

ENTAILMENT MESH: A MEDIATED SOCIAL NETWORK

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Introduction

Entailment Mesh is a mediated social network enabling workgroup brainstorming. The objective of this project is to explore methods of conversation and learning within a ubiquitous information network. This objective includes development of languaging techniques for the emergence of domain specific knowledge.

... a wireless brainstorming tool facilitated by a server-side knowledge engine ...

The Entailment Mesh research project is based upon a conversational and learning systems theory. In the late 1970s, systems theorists Gordon Pask and Paul Pangaro at MIT developed the conceptual framework for a machine conversational and learning system called DoWhatDo. DoWhatDo is a method in which knowledge emerges from conversational interaction involving differing expertise. Using a relatively simple set of action/reaction algorithms that enable conversant associations through relational filtering and substitution processes, we are able to generate multiple layers of knowledge distinct from the original expertise of participants.

Engines-Sex-Leather = Motorcycles

Their significant accomplishment is a recognition that learning evolves from conversational interaction in which the outcome is driven by the conversation itself and is something that cannot be entirely predicted. They also clearly establish the role of human subjectivity involved with inferencing as a central feature in the

evolution of meaningful knowledge. Entailment Mesh uses a similar approach by incorporating a database server as conversational mediator. Server protocols interpose between participants and an evolving database to catalyze a multiplicity of human-computer dialogs and to reconcile meaningful states of the workgroup. Expertise is not built into discrete knowledge models but is resident in the individual expertise of participants who are

engaged within a mediated conversation space. Development of meaningful discourse therefore requires participant consensuality and a shared desire to expand the workgroups knowledge terrain. Conversational trajectory is direct reflection of the workgroups subjective acceptance of a shared heuristic framework. Implicit is the understanding that the server is the mediator of conversation and is the sole agency influencing relativistic interaction with the database. Creation of knowledge emerges through participant efforts to establish interesting relationships with the mediator-server that are both directorial and reactive.

Entailment Mesh explores the processes of self-organization and social semiosis involving subjective inferencing mechanisms realized in a feed-forward knowledge generation dynamic.

This paper briefly introduces the Entailment Mesh research project and the theoretical impetuses that define it as art.

Project Description

Development Status: 1 - Planning

Intended Audience: Developers

Other Audience: Workgroups

License: GNU General Public License (GPL)

Natural Language: English

Operating System: PalmOS

Programming Language: C, PHP

Market projections for wireless technology indicate that half of all Internet access will be via mobile devices within years. The development of wireless content, unlike desktop content, will focus on small units of information appropriate to out-of-office situations. PDAs and Internet phones represent the leading edge of a new era of communication technology that takes advantage of the fluidity of network information discourse and computational agency. In this project, we have developed a method of knowledge generation that self-emerges from multi-participant 'brainstorming.'

Entailment Mesh is an art project. The conceptual basis of this work is centered within theoretical discourses of database and knowledge engineering. Whereas domains of cultural art production centered as advocacy and critique are obsolete and in that the exposition of theory has clearly situated art as code, a new conceptual terrain for art is necessary. A terrain in which art as information system is understood in its fullest capacity. Entailment Mesh is social software. It can be argued that the operatives of internal and external relations that comprise complex social organization as networks blur all lines between structure and process. And such systems are made evident by the presence of complex strata of self-organizing interactions. Understanding the social nature of data relations provides a means of describing a framework for machine knowledge discovery that is not Artificial Intelligence-based. We believe that research models as prototypes can demonstrate this character and serve to redefine knowledge as the result of human-machine mediated processes of relativistic social interaction.

Conversational 'brainstorming' (human-human, human-machine, and machine-machine) can be conceptualized as highly non-linear and of multiple trajectories. Languaging by conversant association appears to be the primary mechanism for establishing relativistic associations leading to new ideas and discovery. If languaging reflects the fundamental characteristics of complex systems, and we believe it does, self-organization, heuristic processes and non-predicative association are present.

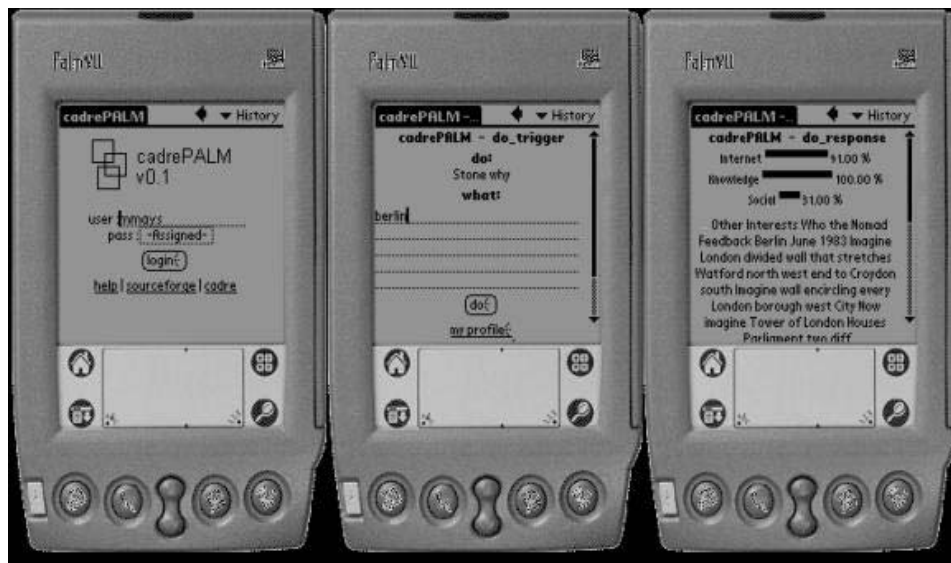
In such systems of conversation, the constituent elements (data processes and their interpretation) comprising the system would be semi-independent and nearly decomposable. Support software for such conversations need not be fully autonomous or completely dependent upon the components of which it is formed. Rather the software can be described as socially complete when participants simply enact algorithms effecting conversational trajectories in such a manner as to increase the demand for inference response from users. The recognition that the 'brainstorming' can be described in terms of complexity is therefore

fundamental. We believe that intelligence (learning and knowledge discovery) is embedded in languaging as conversation and that a set of simple techniques can be described to make it observable.

How it works

Workgroup clients use Palm Organizers subscribed to a dedicated server via the Palm.net wireless Internet connection. A downloadable custom-designed Palm web applications interface provides for easy user interaction with the server. Our approach takes advantage of the extremely limited bandwidth and small, yet readily available, data packets of information that form the network infrastructure of wireless communications.

Entailment Mesh employs a server-side knowledge engine that reflects the ontological character of the workgroup, via meta-profiles of subscribed clients. Expert software guides associations and construction of the collective knowledge model (database). This construction is informed by participant input via a simple Palm interface. Multi-participant communication with the server cat-



alyzes and directs, but does not determine, as appropriate dialog trajectories add new information to the database and initialize complimentary Internet search processes. These processes in turn grow the knowledge model along paths it might not necessarily incorporate.

Once a workgroup is identified, its members subscribe to Palm.net, gaining full access to the wireless functionality of their Palm. Once subscribed, each workgroup member downloads the Entailment Mesh PQA (CADREpalm) Web application. The application requires that an information profile be established. The basis of the profile is a selection of terminology from a list defined by the workgroup manager or participants as group signifier. Each user selects 10 terms from a 50-term list, which can be dynamically changed as new terminology is substituted based on the unfolding of conversational trajectories. Each participant profile also includes name, security information, mobile location, time of day, and access duration and other useful data.

The Palm interface is radically simple. Participants log in using a secure password. The interface initializes the session to establish the conversation cycle and is presented in three segments.

The first segment:

Retrieves an information directive and subject header. For example Transpose, Select, List or Search plus the subject(s) term.

The second segment:

Correlates the subject(s), reflecting preferences of the workgroups' ontological status as determined by the current profiles and active Palm users. Returns relevant 'in-use' terminology of interest to the workgroup.

The third segment:

Searches (googles) the Web using the terminology and returns output. This interface structure enables the feed-forward conversational process to be enacted.

1.

Text input from the user is included in workgroup knowledge model database.

2.

Text input triggering of a request for the knowledge model to be datamined.

3.

Display of the result in the form of a new request for input. Each conversation cycle is calculated in terms of its Internet, knowledge, and social relevancy. The percentage relevancy is plotted in a simple bar graph. The assessment is intended to help the user in determination of subjective inference.

A conversational cycle is complete once the participant enters a text response to the WHAT segment. The participant enacts the next cycle by selecting the DO button and submitting the input as a trigger, which invokes the serv-

database to expand in rapid and unexpected manner and self-directed fashion. It is in this sense that the feed-forward implementation of conversation functions. The entire process becomes highly dynamic as multiple users interact over the network. Relevancy increases during the course of conversational session and even more so through continued use over a period of days or weeks.

The Conceptualization of Entailment

An entailment is a set of rules pertaining to the emergence of self-organization by a system in which uncertain conditions and influences are present. Developed by cyberneticists and information theorists Paul Pangaro and Gordon Pask in the early 1980s at MIT, the concept of entailment was postulated as an essential component of their research into conversational and learning systems. They deduced that conversation and learning are the result of self-organizing processes involving inferencing. The concept of an 'entailment mesh' was thought to be the

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er-mediator and issues the next conversational cycle. The return of information for each segment is relative to the input through associations with other profiles, input request and the current active use and location of workgroup members. Reactive-directive input is entered into the database and correlated by associations of subject searches, which causes the

semantic agency responsible for knowledge creation. They postulated that knowledge emerges directly from information filtering, association, and referencing and substitution processes. Conversation is circular and understood to be a relativistic means of communicating relativistic understandings.

Pask and Pangaro's research involving machine/machine conversation demonstrates that the design of entailment-based conversational systems can enable learning (knowledge) evolved among discrete machines. The process they described was the result of conversation without pre-determined objectives, one reliant on the personal subjectivity's (expertise) of the conversant systems (machine or human). That a machine could be considered to have a subjective expertise was provocative. Their speculation of software that would support the dynamics of conversation between machines necessitated self-referencing processes that could simulate inferencing and issue from sequences of discrete entailments involving information associations, filtering and representation.

Research supporting the Entailment Mesh research project further hypothesizes that meaningful trajectories can be catalyzed by directive-reactive interaction involving continuous inference interactions. These interactions are realized as feed-forward structures and embedded associations supporting thematic conversational drift. At question, of course, is the issue of whether learning and knowledge can be the result of networked interaction alone and whether a system can be designed to demonstrate the consequences. We assumed the nature of 'brainstorming' to be of associations resulting from re-contextualization of information. No specific objective, agenda or purpose is required, other than to infer potential relationships. Entailment Mesh seeks this type of conversation, one that encourages relevancy through tangential discourse, but does so without regressing into meaninglessness.

The Necessity of Inferencing

Inferencing, the ability to pass from one proposition, statement or judgment to another whose truth is believed to follow from that of the former, is indicative of entailment meshwork functionality. Maturana and Varela describe how an entailment meshwork might be considered as an inferencing structure, "In the simplest autocatalytic loops there are only two reactions, each producing a catalyst for the other. But since this basic two-node network establishes itself, new nodes may insert themselves into the mesh as long as they do not jeopardize its internal consistency. Thus, a new reaction may appear (using previously neglected raw materials or even waste products from the original loop) that catalyzes one of the original reactions and is catalyzed by the other, so that the loop now becomes a three-node network. The meshwork has now grown, but in a direction that is, for all practical purposes, "unplanned." Herbert Simon uses the term "nearly decomposable" to further suggest that within a complex system, individual elements composing the system are not fully autonomous but have negligible relationships which cannot be completely discounted. Perhaps entailment meshworks are also 'nearly decomposable' as network processes in which interrelations are, as Maturana and Varela suggest, linked by the remnants of dysfunction and waste.

Entailment Mesh uses the synergy two types of inferencing: human and computer. Humans are terrific at seeing and understanding complexity. Our cognitive being is to a large extent the result of our capacity to address uncertainty. The human ability to

subjectively filter large and complex associations of information is extraordinary. Computers, on the other hand, vastly outperform humans in processes of computation and speed, particularly those involving large quantities of information in the form of data structures. Humans and computers do not share the same algorithms of interpretation, even though they may simulate one another. One is subjective, the other not.

Fundamental to DoWhatDo is: that what follows, follows from what follows. This is to say that learning systems in the sense we have described them are such that they do something as an inference response to what has been done and then evolve as a directive sequence that is both declarative and indicative. As it turns out, this is an interesting characterization inferencing that is ideally suited to both humans and computers. It bypasses the issues of cognition vs. calculation, for the simple reason that by casting the directive-response as a feed-forward agency, the issue becomes one of complexity not interpretation. The system only needs to know how to inference, not what to inference. Knowledge will emerge on its own, where it can. Multiple and simultaneous (networked) feed-forward inference establishes trajectory. Continuous feed-forward inference emerges elaborated pattern. It is precisely this elaborated pattern that is what we might call knowledge.

Entailment Mesh is specifically aimed at trying to design a network as a system supporting this kind of knowledge generation. The Entailment Mesh project is intended as art, as social software.