Multimedia Design: from tools for skilled designers to intelligent multimedia design systems

M. Wilson
Advanced Hypermedia Systems Unit
Department for Computation and Information
CLRC Rutherford Appleton Laboratory
Chilton, DIDCOT, Oxon, OX11 0QX, UK
tel: +44 (0)1235 44 6619
fax: +44(0)1235 44 5831
email: M.D.Wilson@rl.ac.uk

Abstract

Multimedia design can be reduced to the process of choosing a presentation form which can be mapped to a set of domain concepts which you wish to communicate to users so that they can use the concepts to perform a task as effectively and efficiently as possible.

Since the design task is for multimedia, the set of possible presentation forms is as wide as possible, while their are constraints placed on the possible forms, and the mapping, due to cost, time, bandwidth of communication, presentation station abilities etc. derived from the overall task.

One of the major choices in multimedia design is to choose how much of the design process takes place off-line by a skilled human designer, and how much is performed automatically by the system. the consequences of this choice for the role of the designer and the concomitant interactions with the constraints on multimedia design are explored in this paper with reference three systems developed in the last ten years: SMIL/GRiNS (Bulterman et al, 1998) , MIPS (Jeffery et al, 1994; Macnee et al, 1995) and MMI2 (Binot et al ,1990; Wilson & Conway, 1991).

The Synchronised Multimedia Integration Language (SMIL pronounced smile) has recently been proposed by W3C for synchronising multimedia presentations over the world wide web, and GRiNS is the first editor to support authoring in it. SMIL supports four constructs: layout, timing, hyperlinking and tailorability of the presentation, while the human designer chooses the content of a presentation.

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This is the most recent of the three exemplar systems, but also the one with least of the design process automated. The designer holds all knowledge of the task and domain, using it to describe the presentation using the four constructs provided by the language. The presentation is sensitive to available bandwidth, presentation station capabilities and user attributes which can be used at run-time to select between alternatives specified by the designer, but otherwise all decisions are made by the designer at authoring time. The designer has a view of which tasks the information may be used for, but it is really just information retrieval and presentation; the range of user domain tasks which a presentation may be used for is not limited by the designer or the system.

The control/navigation mechanism for the end user is also the most limited since hyperlinking is the only navigation available, and there is no stored dialogue state which can be used to relate to task structure, or tailor the presentation at the client.

The Multimedia Information Presentation System (MIPS) supported queries which were dispatched to heterogeneous information sources to retrieve multimedia information which was integrated into hypermedia presentations as answers to the query. In this case, a large part of the mapping that was design in GRiNS is ontology based query expansion & refinement and matching to database schema. The media content of the presentation was retrieved from databases, but the layout, timing and hyperlinking and tailoring of content for design constraints were automatically constructed on the basis of the query. Compared to a SMIL/GRiNS presentation, the designer has a more remote role, since task descriptions, domain knowledge in the form of an ontology, and local dialogue state can all be stored in the presentation client and used to dynamically tailor the presentation at run time. The range of tasks which the system can be used for is limited by the domain knowledge to the tourism domain, and by the task knowledge to investigating and booking holidays. However, the task limitations can be overridden with a resultant degradation in performance of the query expansion process, and consequently in the information integration and design function. The control/navigation mechanism used in the answer is still limited to hyperlinks, although the query construction is based on a structured dialogue to elicit task, and user information which can later be used in the design process. As in a SMIL/GRiNS presentation, considerable attention is paid to the constraints of cost, time and security in using the communications layer to retrieve the content media items to be presented. The central storage of the ontology and metadata adopted in this system is impractical, but given the adoption by W3C of XML and RDF above that to describe metadata on the web, this approach may become practical in the near future.

The Multi-Modal Interface for Man Machine Interaction (MMI2) demonstrators support layout, timing, hyperlinking, tailoring of presentation, and both the design and construction of presentation forms from minimal basic elements automatically in order to achieve task goals. Here the designer has a minimal role compared to the

other two systems, since the entire presentation and dialogue is constructed at run time based on models of the domain, task, user and dialogue context which are used to guide the design knowledge built into the system. A consequence of the need for rich domain and task knowledge in the system, is that it is limited to the tasks for which these have been encoded. There is no graceful degradation when the limits of this knowledge is reached. Equally, the navigation/control of the presentation is most sophisticated here incorporating typed natural language (English, French and Spanish), direct manipulation of graphics, and the use of gestures as well as hyperlinks. But this is also domain and task limited due to lexica and planning systems. Although the application domain of the demonstrators was in network design and management, no consideration was given to networking constraints on the retrieval of information itself, although this is not a property of the approach. The earliest of the three systems, MMI2 results contributed to the Reference Model for Intelligent Multimedia Presentation Systems (IMMPS-RM) developed as an adjunct to the ISO Presentation Environment for Multimedia Objects (PREMO) standard activity (Bordegoni et al, 1997). This may result in the adoption of similar architectures for other intelligent systems in the future.

Each of the three example systems allows designers to produce interactive multimedia applications, to improve end-users' task performance. Each tool operates over languages which represent the multimedia design, and each tool serves a role in an overall multimedia development method. The three systems clearly cover the spectrum from the central role of designers in SMIL/GRiNS through their partial involvement in MIPS to their peripheral role MMI2, as automation successively increases. In parallel with this, the representation of the content finally presented as media items becomes successively more abstract down this continuum from the raw assets and synchronisation information, through the raw assets and a logically represented query, to pure logical (and meta-logical, e.g. communication acts) representations. Equally, the control/navigation mechanisms for the end user become more varied and richer as one moves through the systems. It also appears that the task specificity of the systems increases as they depend more on abstract representations of content and control mechanisms. Each tool places different requirements on the skills of the designer: for GRiNS, they need graphic multimedia skills, and any analysis or representation they make of the task is up to them; for MIPS, the designer is not required to explicitly analyse and represent the task, although this improves system performance, but a representation of the domain ontology and metadata of the domain information sources is required - the multimedia graphic design skills are one stage removed here, being used to populate the information resources; in MMI2, analyses of the task, domain and user are mandated.

Clearly the multimedia design skills required of GRiNS are currently more available than those required for task and domain modelling. Equally, the interactive

multimedia applications developed in GRiNS can be applied to a wider set of tasks than those of the other systems. The enforcement of task and domain analyses in the development of the other systems leads to more richly interactive applications, but does it lead to more usable ones, or merely ones which are more easily evaluated, and therefore quality assure, over a known limited set of tasks ?

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