Agents Object System

QKS, Inc.

Scripps Research Institute

Challenge:

- Provide a dynamic language toolset that enabled real productivity and design experimentation
- Provide a short learning curve for a team with only C++ experience
- Write software that could control IEEE interfaces to equipment such as Electron Scanning Microscopes
- Provide a framework and environment that would eventually work on Windows

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Director, Neuropharmacology Computing
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Background

The Scripps Research Institute is internationally renowned for its leading research in molecular biology, protein structure, immunology, structural and bioorganic chemistry, viral disorders, thrombosis, hematologic disorders, neurochemistry, cancer chemotherapy, cancer immunotherapy, and drug design and synthesis. It is the world's largest, private nonprofit biomedical research facility.

The Department of Neuropharmacology at The Scripps Research Institute studies the action of drugs on the nervous system. Investigators are especially interested in disorders for which no effective treatment has been found. Many diseases of the brain are still not understood in terms of their cellular or molecular functions. Neuropharmacologists are working to develop a better understanding of infectious, environmental, and inheritable diseases of the brain, and to develop molecules that can reverse the disease processes or stimulate normal repair mechanisms.

In 1993, the Department of Neuropharmacology was awarded a multi-million dollar grant from the National Institutes of Mental Health to develop mapping, imaging, database, and information processing software tools in a nationwide effort to map the human brain. Several other research institutes are members of the Scripps Consortium–Mt. Sinai School of Medicine in New York, the University of California at San Diego, and the University of California, at Irvine. All of the software development is centered at Scripps and is directed by Dr. Warren G. Young. Dr. Floyd Bloom, chairman of the Department of Neuropharmacology, is the Director of the Scripps Human Brain Project Consortium.

Goals

In late 1993, Dr. Young and his group conducted a study of the software tools needed to complete the specific aims of their research proposals under the Human Brain Project. They had concluded that dynamic object-oriented languages were key to their success, and of the limited commercial choices, Smalltalk was the best language. Of the available Smalltalks, QKS's SmalltalkAgents was the only product that met their specifications for performance, solid tools and classes, cross-platform code base, and royalty free deliverables. They purchased their first copy of SmalltalkAgents in late 1993.

None of the programmers had any prior experience in Smalltalk. However, they were able to get up to speed in writing full applications in about three months. They credit the cleanliness of the class framework in SmalltalkAgents, the integrated tools, and the Smalltalk language itself. Coming from the MPW/C++ arena only months ago, SmalltalkAgents proved to be more than just another dynamic software development environment. It was also exciting and sparked a creative wave through the Scripps team.

Mapping the Human Brain

One of the software projects involves controlling light and laser microscopes, acquiring images, and mapping neuronal cells from brain tissue. This is a new version of a system currently developed at Scripps called EMMA - Electronic Mapping and Morphometry Analysis. EMMA currently is written in C for X Windows, but in 1993, Dr. Young had decided to write all new code for Macintoshes and Windows systems, since an informal polling of neuroscientists revealed that personal computers are the most popular and desired computer for new software dealing with research on the human brain. Work on the new application, NeuroZoom, was started in April, 1994. In June, 1994, nearly all of the application was completed, and the results were presented at the first annual meeting of the Human Brain Project in Washington, D.C.

NeuroZoom acquires, analyzes, and displays microscopic data in an integrated fashion across all levels of resolution, allowing the user to move from the synaptic subcellular level through the cellular and regional microscopic levels. NeuroZoom controls these microscopes with an IEEE interface board, using both Quicktime and a high resolution digital color camera (Leaf Lumina) to display live images and to capture images. A lot of their previous code base, for the IEEE interfaces, was reutilized by calling from within SmalltalkAgents the C language foreign function calls in external libraries. The code for controlling the digital camera was new, written mostly in Smalltalk. In this case, the SCSI manager was controlled directly from Smalltalk, with data transfers controlled by C routines, and then transferred to Smalltalk objects.

Tools For Automating Manuscript Reviews

Another project is a family of programs designed to work together to support the submission of peer-reviewed science manuscripts through the entire review cycle. These programs use the Internet as the connecting medium among all users. The basic submit/review/edit cycle is not affected, manuscripts are still written in the same manner as before, and review is still done on a peer-review system. However, the manner in which the manuscripts are sent to the journal editors, and how they are distributed for review are electronically facilitated. The advantages are; greatly reduced time-to-review, time-to-publish, and time-to-read periods. Four of the five programs that make up this family were written in four months. These programs are particularly representative of the speed of the development environment of SmalltalkAgents. The built-in TCP/IP classes of SmalltalkAgents made it easy to develop a robust set of client and server classes. The server in this family is fully multi-threaded and multi-tasking, accepting requests simultaneously over the Internet from the client applications. The beta test period for this will begin in the second quarter of 1995.

In all cases, Dr. Young was concerned with cross-platform portability. Scientists want to use the Macintosh and Windows computers. However, there are still many UNIX workstations in neuroscience laboratories. Gone are the days when they would be expected to develop a unique version for each computer that was in use. They have seen too many promises from software vendors that for one reason or another was not fulfilled. Sometimes the cross-platform code compromised performance (hypermedia tools like Spinnaker Plus, Hypercard, etc), was too complex or awkward to support (Bedrock, Motif), lacked marketability (Component Software, Serius, Novell AppWare), or lacked a feeling of solid, commercial quality (LISP, Dylan, Prolog). QKS's SmalltalkAgents convinced them that a product does exist that does not fall into one of these problem areas. With SmalltalkAgents, they will be able to have their applications running on Macintoshes, both Motorola and PowerPC systems, Windows, OS/2, and X/Motif.

Figure 1: NeuroZoom Application Screen Shot

Deployment Capabilities and Options

Another of Dr. Young's concerns is runtime fees. Many, but not all, of their applications will go into the public domain. There is inertia in the neuroscience world that delays acceptance of new software invading traditional laboratories. It is very important for them to be able to deliver free executables to over 20,000 neuroscientists, demonstrating not only the software that is being developed for the Human Brain Project, and how those scientists can benefit from its use, but also to expose many of them to computers in general. QKS has provided a fair and reasonable mechanism for them to make double-clickable applications that involve no additional cost. Once exposure to these applications breed want, the additional licensing for shared kernels is very economical for full applications that need compiler support, such as in their object databases that map the human brain.

Summary

In summary, SmalltalkAgents gave Dr. Young and the Scripps programmer team the language, the tools, and the support needed to produce applications for mapping the human brain. Generation of high quality, usable code came within a period of months, not years as would be expected with other language systems. They hope that their success with SmalltalkAgents will lead to a faster and better understanding of how the human brain works.

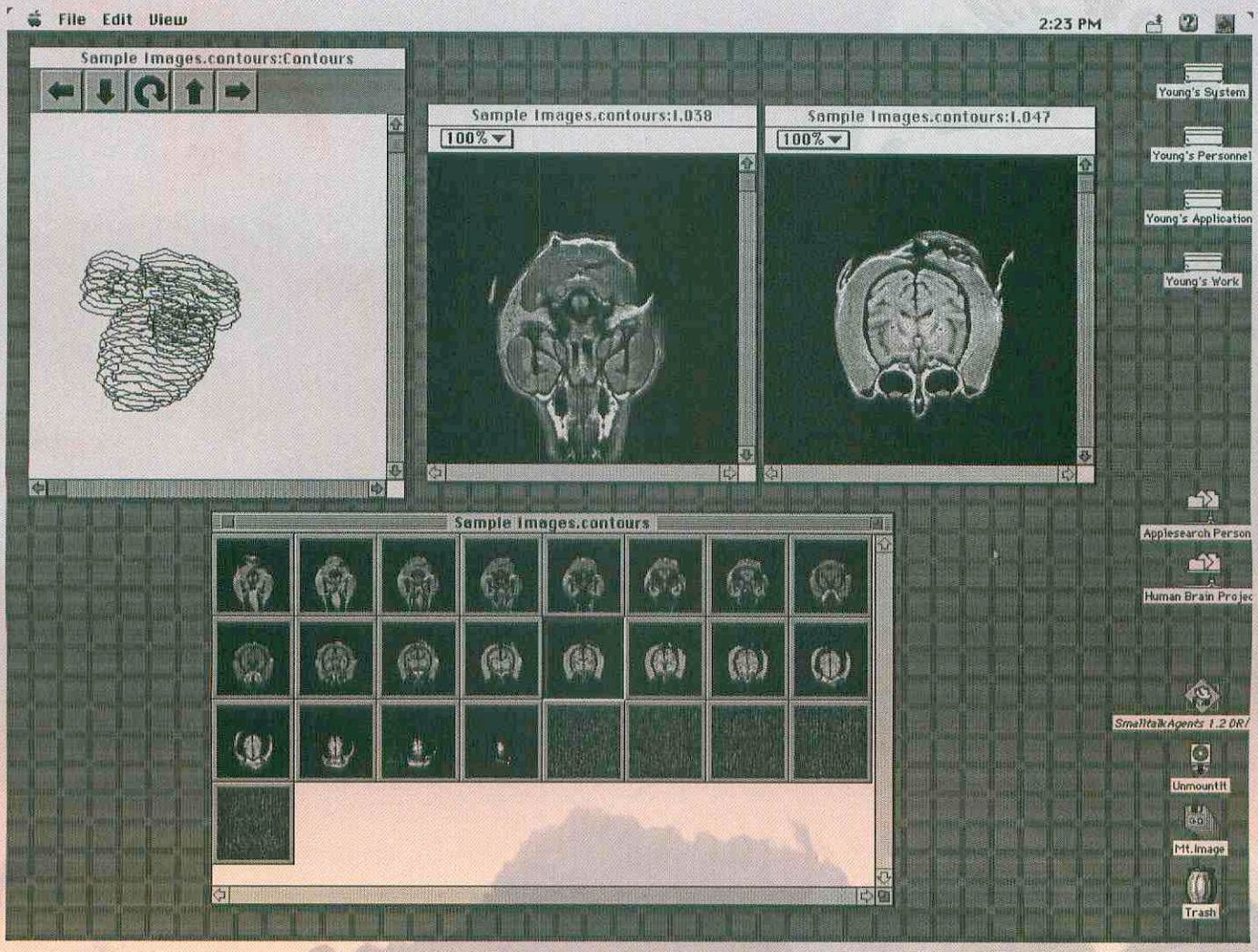

Figure 2: NeuroSlice Application Screen Shot

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