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## Recent applications of the SAMMIE system

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### 1. Introduction

Human modelling systems such as **SAMMIE** can be powerful tools for the design team as they enable predictions to be made concerning problems with clearances, reaching, seeing or the combination of all these requirements that may force unnatural and damaging postures. The potential benefits arising from the use of such systems are discussed below, with reference to some recent projects completed by SAMMIE CAD Ltd.

### 2. Potential benefits

#### *The formal specification of the future users*

Any SAMMIE evaluation requires the investigation of how well human variability, in terms of size and shape, is accommodated by that design. This forces the client to make important decisions about acceptable accommodation range (e.g. 5th to 95th percentile or wider for a particular dimension) and the user population in terms of nationality, sex and age groups at the earliest stage of design. For example, in an evaluation of a helicopter re-design we were able to demonstrate to the client that an existing aircraft was not capable of accommodating the future population extremes (97.5th percentile Dutch male pilots and 25th percentile female pilots of other European nationalities) without structural changes so great as to warrant an almost completely new airframe. As a consequence, the project was aborted at an early stage, well before any major development costs were incurred. SAMMIE was used to evaluate the prototype design of the Fiat Punta, some 2 years before its launch, to ensure that the final design would comfortably accommodate the wide range of occupant nationalities and sizes specified by the manufacturer (Figure 1). The Punta became 'European Car of the Year 1995'.

#### *The formal specification of the tasks*

The next step is to help the client to establish a clear description of all the tasks the users will be required to perform in order that they can be simulated in the evaluation. It can often be the case that this process identifies conflicts between various task functions. For example, SAMMIE was used in the design of the Brussels Tram 2000 (see Figure 1) where it was established that the driver had two equally important but conflicting tasks, namely driving the vehicle and selling tickets to passengers. A cab designed to allow ease of driving was found to be severely compromised by the requirement to have the driver swivel around and sell tickets whilst remaining seated (given insufficient space for the driver to stand during ticketing operations). Since SAMMIE is a visual medium it was possible to clearly demonstrate the problem to the rest of the design team. By group effort a mechanism was developed that



Figure 1. Early evaluation of the Fiat Punto

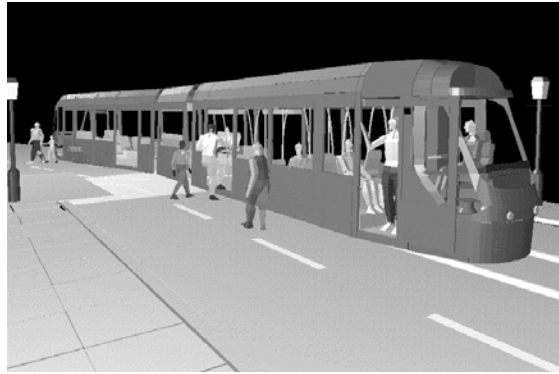


Figure 2. Brussels Tram 2000

allowed the seat to move and swivel such that both tasks could be easily accomplished and that was feasible, cost effective and did not require major changes to the cab or console structure.

#### *The formal consideration of other factors*

Because human models are used as predictive tools it is important to have many other factors specified whilst conducting any evaluations. Such factors include details of the job design as well as the organisational, psychosocial and environmental issues. A recent project examined the design and positioning of a control which would only be used when the aircraft was 'out of control'. This posed several issues which the engineers had not considered because the pilot had always expected to be 'in control' when considering the design of other controls. The motion conditions under which this particular control might be used are so severe that the 'normal' usability criteria for acceptable reach and vision identified were totally inappropriate.

#### *Proactive ergonomics*

Areas of common reach and vision for various sized human models can be identified for the placement of the primary controls and displays before these items have been actually designed in detail. This simultaneous consideration of people issues and engineering issues promotes the identification of optimum compromises which are essential for a successful design. The SAMMIE model for the new Amsterdam tram was based on the bare minimum of engineering hard points as soon as they were established. With a detailed ergonomics specification of the users and their vision and posture requirements it was possible to quickly determine the required seat movement envelope and begin to develop a set of surfaces for the controls and displays (Figure 3). The engineers were provided with an ergonomically designed workstation within a matter of a few days. A mock-up was built directly from the SAMMIE model of the driver's cab and evaluated by a sample of Dutch tram drivers. The design was fully accepted without any changes being made to the SAMMIE design.

#### *Iterative design and evaluation*

SAMMIE CAD were recently involved in the development of the driver's cab for the new Lantau express train for Hong Kong's new airport. The SAMMIE model of the cab structure was built within a single day and work started to develop a suitable driver's workstation well in advance of any engineering work (Figure 4). A total of 8 iterations to the SAMMIE model were made as various constraints were imposed upon the design. These ranged from changes to the external shape of the cab for aesthetic reasons, to increases in the size of the electrical equipment inside the cab, the shortening of the carriages and the introduction of a passenger evacuation route through the centre of the cab. SAMMIE was used to explore how these requirements might be accommodated with the minimum number of compromises. One novel solution that arose from this was the provision of a chair that can be slid into a recess in the rear wall to improve cross cab access and allow sit/stand operation, whilst still providing a high quality seat system. A full size mock-up was built from the SAMMIE design which was used to confirm the easy evacuation of passengers in an emergency.

#### *Improved communication*

Collaboration is encouraged by human modelling CAD systems as the system can act as a focal point for the design team even before detailed engineering development work commences. The use of a human modelling CAD system is systematic and objective in its approach which enables all stake holders in a project (such as the designers, manufacturers, installers, operators, maintainers, recyclers) to examine any assumptions and constraints and to question the conclusions drawn. They can easily visualise any design problems identified and also have a direct involvement with the investigation of alternatives. This gives the ergonomist the opportunity to be proactive and to support the other design team members using communication methods (i.e. computer graphics) that are completely natural for them.

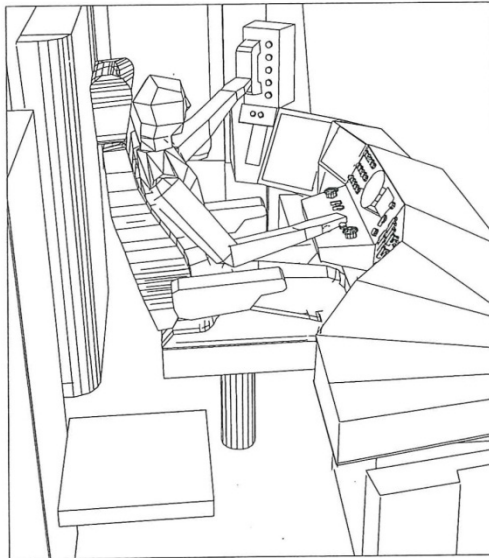


Figure 3. Development of the Amsterdam tram driver's cab

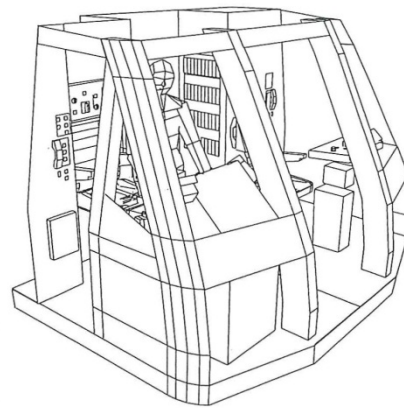


Figure 4. Hong Kong Express Train