion of distance as the crow flies, simply because there is no distance independent of route taken. Cyberspace restricts us in a way that (theoretically) physical space does not. Imagine, for example, two next door neighbours who own computers which are connected to different networks. If I want to get from one computer to the other, I can (theoretically) just walk though the walls of the houses to achieve my aim. Yet electronic information passing from one computer to the other will always be restricted to the designated routes (cables) of cyberspace. There is not even a theoretical possibility of passing through walls in cyberspace.

Kantian Conceptions

For Kant, spatial relations are mind-dependent. Our conception of the universe as extended spatially beyond ourselves is not a feature of reality (or things-in-themselves), but simply a function of the *a priori* scheme which we project onto reality and through which we interpret reality:

> Space is not an empirical concept which has been derived from outer experiences. For in order that certain sensations be referred to something outside me … and similarly in order that I may be able to represent them as outside and alongside one another … the representation of space must be presupposed. (Kant, 1929, p.68.)

Since space is simply a schema which makes possible our experience of a world external to ourselves, once space is separated from the schema it "stands for nothing whatsoever" (*ibid*., p.71). Thus space, for Kant, is "empirically real", but "transcendentally ideal".

We might perhaps want to give a Kantian interpretation of cyberspace—we cannot envisage or experience cyber objects in the absence of cyberspace and so we (incorrectly) attribute cyberspace to the world-in-itself, instead of recognising it as an *a priori* schema necessary for our experience. Kant insists that (*ibid*., p.68), "We can never represent to ourselves the absence of space, though we can quite well think of it as empty of objects." Perhaps this is why the application of Newtonian ideas about absolute space sound convincing when applied to cyberspace. Perhaps my suggestion that cyberspace remains, even after the annihilation of all cyber objects, reflects my *a priori* structuring tendencies.

Yet cyberspace depends much more heavily on human constructs than even the Kantian analysis of physical space suggests. It is not simply a matter of us envisaging cyber objects existing in cyberspace, our psychology allowing us to do nothing else. Rather, we are actually responsible for the creation and upkeep of those cyber objects and the space in which they exist. In the words of Everett-Green (1996, p.2): "The Internet depends upon its users to supply and share content and to act cooperatively to aid its dispersal." We are responsible for making information available, for ensuring

ease of navigation, for improving and speeding up technology, for censoring inappropriate material, for responding to questions and queries, for keeping information flowing and knowledge growing. Without these ongoing human activities, cyberspace and cyber objects would become meaningless. And this is something we certainly cannot say about many objects in physical space—mountains, rocks, stars, electrons etc.—whatever kind of *a priori* schema we have for individuating these objects. In this sense at least, cyberspace depends on human control and construction in a way that far surpasses any kind of subjectivist interpretation of physical space.

Conclusion

I have argued that cyberspace can be broken down into the four sub-concepts, place, distance, size and route and that our understanding of cyberspace is (roughly) equivalent to our understanding of physical space. On the basis of this similarity, I have shown that we can apply a number of philosophical positions regarding physical space to cyberspace.

I am not, however, claiming that cyberspace is exactly similar to physical space, nor that cyberspace can be subsumed under one particular theory of physical space. Rather, we have seen that cyberspace exhibits characteristics associated with each of the theories covered in this paper—substantival, relational, Einsteinian and Kantian—and in fact encompasses other characteristics far beyond the scope of any of these theories. This should hardly come as a great surprise, given that cyberspace represents an exciting new medium which allows us to communicate, teach, learn and understand in ways never before imagined.

Despite the differences, cyberspace is, in one way, intimately connected with the physical world. Cyberspace depends, for its very existence, on hardware and software, cables and routers—it depends on physical objects existing in physical space. And, of course, this intimate connection between the two also represents a fundamental difference—physical space, if it exists, depends on nothing at all.

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Notes

[1] With many thanks to Steffan Corley for his comments on and criticisms of an earlier draft of this paper.

[2]As we will see later on, our conception of cyber distance is intimately tied up with time in a way that our concept of geographical distance is not.

[3] Modern day relationalists include events in the set of spatial entities, but for ease I simply use the phrase "physical objects".

[4] I say "theoretically" because we need at least the two provisos that we can 'look into' networks and see what is going on at any moment in time and that we can work at the speed of light!

[5] Quoted in J.R. Newman (ed.), 1956, *The World of Mathematics*. New York: Simon and Schuster.

[6] Obviously this is an idealisation given that planes do not always travel at a uniform speed, they have to take off and land, their progress may be inhibited by other traffic and so on. But we can still say that travelling time more-or-less reflects geographical distance.

[7] Incidentally, the traditional substantival/relational debate continues in relation to Einsteinian space-time, with the independent existence of space-time points now being the bone of contention. See, for instance, Christensen (1981) for discussion.

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