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## The Human Brain: A Multimedia Tutorial For The Independent Learner

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## ***THE HUMAN BRAIN: A MULTIMEDIA TUTORIAL FOR THE INDEPENDENT LEARNER***

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### **1. INTRODUCTION**

*The Human Brain* is a multimedia, interactive, computer-based tutorial on the structure and function of the human nervous system. In creating it, we aim to solve a number of problems, both subject specific and general. As a subject, the structure and function of the nervous system is difficult to teach using traditional methods and there is a lack of integration in the teaching of structure and function. More generally, we are concerned with the difficulties of both assessing student understanding of a particular subject and remedying any deficiencies when the student is learning independently. Finally, we hope to resolve the conflict between linear and explorative modes of presentation of material in a teaching system.

### **2. TEACHING BRAIN ANATOMY**

Biology, medical and psychology students studying the structure and function of the nervous system find the subject matter very difficult and institutions of higher education have always had problems with teaching this material successfully. In particular, the complex 3-dimensional shape of the internal structures of the brain is extremely difficult to describe, making the anatomy of the brain both difficult to teach and difficult for students to understand. Traditional anatomy textbooks rely on photographs or drawings that use perspective to give the impression of three dimensions, but written descriptions and images on the printed page do little to convey 3-dimensional information, particularly to the inexperienced. Some institutions can offer students practical experience of seeing, handling and dissecting real brains, but this is impossible in a distance-learning environment and, in Europe at least, is becoming rarer even in conventional institutions as a result of increasing legal restrictions.

*The Human Brain* solves this problem by using animated sequences which show various parts of the brain being rotated to reveal their 3-dimensional shape, and demonstrate how the various parts of the brain fit together. The 3-dimensional images of the internal structures of the brain used in the animations have been generated by computer from a database of measurements of human brains, set up specially for the project. The tutorial also provides students with a ‘virtual brain’ that they can manipulate for themselves.

### **3. INTEGRATING STRUCTURE AND FUNCTION**

In general, courses on the nervous system teach anatomy separately from function, with the result that students find it difficult to relate the appearance of the brain with what it actually does. In contrast, *The Human Brain* teaches structure and function in parallel throughout, thus facilitating student understanding of the intricate links between the two.

### **4. ASSESSING STUDENT UNDERSTANDING**

When such a difficult and complicated subject as the human nervous system is taught in a distance-learning environment, it is vital to be able to assess student understanding as they progress through the materials, and to have some means of directing students to remedial materials for those areas where they have not reached the required standard. To address this problem, we have developed a means of ‘qualitative’ assessment and incorporated it into *The Human Brain*.

The assessment is based on a series of questions presented to the student at the end of a section. Each question is linked to one or more ‘concepts’ (topics) and tests at least one of them rigorously; other concepts may or may not be tested as fully. For each concept, each question is graded according to how well it tests that concept. Every time a student answers a question correctly, a weighting is assigned to each concept in relation to the question gradings. Once the student reaches a weighting threshold for a particular concept, they are judged to have learned and understood it. The system thus builds up a model of the learner as they progress through the assessment. When they have finished working through the questions, the students are provided with a score, given a list of topics where their understanding is poor and invited to study a remedial tutorial. The remedial tutorial takes the student through the relevant materials again but is tailored precisely to those topics where the assessment revealed some weakness in the student’s understanding.

### **5. LINEARITY VERSUS EXPLORATION**

Computer-based learning packages are generally of two types: either a highly structured tutorial with materials presented in a relatively linear fashion or an encyclopedia-style explorative resource. The former does not provide the student with any freedom to study the materials in the order they choose and tends to be very restrictive. The latter makes it difficult for students to go through the materials they need to study in a systematic way; they easily become ‘lost’ in a succession of hyperlinks, unable to get back to where they were before. If students are to meet defined learning objectives, it is important that they study all the relevant materials and do not simply wander around in a sea of information.

We have resolved this conflict in *The Human Brain* by combining the best features of linear and explorative learning packages. The student is guided through the available information while allowing them some flexibility to navigate within part of the system. The tutorial is structured in a relatively linear way, with a limited number of hypertext links and only a few side paths available at each stage in the tutorial, each consisting of no more than 2 extra levels. This means that students have the opportunity to explore additional, more detailed, materials if they wish, but can always return easily to the main route. The system thus enables specific teaching objectives to be met yet adapts itself to individual learners.

## **6. BEYOND *THE HUMAN BRAIN***

*The Human Brain* is being developed as a tutorial both on CD-ROM and on the Web. When completed, it will provide teachers in this difficult subject area with a more effective pedagogic tool and their students with an enriched learning experience, appropriate to independent learners either in a distance-teaching situation or taking a course in a conventional institute of higher education. Perhaps more importantly, the approach used in this project will be applicable to other subject areas. The tutorial is based on a software shell, which provides all the functionality needed to present the materials, including the qualitative assessment module. The subject-specific teaching materials are held as separate files external to the shell. This means that the shell is 'neutral' in subject terms: it can be used to present teaching materials and assess student understanding of those materials in any subject.