LANGUAGE, ACTION, AND COMPUTER NETWORK INTERACTION

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Abstract: As computer networks become an increasingly dominant influence in the architecting of computer systems, it is of the utmost importance that computer system designers develop coherent perspectives within the domain of networked human interactions. The corpus of work in speech and language action theory (Austin, 1955; Searle, 1969) has had a dramatic impact on computational linguistics and has led to new understandings of how network technology can support more productive levels of group work and action. The notion of "conversation for action" (Flores, 1981) has become the foundation for a new human/computer network paradigm. This paper attempts a broad synthesis, through an understanding of the shaping influence of language action, into a perspective which transforms our traditional noun/object based design orientation. We describe here one nascent direction for the design of computer systems as networks of linguistic media.

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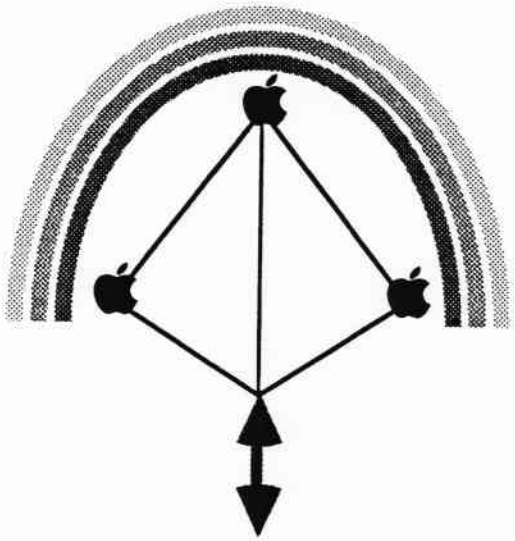
"The way to figure out what needs to be done is through exploring the human sensory and cognitive system and the ways that humans most naturally interact. Join this and you grasp the future."

- Nicholas Negroponte (1987)

"Computer technology always moves in the direction of doing more with less. ··· material-wise there is not very much to a computer. What counts is the knowledge of how to put things together to perform usefully.

- Arthur L. Loeb (1975)



"· Smalltalk is a vision. ·Smalltalk is based on a small number of concepts, but defined by unusual terminology. ·Smalltalk is an environment. ·Smalltalk is a big system."

- Goldberg and Robson

It is the year 2000. A student of the history of technology asks his appleTree™ for interaction with The Buckminster Fuller Works. He feels a tinge of joy when he receives Fuller's challenge: "*Dare to be naive.*".

Contents

1. Linguistic Distinctions

Winograd and Flores (1986-87) have noted that in the various domains of human work and action (the educational classroom, the scientific research laboratory, the business office, etc.) we find patterns of human language usage which form a tacit structure underlying the possibilities for coordinated action. The fundamental notion with which we are here concerned is the background of shared linguistic distinctions -- that within the various spheres of human action, it is the distinctions created by language which allow people to perform in significant ways and especially to perform together. While this may, at first glance, seem obvious or even prosaic, when we look more closely we realize that the entire universe of *action* in language, and its semiotic consequences, is massively under-examined, masked as it is from ordinary consciousness by its intrinsic environmental pervasiveness.

> When something is invented -- say, the tape recorder -- it is invented linguistically; a new distinction is introduced into the language that people speak. Now people can ask someone to loan them a tape recorder, request that meetings be tape-recorded, and so on. A tape recorder isn't an object. It isn't a machine that was invented when *a* tape recorder was invented. Rather what was invented were possibilities for action.
>
> -- Flores and Graves (1986)

Obviously, the existence of physical objects which are specific instances of tape recorders is not being called into question. The important point here is that along with the invention of the physical electro-mechanical system called "tape-recorder", there is also invented a new distinction in the language which opens a new domain of possibilities for action. In our example here, this new domain of linguistic action is also called "tape-recorder" and without this corresponding linguistic distinction the electro-mechanical phenomenon called "tape-recorder" might just as well be used as a "boat anchor". Another example will help to clarify: a combustible, black powder made from saltpetre, sulphur and charcoal was invented by the Chinese and used by them in the artistic activity of pyrotechnic displays long before it became "*gun*powder", a distinction which opened-up many new possibilities for action in war and hunting. It is not the physical existence of *things* alone which is significant. Rather it is how we represent them linguistically which frames our relationship to them and reveals the possibilities for action intrinsic to their nature. Distinctions in language are that aspect of mental construction which are critically controlled for the purpose of identifying and segregating within the flux of experience those aspects or elements which belong fundamentally to the order of what *is* -- the constructions the mind makes in order to be in a world in which it can know and act (Deely, 1982).

This emphasis on the actions which are made possible through linguistic distinctions provides us with a natural, process oriented perspective for the analysis of how people might interact with each other through the use of network technology. From the language/action perspective (Winograd, 1986) we tend to view a network, for example, as possibilities for various actions which one may take when one is *net-working*. The noun becomes a verb, and a domain for linguistic action is created.

2. Computer Networks as Linguistic Media

There are two assumptions regarding our concern with computer network technology which need to be made explicit from the beginning: 1) With large international projects like the Integrated Services Digital Network (ISDN), ubiquitous infrastructures of high quality computer networks will become as commonplace as the telephone is today. In many countries, networks will become a public utility like gas or electricity. 2) With these very large scale digital networks, the computer will evolve into a mature linguistic medium. Millions of people will use the computer as a way to extend their domains of linguistic action.

To begin to see the many possibilities of linguistic support, extension, and even transformation which network technology has brought and may bring, we must first move beyond the "ordinary" view of language itself. We must begin to view language as more than an intuitively transparent constant -- as if it is enough to think of language as the phonology, syntax, semantics and so on of English, French, HyperTalk™, etc. We must begin to see language from something of an anthropological perspective, i.e. as the cultural vehicle which establishes a common background of experiences, habit structures, and sign relations which embody the history of existing groups or form the foundations for new groups.

Above all, given network technology as our present focus, we need to develop a clear understanding of the relationships between computer network technologies and the linguistic backgrounds which will be supported, extended, transformed, and mediated by them.

In so far as our computer network systems become a ubiquitous part of the background of linguistic action in the world, they must be designed simultaneously for integration into a preexisting context of linguistic distinctions, and also provide new possibilities for linguistic effectiveness. We must shift the focus of conception toward the networks themselves and the qualities of virtual space we create by designing and using them. This is not to say that the computer is unimportant or to be taken for granted. It is merely that the computer as a linguistic medium does not exist apart from its component position in a network. "The computer" must become part of the *background* of support. Even the fundamental computer/microprocessor technology is moving in this direction with the advent of powerful processor technologies which exist like logic elements in a design library ready to be integrated into further levels of system complexity. In such an integrated environment, "the network" becomes part of the existing background in support of linguistic action, and "the computer" itself might even be presented as an icon which is supported by those possibilities for action which are, more or less, universally associated with "computers" -- "the computer" may become a virtual "tool" within the greater virtual space created by "the network". The network itself is a structure of inter-relationships within a larger background of supra-relationships which includes human "natural language" and other aspects of human culture. Computer networks are *post-linguistic* structures. They follow the development of and presuppose the existence of an ongoing linguistic background. They form a medium which, as Deely states,

> exist(s) beside, alongside, aside from, language (itself) -- yet based on and derivative from it. And they (post-linguistic systems) *react* upon language [they "shape it", as might be said], by influencing the semiotic exchanges that transpire through language.

When we design a computer network as linguistic medium, we are, ultimately, designing a set of shaping influences for linguistic action. This is because we are designing a new medium, the content of which is the preexisting medium of language. It is this quality of being a medium, as it were, for another medium, which gives the relationship between computer networks and language its unique (and perhaps confusing) self-referentiality.

After Deely, let us attempt to graph the relative position of the post-linguistic medium of computer networks in the continuum of human experience (Fig. 1 below). We are here concerned with gaining ground toward a clear conception of the location of computer networks within the space of linguistic experience and action. This mapping of location will allow us to more clearly see the relationships between computer networks and language in general. Fig. 1 is divided into three main areas: 1) At the level of perception, the organism is involved in a synthesis of sensations which is primarily determined by the structure of the organs of sensation (our enumeration of sensations, i.e. color, taste, etc. is not meant to be exhaustive). For example, by virtue of the spatial positioning of our eyes and other basic structural features of our vision system, we humans have binocular and stereoscopic vision which allows us great depth of field of focus. Our vision systems have evolved in such a way that we have an intrinsic faculty for perceiving the spatial relationships around us, even at very great distances. Anthropologists know that our distant

predecessors were tree dwelling primates who evolved a range of spatial faculties so that, among other things, they would be able to judge how far they must jump in order to reach their next prehensile perch, rather than fall short and become extinct. To our great advantage we humans have retained and continued to evolve our sense of spatial relationships. 2) The need to express our perceptions has led to the development of natural language, which we will explore in the next section. For now let us note that beyond the fact of using grunts, gestures, etc. to express hunger, anger, fear, and so on, our ancestors at some moment also must have grasped the notion that the

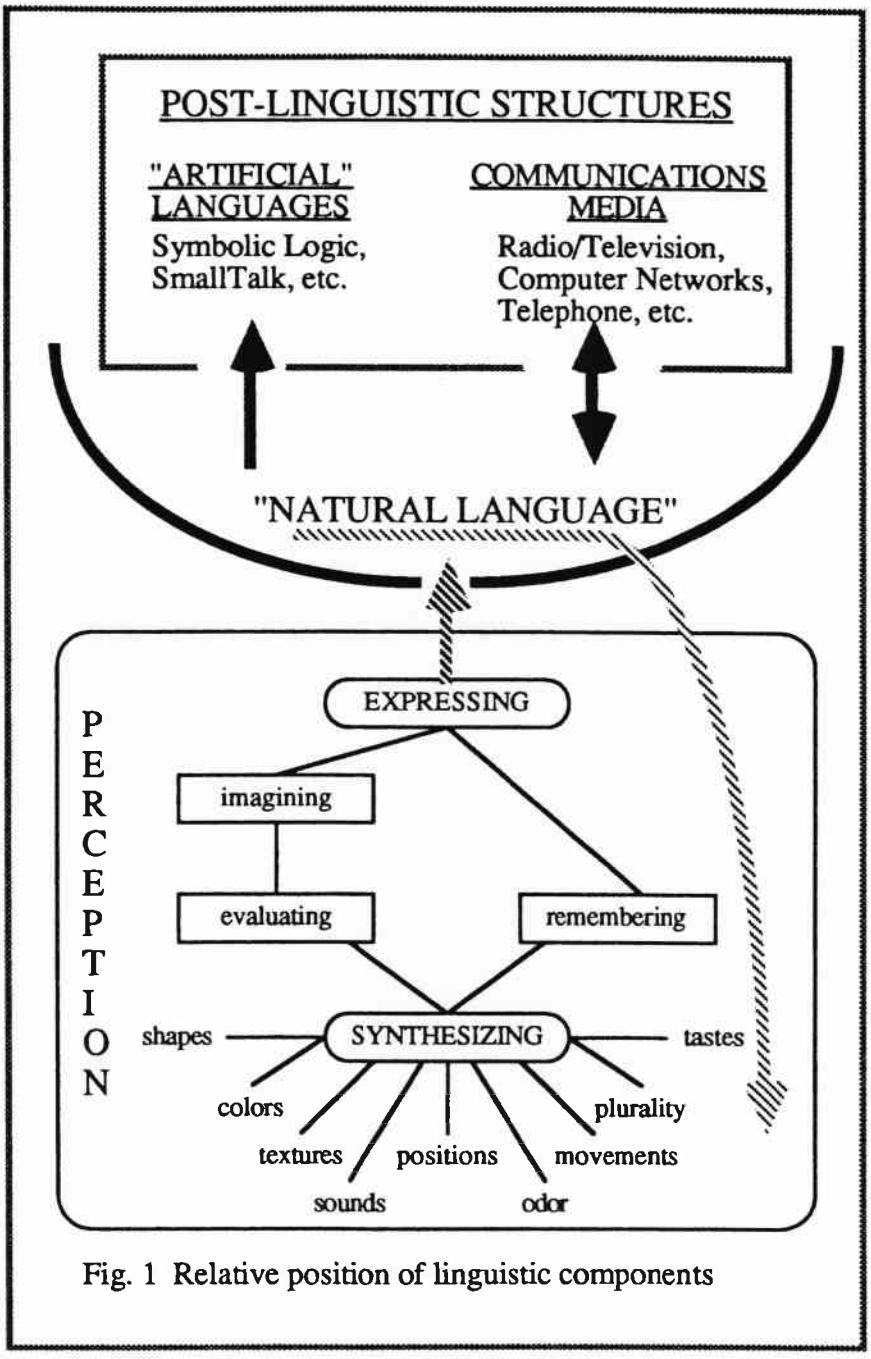


Fig. 1 Relative position of linguistic components

act of grunting or gesturing itself was distinctly possessed of the virtue of representing something other than itself, of the virtue of "signifying" (Maritain, 1957). 3) From our linguistic orientation to the world have emerged what John Deely calls "post-linguistic structures". Again, our examples are far from exhaustive but they serve to express the relationships with which we are here concerned. Deely himself includes Religious Traditions, Civil Government, and Business

Institutions in a more inclusive level of post-linguistic structures. Our focus is on the lower level of technological infrastructures.

3. Language

Marshall McLuhan (1964) observed that "Language does for intelligence what the wheel does for the feet and the body". In the taxonomy of human experience, language is *the* technology for the amplification and extension of human intelligence. The "creation" of verbal patterns may have been preceded by emotive grunts, gestures, and images (Paleolithic cave art), but with the advent of human verbal language (Fig. 1, "Natural Language"), the mind itself finds its means of transportation -- its means of interaction with itself and other minds. Natural language is *the medium* of human intelligence.

Intelligence itself, however, can take many forms, and the experience of understanding and acting in language is very different from one culture to another. As a rather extreme example, there is the story of the UNESCO project which brought water pipes into the individual dwellings of a remote Indian village. The villagers soon asked that the pipes be removed -- their social life had taken a downturn because they no longer had to meet at the communal village well to fetch their water. To the UNESCO people the water pipes were offered as a "modern convenience", but to the villagers the pipes meant an unwanted change in their cultural milieu. This example will serve to emphasize the importance of context or background to the meanings associated with actions. Notice also that the "performative" action (Austin, 1955) of installing the water pipes is neither true nor false in the declarative sense. It simply turned out to be, as Austin would say, an unhappy performance. Language itself is both a part of, and an evolving influence on, the backgrounds of cultural meaning associated with human performance.

The domain of our performance within the virtual space defined by computer networks is language. The kind of action which it is possible to mediate and support with network technology is action in language. This is not to say that video, graphic icons and graphics images in general are not an integral part of network communication -- they are and will continue to grow in importance. However, in so far as pictorial images and icons are part of network communication, the desired result of which is not passive viewing, but rather some action, then even networked graphic images, video, etc. must be woven into the fabric of linguistic communication.

> All linguistic communication involves linguistic acts. The unit of linguistic communication is not, as has generally been supposed, the symbol, word or sentence, or even the token of the symbol or word or sentence, but rather the production or issuance of the symbol or word or sentence in the performance of the speech (linguistic) act.
>
> - Searle, 1969

Searle's "speech act" perspective on language shifts our emphasis, within the medium itself, away from the objects of language (symbol, word, sentence, etc.) to language as medium for action/performance. This performance oriented perspective tends to create *action domains* from the ordinary assumed meanings of things including linguistic meaning itself. We are led beyond merely representational, noun oriented meanings toward a realization of opportunities for activity. Language *acts* within us, on us and from us. As an example, the word "video", in modern usage, has become a noun which passively denotes the visual elements of television (or in common slang a certain type of packaging of anything to be viewed and heard on television). In the original Latin, however, "video" is a verb which indicates the act of seeing (one might say the art of seeing), and in particular, seeing things which are intentionally provided for one to see. If one were to study video from this perspective, one would study the art or science of seeing things which are contrived to be seen (since F. de Saussure this has been part of the field known as semiology), as well as the "things" which make up modern "video technology". The emphasis is on the human activity of seeing, and on the possibilities for working with that "seeing" as action. This new verb based emphasis opens up a domain for all kinds of activities which our usual use of the term "video", as a thing, has the effect of masking-out. The possibilities for involvement in

activity are hidden behind an edifice of things. Notice that to make this *shift* in perspective we move through a kind of virtual linguistic space, over or around a representational tableau of nounness and things, into a domain of verbness and possibilities for involvement in activity, and that we are transported through this "space" in the vehicle of language.

"thingafication" of action:

From the noun/thing oriented perspective even the notion of action itself is demoted to the level of a thing. In recent computational paradigm work, we see the development of anthropomorphic "actors" and "agents": anthropomorphism of computational functions so that the "user" has the illusion of an anthropomorphous relationship with computer technology. This is nothing more than the presentation of computer technology as a surrogate for a *human* servant. It is easy to see how offensive this direction can become when we consider the racial consequences of the color of the pixels which represent the "agents" "flesh", or the ethnic accent of its synthetic "voice", or its represented "sex". It is the thingafication of human individuality and action which is offensive. Negroponte uses the term "unethical robots" for some of the products of this design direction. But beyond the potential for social and psychological offense, the presentation of computational functionality behind the mask of an anthropomorphic image represents a poorly thought out design relationship between form and function. The highly complex and uniquely personal relationship between human intelligence, creativity, and knowledge; the nature of human memory; the interplay between the conscious and the unconscious mind -- the fact that individuals possess highly idiosyncratic ways of actually generating personal conceptual contexts, from one moment to the next, in which to embed new information and thus give it meaning; that individuals tend to remember what an experience has meant to them rather than the details of the experience itself -- all this hardly speaks well for a design approach which attempts to characterize the relatively simple functions of computational technology in the image of a human being (even the human image reduced to a cartoon). The rich products of the human mind do not reveal themselves to be of the same specialized, simple, functional character as the workings of computational technology. Our survival as a species is attributed to our ability to respond with great flexibility in our interactions with the world. The "if-then-else" "choice" constraints of computational logic are of a different order than the "as-if-probably-in-some-contexts" processes of human thought. It is generally agreed that a high level of specialization (constraints) in a species leads to greater opportunities for extinction. Human adaptability favors probabilistic generality over narrowly accurate and specific computational constraints. When our designs present the functions of computational technology through the medium of a human image, we are, in effect, saying that a human being is a metaphor for computational technology. The problem with using an anthropomorphic image as a metaphor for computational functionality is that its form is not a good design match with the functions it embodies (*as the study of human cognitive processes advances into the 1990's this mismatch will become even more obvious).* The great success of the Apple Macintosh "desktop" metaphor, on the other hand, stems from the well thought out ontological relationship between its form and function (between the metaphor and the possibilities for activities it supports). The fact that the local, personal "desktop" is no longer a compelling metaphor for many functions of computational technology is the result of the new, central, and transformational role which network technology is playing in computer architecture -- not the result of computers becoming more like human beings.

From the language action perspective, anthropomorphic "actors" and "agents" represent an awkward attempt to extend the thing oriented perspective beyond its meaningful limits. In the domain of language action and interaction, the focus is on *human* involvement, participation, and performance. The concept of a pack of little anthropomorphic "actors" and "agents" milling about some supposed "world" of computational things, performing great services on our behalf, is just the sort of hallucination to which one is led by staring too long at things without acting.

Here, in the English speaking West, we are all carriers of this fundamental orientation to the world as thing, as object. It is a "world view", formed in us by the language which we use to express the world to ourselves and others. It is a sad, but natural, result of this view that we even see ourselves and each other as things. Even our most progressive institutions have departments of "Human Resources", revealing our deeply rooted tendency to view human beings as just another

industrial resource to be consumed. On the other hand, if we shift the emphasis of the phrase "human being" considered as a noun, to human being as an activity in the world, we perform a simple magic which opens up the previously hidden possibilities for involving the total human in the conscious activities of his or her "being-in-the-world" (Heidegger, 1962).

> A rose, for instance, grows, has thorns, blossoms, and fragrance, but often is stored in the brain only under the single word -- *rose*. As Korzybski, the founder of general semantics, pointed out, the consequence of its single-tagging is that the *rose* becomes reflexively considered by man only as a red, white, or pink device for paying tribute to a beautiful girl, a thoughtful hostess, or last night's deceased acquaintance. The tagging of the complex biological process under the single title *rose* tends to detour human curiosity from further differentiation of its integral organic operations as well as from consideration of its inter-ecological functionings aboard our planet. We don't know what a rose is, nor what may be its essential and unique cosmic function. Thus for long we have inadvertently deferred potential discovery of the essential roles that are performed complimentarily by many, if not most, of the phenomena we experience.
> ...
> My old semantics permitted common-sense acceptance of such a sentence as, "A man pounds the table." I found it necessary to change this form to a complex of events identified as *me*, which must be identified as a verb. The complex verb *me* observed another complex of events identified again ignorantly as a "table". I disciplined myself to communicate exclusively with *verbs*.
>
> -- R. Buckminster Fuller (1975)

Here is an example of Fuller's verb oriented language (1981): "Conventional critical-path conceptioning is linear and self-under-informative. Only spherically expanding and contracting, spinning, polarly involuting and evoluting orbital-system feedbacks are both comprehensively and incisively informative." -- Fuller is always evoking the action-inflection of linguistic distinctions. His writing is linguistic action formed from action-inflections. This is what Gregory Bateson (1972) means by the term "Metalogue", i.e. when the way you are communicating is part of what you intend communicating.

Of course, we are dealing with *relative* inflections and properties. We are not suggesting that one should, or even could, drop one's orientation to the world of objects and things. We would lose our ability to function in the practical "day-to-day-world" without our fundamental orientation to the "world-as-thing". It is, however, our understanding that the traditional stress on nounness and thingness creates the illusion that the language is exclusively a representational system of signs (words, phrases, etc.) which "stand for" things, i.e. material objects, emotions, mental states, the world, etc. In addition to the thing-inflection of a linguistic distinction, there is also an action-inflection. A linguistic distinction *is* sign, but *functions* to actively design (de·sign; de·sign·ate) the possibilities for linguistic action. To rephrase: there is a naming dimension and a verbal dimension to linguistic distinctions. In Latin the word "verbum" (verb) means word. In English the word "verb" means a word used to indicate an action, occurrence, etc. When we add the suffix "-al" to the word "verb", we form "verbal" which pertains to the use of words in general. The fact that in English many words do commonly function as both nouns and verbs serves to illustrate our point. For example, a complete definition of the word "engineer" includes the noun/name sense: person skilled in a branch of engineering ("Dave is an engineer."); and the verb/performance sense: bring about, construct, create, act as engineer ("Dave can engineer the project."). In this latter case the word "engineer" is not a simple sign which stands for an object, thing, etc. -- it refers to a domain of activity and to Dave's performance in that domain. With the invention of the *ENGINE* a new domain for activity was generated. The inflecting suffix *-er* was added to express the sense of a person acting within the new domain. English gerunds, e.g. *smoking* in "Susanne's *smoking* bothers me.", which have been such an ambiguous mystery to linguists, may simply evoke the action inflection of a distinction (Susanne's smoking) which, on

the surface, seems to contain a possessive and a verb yet in reality is simply Susanne involved in the activity of smoking (Campbell, 1982). Susanne does not own the *thing* called *smoking*, rather she is in the domain of activity signified by the linguistic distinction.

Now, it is our program to create a paradigm which is constituted of a subset of linguistic distinctions, relevant to computer network interaction, which are fundamentally possessed of action oriented, i.e. performance/process inflected meaning. This action-inflection must be present directly from the distinction itself. However, before we attempt such an ambitious synthesis, let us look into the semiological contrast between the noun/thing and the verb/action orientation to "the world" through language. This will firm-up the foundation on which we construct any meaningful work.

4. The Shift from Thing Oriented to Action Oriented

Out of our "Natural Language" background, our post-linguistic structures have emerged. But notice that in Fig. 1 the arrow which connects "NATURAL LANGUAGE" with COMMUNICATIONS MEDIA points in both directions, indicating a reciprocal interaction between them.

> While computers probe and imitate the "society of mind", they are also shaping the mind of society. Computers and communications have already blended so far that they are one activity, still without a verb to express what it does. We don't even have a word for the nervous activity in the body -- it's not "thinking", "sensing", or "talking". All the chemical and energy activities in a body (or a society) have a word for their sum action -- "metabolism" -- but there's no equivalent word for the sum of communications in a system. The lack of a word signals a deeper ignorance.
>
> - Stewart Brand (1987)

> Synergy means behavior of whole systems unpredicted by the behavior of their parts taken separately.
>
> - R. Buckminster Fuller (1975)

We wish to clarify the nature of this reciprocal interaction (synergy), and in particular we wish to understand how the paradigmatic shift from "world-as-thing" to "world-as-action" in natural language may be supported, extended, and made manifest through the use of computer network technology. To gain light toward this clarity we must first see how it is that we human beings stand in relation to "world-as-thing" on the one hand, and to "world-as-action" on the other.

"world-as-thing":

We stand *before* the "world-as-thing" in language. The world is a thing and we are a thing perceiving the world. From this completely Newtonian perspective, we "live" in a world which is significant to us only in so far as we can use or not use the things of which it seems to be made. The popular slogan, "Meaning Is Use" embodies this perspective. That which we believe we cannot use, we think of as in a kind of reserve for possible future use. Our fundamental relationship to the "world-as-thing" is that of user to that which is used. Knowledge of the "world-as-thing" takes the form of recording, as John Searle says, the "brute facts" of empirical observation. The fundamental semiotic activity in this thingification of the world is as follows: 1) We wish to stand apart from and to dominate the world around us; 2) Linguistic distinctions are "created" which allow us to represent the world to ourselves as a collection of things which we may dominate in two ways: a. we control them by using them directly, e.g. consume them, transform them, etc.; or, b. we segregate them out and bring them under the inquisition of the scientific method, i.e. we trap them or frame them in their thingness and interrogate them, demanding that they reveal how they *work* (so that we may either put them to work for us or simply represent them to ourselves, categorize them, etc.). Until very recently, the momentum of

Newtonianism gave us a "golden era" in which we tried to stand apart from the world and simply use it, fix it in a taxonomy, or trash it. The cover of the October 31, 1988 issue of **U.S. News & World Report** is completely dominated by the words: "PLANET EARTH · *HOW IT WORKS · HOW TO FIX IT*". The following is an excerpt from the cover article:

> Power plants that instantly turn 100-million-year-old coal deposits into atmospheric gases and bulldozers that plow tropical rain forest into grazing land may not threaten the existence of the planet -- but they could alter the environment for decades or centuries. Even a few degrees' change in the average temperature of the planet could make Iowa a desert and Alberta a breadbasket, and raise sea levels enough to flood Florida and the Caribbean islands.

In Life magazine's January 1989 issue, which features "1988: THE YEAR IN PICTURES", the main article is entitled *"THE EARTH STRIKES BACK"*:

> In a year of political violence, presidential elections and Olympian feats, the most significant story of all was the planet we live on. Buffeted by decades of abuse the earth unleashed furious forces. It has begun to demand our attention in ways we can no longer afford to ignore.

These distinctions do not express the specialized perspective of a handful of scientific researchers in ecology, biology, zoology, etc. They are becoming part of our most important shared background of linguistic distinctions: those which we hold concerning the world in which we all live. Today it is not clear whether all of the damage which we have done to the world in which life lives is reversible. It is not yet clear that we will physically survive our own will to dominate as expressed in the way we "defend" ourselves with nuclear weapons. Clearly our Newtonian view of the world and each other as mechanism, as thing, is inadequate even for our own survival. Taken on its own, Newtonianism is a reckless oversimplification. We are now forced (by the very feedback processes of our environment) to see that we do not stand apart from a world made up of things in which we ourselves are the special, dominant thing. Where once we only saw a thing to be used, we are forced now to recognize the existence of a *domain* in which we ourselves live and act. Our actions determine our relationship to the domains in which we live, and, as we noted above, it is the distinctions we make in language that determine what we understand to be possible in action.

As Nobel Prize winning physicist Ilya Prigogine (1984) has stated regarding Newtonian science:

> ...[it] is no longer our science. Not because we are concerned today with new, unimaginable objects, closer to magic than to logic, but because as scientists we are now beginning to find our way toward the complex processes forming the world with which we are most familiar, the natural world in which living creatures and their societies develop.
> ...
> The first objects singled out by Newton -- falling bodies, the pendulum, planetary motion -- were simple. We know now, however, that this simplicity is not the hallmark of the fundamental: it cannot be attributed to the rest of the world.

The scope of this paper does not permit an extensive account of the revolution which is now proceeding in science as a result of the shift from the *dynamics* of Newton's lifeless world of things to the *thermodynamics* of the highly complex and inhabited world of active matter and time.

"world-as-action":

We live *within* the "world-as-action" in language. We are a part of the active matter of the "world-as-action". The world is a *lattice of domains* for involvement in action. Within this lattice are all human institutions with their systems of rules for determining the legitimacy of actions.

According to Searle, human institutions provide the contexts and rules which give meaning to linguistic action. Searle defines "institutions" as "systems of constitutive rules":

> Our hypothesis that speaking a language is performing acts according to constitutive rules involves us in the hypothesis that the fact that a man performed a certain speech act, e.g., made a promise, is an institutional fact.

Searle goes on to segregate "institutional facts" from what he refers to as "brute facts". Brute facts comprise a type of systematic knowledge which is epitomized by the natural sciences and the general record keeping of empirical sense experiences. Institutional facts, on the other hand, require some consensus of rules which constitute an institutional background of sanctions. When action agrees with the constitutive rules then we have an occurrence of an institutional fact. When action does not agree with the constitutive rules then either the rules must be enlarged to accommodate and assimilate the new action, or the new action will be viewed as alien to the institution in which it has occurred. For example, group "charters" form an important method of making explicit the constitutive rules which form the institution or sub-institution which is the group.

We would like to expand our field of vision beyond Searle's speech act relation and the constitutive rules and sanctions of human institutions. It is our understanding that human activity in language is part of a closely packed continuum which includes all other human activity. Language is not merely an institutionally validated tool that we use to communicate with each other. Language is a medium through which we perform the acts of "communicating with", i.e. understanding, the world. Searle himself seems to understand this when he writes:

> There is a certain picture we have of what constitutes the world and consequently of what constitutes knowledge about the world. The picture is easy to recognize but hard to describe. It is a picture of the world as consisting of brute facts, and of knowledge as really knowledge of brute facts. Part of what I mean by that is that there are certain paradigms of knowledge and that these paradigms are taken to form the model for all knowledge.
> ...
> Leaving aside the question of the status of statements in ethics and esthetics, which are controversial areas anyway, there are many kinds of facts, and facts which obviously are objective facts and not matters of opinion or sentiment or emotion at all, which are hard if not impossible, to assimilate into this picture.
> ...
> They (institutional facts) are indeed facts; but their existence, unlike the existence of brute facts, presupposes the existence of certain human institutions.

It is our understanding that the world of "brute facts", into which Searle cannot fit his "institutional facts" of linguistic action, is the very "world-as-thing" which we have discussed above. Searle's "institutions" are really domains for linguistic action. The constitutive rules of these domains, in the broader sense, may or may not be of human convention. Searle's main hypothesis is that "speaking a language is engaging in a rule-governed form of behaviour". As we have noted above, "the world" (including our natural environment) may react to the actions to which we are led by the kind of knowledge or distinctions in language we possess. The rules of our natural environment are most certainly not of human invention. It is our understanding that the linguistic action of speech is essentially the same as other forms of linguistic action, e.g. understanding the meaning of this essay, or learning that there is a hole in the Earth's ozone layer by listening to it said. Thinking, reading, and listening are linguistic actions which entail a sort of speech (linguistic) act to oneself. Thinking, reading, speaking, seeing, and listening are all also domains of linguistic action in which most of our abilities to perform in significant ways are formed. Our "*picture of the world*"; the *world-as-tableau*; the *world-as-thing* -- *it* is very significant, but it is

only through the *representational inflection* of language that it is formed. There is also the *action inflection* of linguistic distinctions. The action inflection of a linguistic distinction is like a door which opens out into the possibilities for involvement in activities. The representational inflection of linguistic distinctions provides us with our picture of the world, which we observe from outside the borders of its frame. Searle cannot fit language acts into our picture of the world because we do not experience them from outside; we are directly involved in the activities of language as linguistic action. Linguistic action is part of us. By extension, part of what we are is a medium for our own knowledge, understanding, and action. Linguistic action makes us a self-referential process vis-á-vis the world.

After more than forty years of research in nuclear physics, David Bohm (1987) writes:

> ...we customarily say, 'One elementary particle acts on another', but each particle is only an abstraction of a relatively invariant form of movement in the whole field of the universe. So it would be more appropriate to say, 'Elementary particles are on-going movements that are mutually dependent because ultimately they merge and interpenetrate.' However, the same sort of description holds also on the larger-scale level. Thus, instead of saying 'An observer looks at an object', we can more appropriately say, 'Observation is going on, in an undivided movement involving those abstractions customarily called "the human being" and "the object he is looking at".'
>
> These considerations on the overall implications of sentence structures suggest another question. Is it not possible for the syntax and grammatical form of language to be changed so as to give a basic role to the verb rather than to the noun?

Now, in Sanskrit (or Sanscrit), to which all the Indo-European languages are strongly related (and perhaps in large measure derived), the *verb* is the root. There is a verb-root within every word. This verb-root does not change during word formation as its meaning is variously directed and inflected by the use of prefix or suffix. For example, the Sanskrit word *janman* is translated as the noun *birth*, but it is formed of the verb-root *jan* (to be born) and the inflecting suffix *man*. The effect of the inflection is to represent the *activity* of being born in its noun, thing orientation as *birth*. In Sanskrit, if the root itself forms a complete distinction, as in the case of *jan* , there is no need of prefix or suffix to inflect the action orientation -- it is already a verb. It is no accident that the verb is the root in Sanskrit. The verb-root of the word *Sanskrit* is *kri* which means 'to do or act' along with *sam* (the classical spelling is *Sam*skrita) meaning 'to make perfect, complete'. A sense of process, of becoming *bhâva*, of activity is absolutely basic to the distinctions of Sanskrit. The primacy of the verb-root in the ancient and highly influential natural language of Sanskrit serves to illustrate a naturally occurring system of action oriented distinctions.

Our desire to make this shift in perspective from language as a representational medium to language as a form of action follows our realization that a fundamental shift in our way of being-in-the-world has already occurred. It is the shift from the idealized illusion that we stood before the world-as-thing armed with our will to dominate, to our present inescapable realization that we are, ourselves, an integral part of the active matter of the world-as-action. Further, we are inextricably linked to the world by the impact of our actions; that action in language is one of our most significant modes of action (perhaps the most significant); that the possibilities for action in language are generated by linguistic distinctions; and that our linguistic distinctions are shaped to a large extent by the technological environments of post-linguistic communications media such as computer networks.

When we design an instance of a networking communications environment, we are shaping the possibilities for linguistic action out of the raw material of linguistic distinctions. We *perform* with a word processor, or a network, or any other computer based technology through the linguistic distinctions which are made manifest by its *system*. As designers we may be either conscious or

unconscious of this, but it is always at the heart of the design, and it is also what ultimately becomes most obvious as people begin to work within the constraints and possibilities which the design embodies. The first phase of design is *always* -- intentionally or inadvertently -- the design or adoption of the linguistic distinctions which will become manifest in the final form of the system.

5. Network-Space / NetWorkspace

In the architecting of any computer system environment there are spatial relationships which are created. When one shifts the focus of conception, as we have, to the network itself rather than to the "on-line-data" or "the computer", one becomes aware of a different kind of spatial relation which is central to our understanding of what a network may be. All action implies a space for that action to unfold. Linguistic action within a computer network takes place within network-space. There is a *geometry* to network-space which simply does not exist in the personal computer as a separate entity. The way in which we characterize the nature and relationships of space which are generated from the distinct qualities of computer networks will determine a large part of our design perspective and the set of problems or breakdowns we bring into focus.

Earlier we mentioned that we human beings are the inheritors of many highly evolved faculties for the perception of spatial distinctions. Our primate predecessors adapted to life in the aborial domain of the forest canopy, where a keen sense of spatial relationships were formed by a combination of DNA algorithms and the selective influences of the environment. These early Primata moved their entire bodies about through the trees, from perch to perch, high above the earth, in order to be with sources of food and each other. One can envision the primordial forest canopy as a sort of archetypical primate network of spatial relationships through which our "primary" predecessors communicated using vocalizations, and by moving themselves from point to point. Anyone who has ever seen a Gibbon monkey swing fluidly through a jungle canopy cannot help but be impressed with the integration of the animal's movements (brachiation) in the "network" of branches and trunks in which it performs 90 percent of its locomotion. Even in our human technological world we naturally use the tree as a metaphor for the way we organize abstract linguistic relationships. We often organize our "world of language and information" into "tree structures" so that we may navigate through it using purely linguistic relationships. We speak of computer programs "branching" at certain points, "root" directories, "leaf" nodes, network "trunks" etc. Almost the entire anatomy of trees has been metaphorically reapplied to signify a set of spatial relationships which exist only abstractly and linguistically within the cognitive domain of computer "information". (Not to place too fine a point on it, when computers became "personal" , i.e. part of the individual human domain, they were often given names like Apple, Acorn, Apricot, etc. In the early days of the personal computer industry it was something of a pun around Silicon Valley, which had once been covered in fruit orchards, to see the fruit of this new industry ripening here and there.)

On a more down to earth level: we understand that there is a fundamental link between the kind of *virtual linguistic space* which is created by computer networks and our basic human adaptive morphology of spatial perception; and that our highly developed, multi-dimensional sense of spatial distinctions was "selected for" in adaptation to the aborial world of our primordial predecessors. Viewed in this light, we will now attempt to characterize the nature of the "spaces" which are created by computer networks.

When we move from the local, individual, private space of our personal computer into network-space, we are moving into a new domain of possibilities for a new sort of action. It is a shared space; a group space; a social space; a space in which the focus is on inter-action and synergy between individuals who "inhabit" the space, and on coordinated or orchestrated action. This completely new kind of technological space is itself the subject of a new set of architectural concerns and questions. As designers we are suddenly faced with the problems of creating a completely abstract representation of a conceptual linguistic domain.

We will advance the working hypothesis that this new network-space *is* a *domain*, and that within this domain there exist *vectors* along which linguistic inter-actions "travel" between the "inhabitants" of the domain. Efficiency urges us to insure that inter-actions always "travel" along a *geodesic* vector, i.e. shortest possible line over a surface. Thus our network-space is a domain in which inhabitants are connected by inter-actions along geodesic vectors. Let us clarify our meanings. What do we mean to signify by the word *domain*? From the perspective of etymology, it is consistent to extract the root word *dome* from domain. Both the French *domaine* and the English *domain* contain the notion of *sphere* in their ancient and modern meaning. A dome is generally hemi*spherical* in form. The Latin word for dome is *domus* which means *house*. The French word *dome* means canopy or vault. Our definition of network-space will follow from this as *a space circumscribed by a dome which is structured from geodesic vectors*. The intersections of these vectors will signify the spatial positioning of possible inhabitants or possible interfaces with other sub-domes or higher-level-domes. We thus have structured a *geodesic dome* to signify the fundamental character of network-space (Fig. 2).

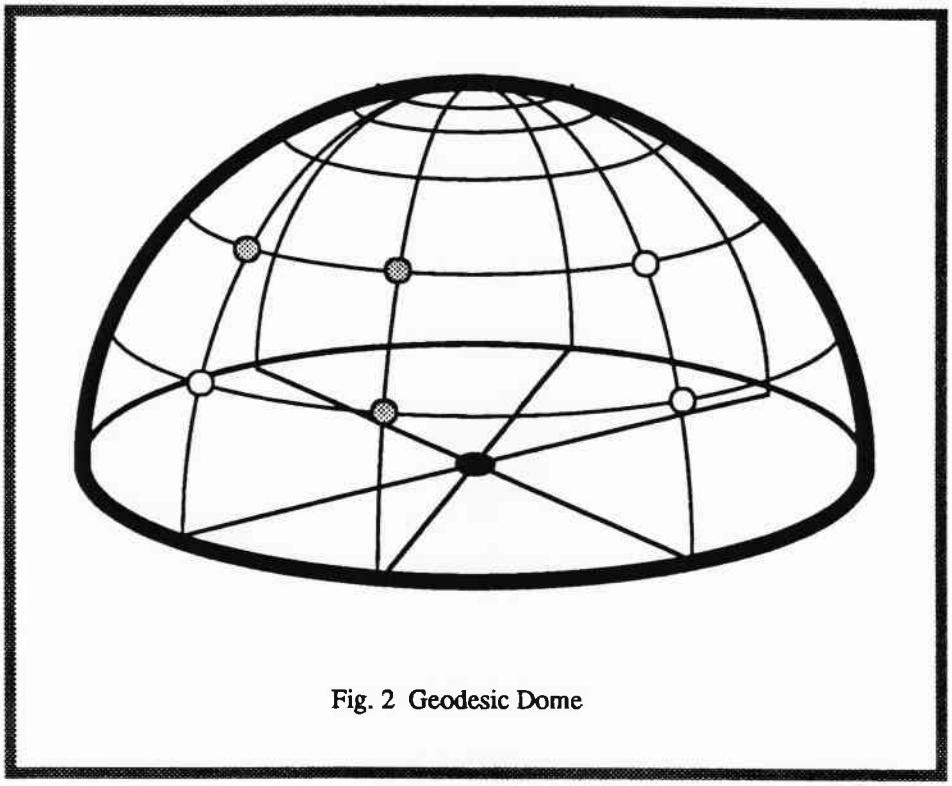


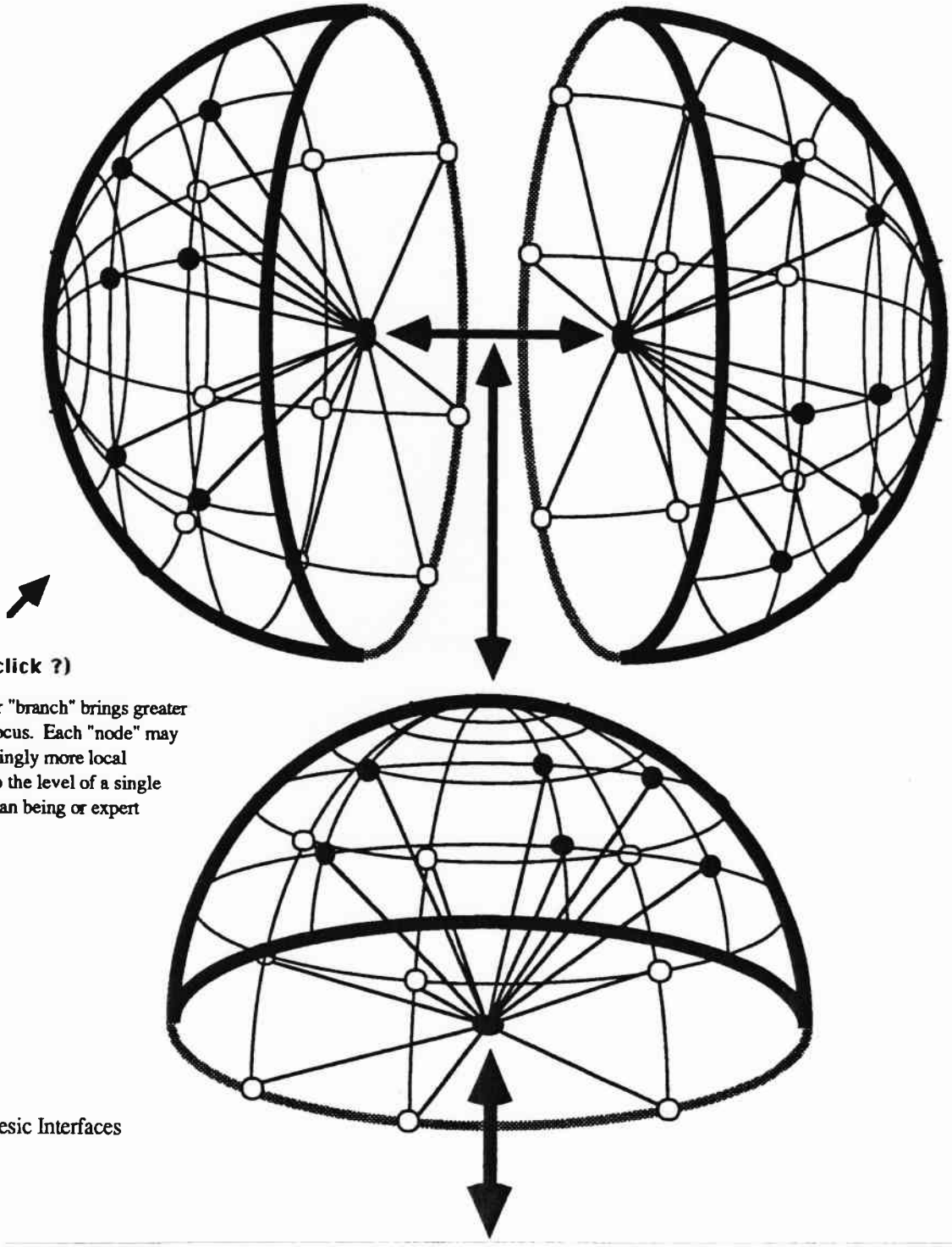
Fig. 2 Geodesic Dome

Interfaces between higher-level-domes and sub-domes will occur at a point in the center of the circle at the base of the sub-dome which is intersected by vectors from each inhabitant position on the canopy of the sub-dome, and the local intersection of vectors on the higher-level-dome (Fig.3).

This organization of network-space provides us with a general structure or context in which we may embed linguistic distinctions, i.e. *signs* which refer to: (1) inhabitants, (2) the linguistic actions and inter-actions which are explicitly supported by the system, (3) the building blocks for constructing new actions and inter-actions as needed, and (4) the location of various forms of "on-line" (we would rather say "vectored") information or applications, e.g. expert systems, databases, document creation with graphics tools, mathematical tools, telephony, multi-lingual translation, etc. Thus our working definition of network-space: *a dome of intersecting geodesic vectors which serve to connect the inhabitants of the dome canopy to each other and to other domains.*

Within a graphical representation of this network-space, we may easily distinguish relevant domains for our linguistic action -- from inter-action with a single other individual and vectored information, to large group inter-action involving any number of domains and sub-domains.

Within domain-space we can support notions of foreground and background space, and all of the rich set of 3-dimensional relationships needed to coordinate activities and find objects. The addition of some small amount of interactive "animation" can allow us to "go" *in-out-and-around* a richly dynamic geodetic depth/space. Notice that this representation of **net·workspace** *is a domain of possibilities for linguistic action.* It is a topology which orients the inhabitants of the domain-space to each other and the "world of language and information" which is formed by the network. To paraphrase Flores and Graves: A (*network*) is not an object or thing. It is not a machine that was invented when (*computer network technology*) was invented. Rather what has been invented are possibilities for action. Our **geodesic·domain·net·workspace** is a setting in order of our experience of linguistic action using network technology.



Each "trunk" or "branch" brings greater local domain focus. Each "node" may contain increasingly more local sub-domains to the level of a single individual human being or expert system, etc.

Fig. 3 Geodesic Interfaces

6. Networked Linguistic Inter-action

The background which we have so far developed serves as a sort of preadaptation to linguistic inter-action in network-space. Several key notions have emerged. We have stated that mediums for natural language, such as communications networks, have a shaping influence on the natural language acts which occur within them. There is a kind of code or grammar which is more or less intrinsic to a given communication medium. For example, the telephone tends to appropriate language which is shaped toward the intimacy of speaking directly into someone's ear. The telephone allows us to eradicate the conversation breakdown which came with physical distance, and delivers our spoken word within the intimate vicinity of the human ear. So long as our telephone conversation is personal and friendly, the medium of the telephone itself vanishes into the background and all that exists for us is the conversation. On the other hand, if we receive an impersonal or a "threatening phone call" from someone, if the tone of the conversation is not friendly enough to feel safe within the intimate space of direct physical contact to the vulnerable ear, then the medium comes more into the foreground of our experience -- it becomes a "telephone call". The general shaping tendency of the telephone on natural language acts is to adapt them to the intimacy of close contact with the ear. Of course this also establishes a very effective channel for violating that intimacy. As McLuhan so ardently put it a quarter of a century ago:

> The child and the teenager understand the telephone, embracing the cord and the ear-mike as if they were beloved pets. What we call "the French phone", the union of mouthpiece and earphone in a single instrument, is a significant indication of the French liaison of the senses that English-speaking people keep firmly separate. French is "the language of love" just because it unites voice and ear in an especially close way, as does the telephone. So it is quite natural to kiss via phone, but not easy to visualize while phoning.

Communications networks which include computer technology at their interface with humans have an element of linguistic flexibility which common telephony, radio, or television, etc. do not possess. The ability to use computational technology to proactively shape the surface of linguistic action and inter-action carries with it the potential not only to eradicate communications breakdowns but also to enrich the possibilities for the communicative activities in which we may participate. The basic distinctions which are manifest in the interface are, in an ultimate sense, "the system", but it is the way in which we, so to speak, "open out" from the basic distinctions into their human performative inflection which is most engaging. The central design question becomes:

"What actions can the *performer perform* from these distinctions in this medium?"

Computational technology as communications media possesses an intrinsic and active linguistic element which is derived from its fundamental "machine-language" core, and which is variously transformed through stages of *translation* toward its logical conclusion in a full scale representational simulation of environmental images, textures, sounds, etc. Throughout each stage of the possible translations, out from the basic linguistic architecture of the processor technology, to the encoding of text characters, to "interactive" three-dimensional images on a display, the significance of the computational medium itself shapes the character of the language which is generated through its use. The process of encoding distinctions within the surfaces presented by computational technology which serve to open up possibilities for language action, structures the expressions which will occur during communication.

Computational technology as "the computer" tends to stress the representational role of linguistic distinctions. To answer why this is so, we must first examine the essential nature of the distinctions implicit in the technology itself. Let us begin by looking at what we commonly call "data" stored in a computer memory, i.e. more or less appropriate, *primary representations* of *things*. Even an individual digital signal *value* ("bit") of "on" or "off", "high" or "low", "one" or "zero" has obvious linguistic data value in a given *context* in that it may *represent* a number, or a level, or a direction, or a state, or a yes-or-no answer to a question, etc. But even at this most primary level of the representational function of an electronic voltage, the action/performative

inflection is present, although distantly so, as signified by the constantly implicit *OR*-choice ("on" OR "off") performance of the human author(s) of the choice-determining computer program. Data becomes information when a decision must be considered. In making any choice between "this" OR "that" there is a moment of indecision which was reached by the human being(s) who wrote the program. We may recognize the programmer's action at this level as a sort of OR-logic-choice-performance, but because the programmer's act of choosing is in the past relative to the time of use, we only become aware of it when a breakdown (such as a bug) occurs, which in turn brings "we-the-user" to a moment of irresolution.

At the most fundamental level, *logical* patterns are imposed on electronic voltage values in order that they may *represent* things (at first level usually numbers, text characters, gray-scale values, colors, etc.). From an array of these fundamental data elements, i.e. logically patterned electronic voltage values, the essential function is one of choice: this or that numerical digit, this and this gray-value *OR* that and that gray-value, character, color, etc. The OR-logic action of *choice* is the essential linguistically active media influence of computational technology. Thus we begin to see that from its very essential nature digital computer technology implies both representation and action. However, because action in relation to computational technology is traditionally thought of as the action of the computer program, the human performative action of the programmer(s) only becomes apparent when a breakdown occurs. This, of course is all part of the basic machine nature of a computer and is extremely useful in domains of calculation, problem solving, simulation, etc. The fact that linguistic activity at this level tends to be constrained to a sort of choosing between representations, i.e. translations or encodings, of *things*, is less cause for alarm than for opportunity. While the richness of representation may be carried so far as to attempt to simulate "the world" or even the human mind, if we can *program* (act) in the simulating language we can still choose which world and who's mind.

Now, what happens to this kind of relatively closed system of programmatically determined simple choices when we involve networked communications at the fundamental, architectural level of our concepts for design? Is it merely a matter of extending the *things* we may *choose* (e.g. the Apple chooser concept), or can we appropriate some fundamentally new possibilities for action within the technology? So long as we view a network as a linguistically passive *thing* (wire) which is simply used to *connect* (connectivity) computers, printers, file-servers, video systems, etc. together, then no new activities emerge. (All of these *devices* have been consolidated into highly localized designs for years.) It is only when we emphasize the new possibilities for *action* which network technology generates that we begin to form the new distinctions necessary to transform "the computer" into a unique, flexible, and engaging linguistic medium.

"What are the new action-oriented distinctions which networks generate?"

As we mentioned earlier, the virtual space generated by networks has several intrinsic qualities: shared, group, interactive, *synergetic*. Synergy, as Fuller (1975-79) reminds us, "means behavior of integral, aggregate, whole systems unpredicted by behaviors of any of their components or subassemblies of their components taken separately from the whole". It is thus in the synergy which is created by the integration of networking with the separate component parts of computational technology that we may hope to find the new, unpredicted possibilities manifest by the distinctions of behavior of the whole system. With networks our conceptual field is widened so that we are no longer focusing on *one thing* and another *one thing*. It is the communicative *relationship* between individuals which will determine the success or failure of *the network* -- "the network" as a linguistic medium is a network of linguistic acts. The new synergetic domain which is generated from the combination of networks with the actively linguistic medium of computational technology is human linguistic *communication*. The plurality of linguistic acts which constitutes the communicative network involves individuals in a broad but finite number of distinguishable linguistic activities. New functional possibilities arise from the synergetic combination of context, linguistic action, and linguistic reaction. Computational technology, by virtue of its inherently active linguistic nature, can use its representational strengths to manifest highly inviting context "doorways" or "entrance points" which serve to help the "inhabitants" of the network/context/domain build and distinguish their own possibilities for significant action. We will call them "doorways" instead of the more common "windows" because we wish to impart the

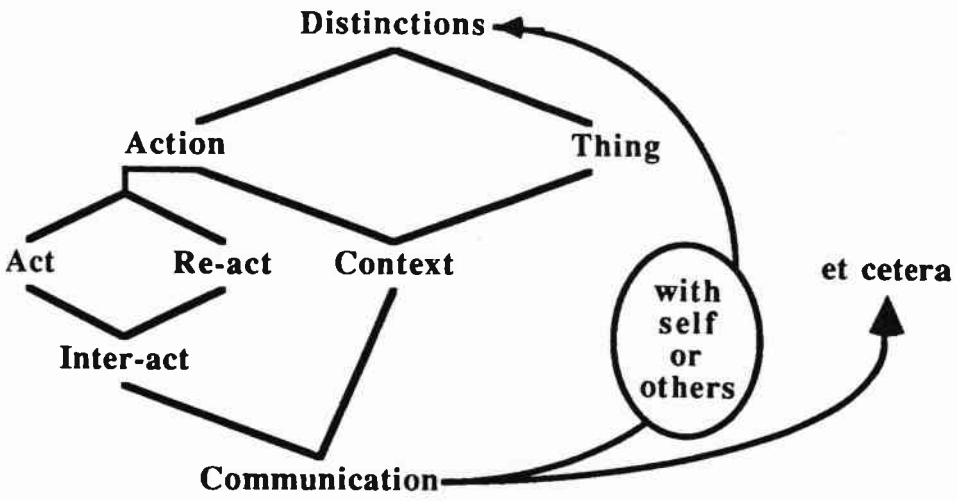
experience of actually *moving* into and out of domains of activity rather than the present form of *looking* through a window frame at things. These "doorways" into domains (*domains in the sense of environments*), shape part of the *shared synergetic context* in which individual networked action becomes significant to individuals within a *group*.

In order to allow full range for individual expression, and thus engagement, we must provide the ability for individuals to modify, expand, and express their own unique contributions to the form of these "doorways" and the activities within the domains. The structure must not be too brittle. One must be able to personalize, customize, add to, and subtract from the distinctions of the network domain. Choice is an important form of linguistic action. With manifestly active "doorways" into domains of activity, we not only *choose* but also *enter and perform*. The active surfaces of "the system" must inspire us to *explore* and invite us to *find*. The synergy of networking with computational technology creates a proactive environmental context for linguistic meaning.

Functionally, a communications network consists of clusters of language acts which satisfy in some way the networked performers. These *conversations* (Flores, 1981) may or may not be in the service of some *consciously*, predetermined goal. Being the curious, testing, investigative creatures that we are, we may perform some linguistic act merely in order to see what the *reaction* will be.

It is our understanding that all linguistic action has one fundamental, often tacit "goal": to generate a *reaction* on the part of the being, self, individual, group, agency, institution, elements, world, universe, god, or whatever else there is to which one's imagination may lead one to address linguistic action. (In our present context we will limit ourselves to the addressable "inhabitants" of our geodesic/geodetic network-space.) It is even the case, infrequent though it may be, that the reaction desired is no perceivable reaction at all. Most of us have experienced the context determined, clear linguistic significance of the language act of someone's silence relevant to a particular situation. In other words, even the absence of linguistic action may take on the significance of a linguistic act in certain *contexts*. If I address some networked linguistic action to everyone "on" a working network, and the reaction is the unending, complete absence of any of the forms of reaction commonly taken, i.e. "silence", then inter-action has still occurred. This "silence", however, only becomes communication when there is some sort of shared context or situation which is "inhabited" by the participants (Barwise and Perry, 1983). "Silence" can be a very important linguistic act in that it often functions to allow the shared *context* itself to come to the foreground of experience -- silence may be a way of allowing the context to "speak" for itself. The context with which we are here concerned is generated from the shared linguistic distinctions which are made manifest in the synergy of networking and computational technology. The kind of system we are referring to is really a language in its own right. Just as the distinctions of object-oriented computing were given form in the SmallTalk language, action-oriented distinctions require formal linguistic expression if they are to be incorporated into the basic fabric of computational technology. As designers in this new synergy, we find ourselves directly responsible for the designation (de·sign·ation) of the fundamental linguistic distinctions which constitute the basic linguistic system. The first design task is the design of a new computational/networking language.

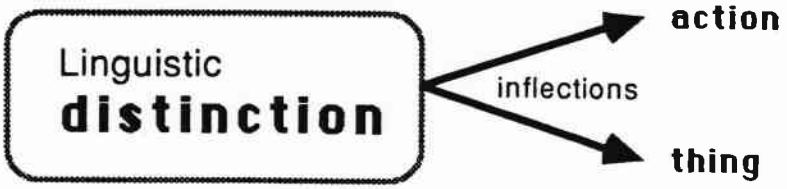
In addition, we are also responsible for the design of the possibilities which "users" are given for generating their own personal contexts for meaning. These "user" generated contexts may, through group consensus, eventually become part of a shared, group networked context, but this is not necessarily their essential function. The individual may be involved in language action directed toward a reaction of private learning. The ability for the individual to tailor or generate active contexts (domains of activity as we have been calling them) is absolutely basic to real productivity and education. Our paradigm of distinctions, representations, and actions must be *generative* (see Chomsky) in that from its basic finite structure or grammar of distinctions a near infinite multitude of expressions can emerge. This generative capacity we will call the *et cetera* distinction.



The ability for the "user" to generate (et cetera) the *contexts* or domains for linguistic action is very possibly the most significant form of activity which a "system" of linguistic distinctions can attempt to support.

7. An Example

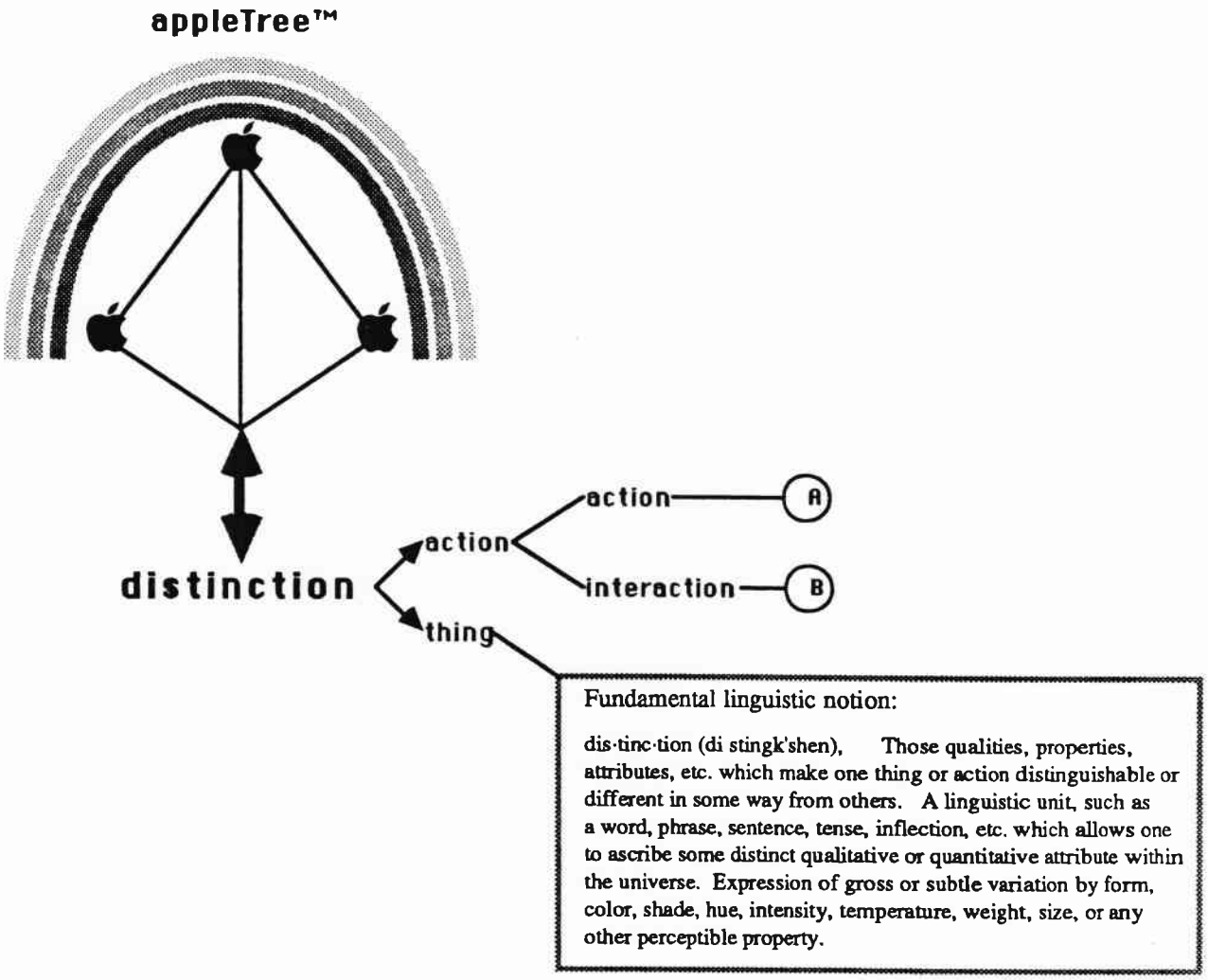
The root form, or basic operational unit of our design approach is the linguistic distinction. It consists of three attributes: 1. a distinguishing linguistic symbol or symbol group, e.g. a word, sentence, tag, icon, image, etc.; 2. the action inflection, i.e. possibilities for action which are generated from the distinguishing symbol(s); 3. the thing inflection, i.e. information about the symbol(s) -- definition, meaning, how it works, object it refers to; links with other distinctions, etc.

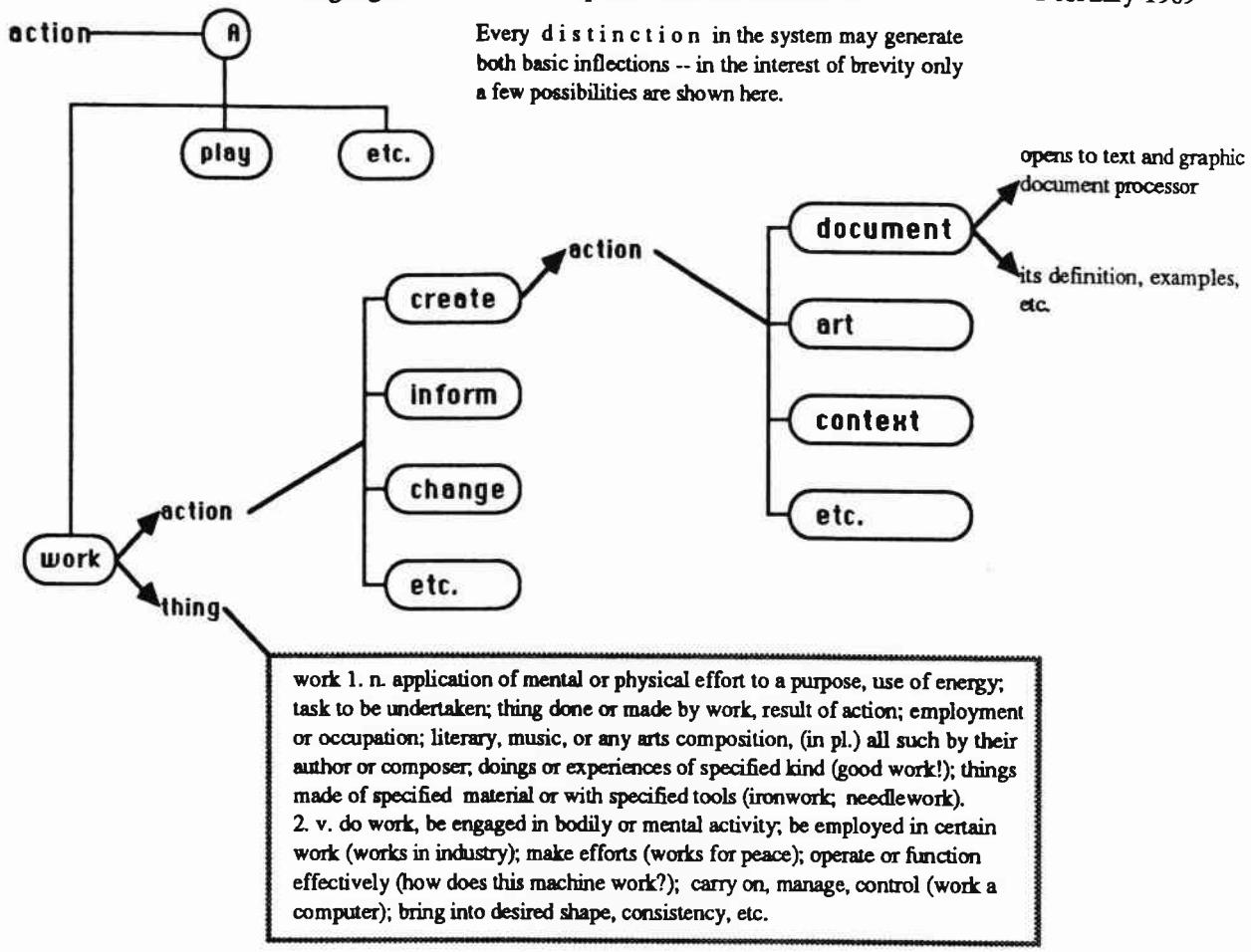


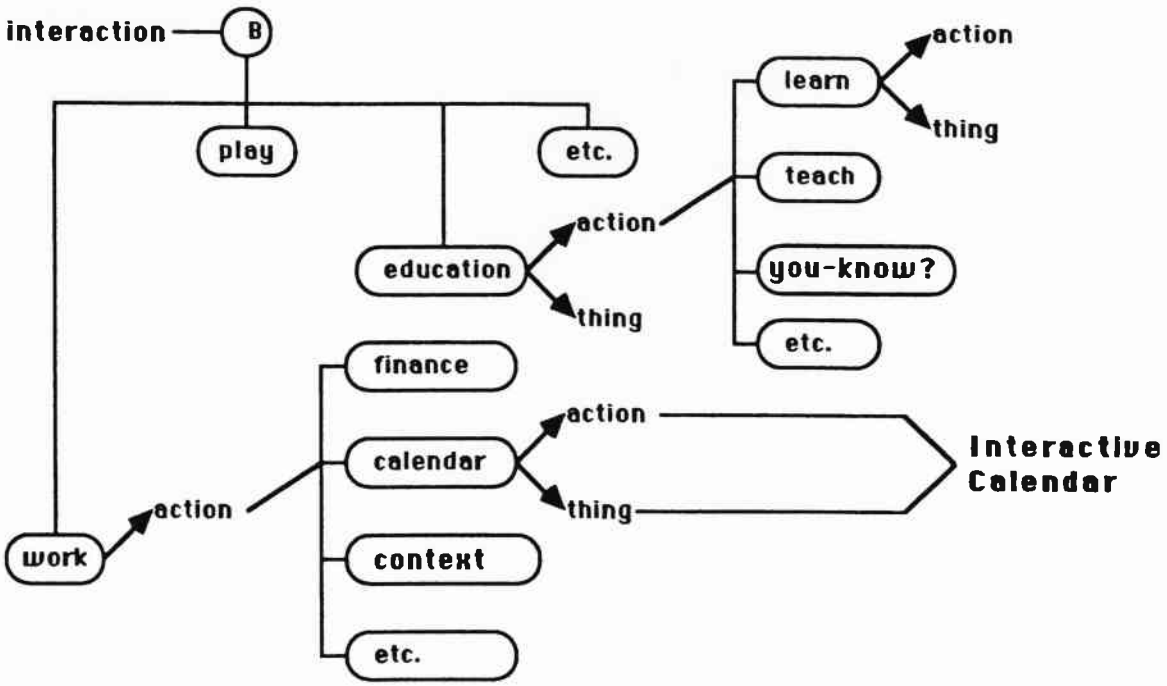
The tree-structure which follows is not presented as an instance of a graphic interface to a proposed system but rather as a sketch of the kind of linguistic relationships which naturally develop from our fundamental d i s t i n c t i o n notion and its two basic inflections.

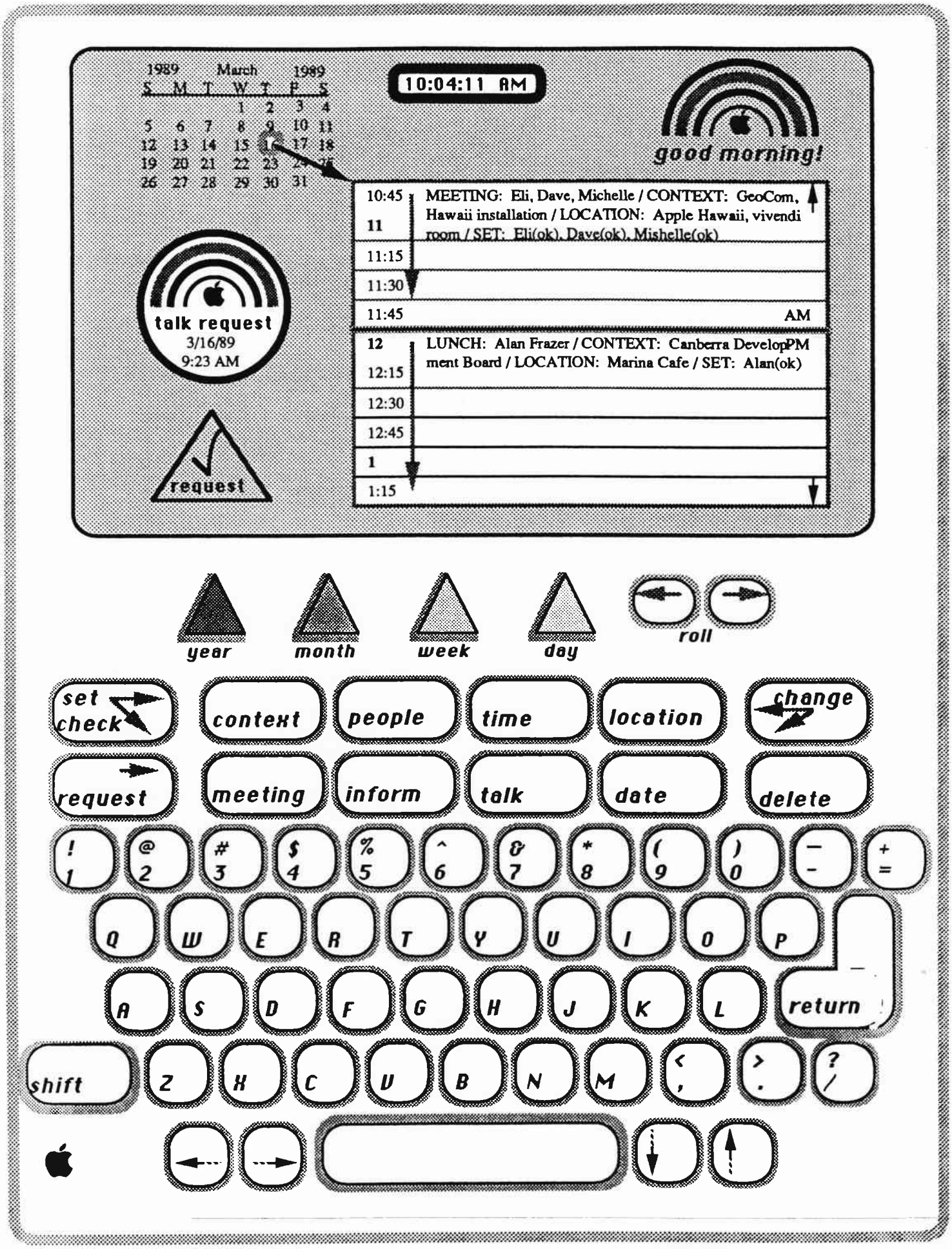
Concept:

Geodetic Network









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