

Four decades of SAMMIE

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SAMMIE (System for Aiding Man Machine Interaction Evaluation) is a digital human modelling system that has been in development and use for the past 40 years. Three-dimensional geometric representations of working environments and specific equipment can be built using SAMMIE and evaluated using a human model that is a 3D representation of the human body with articulation at all major body joints. Joint movements are constrained in a realistic fashion and the body shape can be varied to represent the size and shape of the relevant national or occupational populations. SAMMIE is intended for use in the very early stages of the design process, potentially saving costly design changes, to test the suitability of environments for the appropriate user populations.



SAMMIE was initially developed at Nottingham University by two PhD students starting in 1968. The *New Scientist* cover of May 1970 (reproduced with permission) illustrates the early 'Ned Kelly' look - the crude gender differentiation of the passenger was the work of the editors. The strap-line 'Computer ergonomics fits man to machine' should make all ergonomists shudder, and again was the work of the editors. The early work was as notable for its innovative computer graphics as much as the ergonomics, and such was the scarcity of graphics devices that the students travelled to the National Physical Laboratory in Surrey each weekend where they took over the lab's entire computer power. In the early '70s the researchers spent two evenings a week using the mainframe computer at Warwick University (a 0.064 megabyte (!) Elliott computer) using paper tape and later, punched cards for programming.

In the mid '70s a major Science Research Council grant awarded to Professor Maurice Bonney allowed the purchase of one of the first Prime minicomputers in the country which became an integral part of the beginnings of JANET (Joint Academic Network). By the late '70s the SAMMIE software, whilst continuing to be developed, was being applied in both research and consultancy work including mirror design for Leyland trucks

SAMMIE has been based at Loughborough University since the 1980s, becoming a limited company (SAMMIE CAD Ltd) in 1985. Development has continued under the direction of Professor Keith Case and

Professor J Mark Porter and a team of programmers and ergonomists.

Over the years the SAMMIE team has developed protocols for the assessment of driver's seat adjustability ranges, visibility of controls and displays and other analysis techniques. These have then been applied to numerous research and industrial applications, with a strong emphasis on the validation of the virtual analysis by using physical mock-ups in the later stages of the design process. SAMMIE CAD Ltd has continued to provide a consultancy service over the years with collaborators and clients including the Brussels Tram, the Eurofighter aircraft, Hong Kong airport Lantau Line, Rover Group, Fiat, Jaguar and Rolls Royce, and most recently, the Rail Safety and Standards Board (RSSB), NCR, and Shanghai Automotive.

In 1994 the SAMMIE team, Professors Maurice Bonney, Keith Case and Mark Porter, received the Otto Edholm Award from the Ergonomics Society in recognition of their significant contribution to the development and application of ergonomics.

In many respects SAMMIE was ahead of its time in the 1980s. The ability to vary the somatotype of the human model and the joint constraints system is yet to be matched by other human modelling systems. However, SAMMIE continues to evolve. SAMMIE now runs on Windows Vista using a vastly improved rendering technique and incorporating data sets derived from DTI ADULTDATA. The SAMMIE manikin now has 46 joints, some 28 more than the original, and in recent months has gained a segmented hand model that allows the representation of reach to be limited by the hand postures that are required to perform different control interactions.

Another major advance to SAMMIE is the facility to represent the abilities of a range of elderly and disabled people in terms of range of joint motion that has been made possible by the AUNT SUE Project (Accessibility and User Needs in Transport, part of EPSRC's Sustainable Urban Environments Programme). This project expanded the potential of the SAMMIE system through a new version of the program called HADRIAN. This inclusive design tool is the first human modelling tool to combine individual datasets for people of a wide range of ages and abilities, describing their size, shape, strength, postures and coping strategies (both physical and emotional), together with a task analysis tool that allows for the automatic evaluation of concept designs in a CAD environment. Peer review for the developments under the EQUAL call judged the research to be "outstanding" overall, and "internationally leading" for research quality.

SAMMIE continues to be developed and used for research and consultancy by Professor Keith Case based in the Mechanical and Manufacturing Engineering Department at Loughborough University, in collaboration with Dr Russell Marshall and Steve Summerskill, both lecturers in the Department of Design and Technology at Loughborough University, who worked closely with Professor Mark Porter for ten years.

