A beautiful and clear illustration occurs in the first chapter of Peter Rice's *An Engineer Imagines* (1994), the evocative autobiography published after his untimely death in 1992. It centres on the design of the structure of Centre Pompidou and particularly on the use of the gerberettes, the short-propped cantilevers beyond the columns.

Centre Pompidou, or Beaubourg as it was first called, was won in an open international competition by Renzo Piano and Richard Rogers in July 1971 from among 687 entries. Piano and Rogers had been encouraged to participate in the competition by Ted Happold who headed the Structures 3 group at Ove Arup & Partners, engineers, in London. Peter Rice was an associate and had returned to London three years before, after working for several years on the Sydney Opera House. The idea of structure as a framework was very much a current preoccupation. It suggested a permanent structural element which could carry a variable, perhaps even temporary, infill. Flexibility was the idea which acted as powerful motivation and could justify many architectural decisions. Large clear spaces, and thus long spans, were considered important if flexibility was to be achieved; the span at Beaubourg was to be 44.8 m (147 ft).

The competition drawing of the structure shows a braced external skeleton consisting of water-filled tubes which would provide the necessary fire resistance. The notion of a water-filled hollow structure clear of the building and therefore less likely to be exposed to extreme heat had been explored for some time previously by Ted Happold and Koji Kameya while in Kuwait in 1969, as were castings for joints (Happold, Sir Edmund, 'Essential Engineer' review of 'An Engineer Imagines' by Peter Rice in RSA Journal, January/February, 1995). The attack on P_1, the initial problem in the Popperian sequence, as far as the structure was concerned, was thus conditioned by current general ideas and personal interests. Clearly more orthodox structural solutions might also have provided

answers (not least putting a column in the centre of the span) but were rejected because of the way the initial problem was viewed. Problem recognition is one of the key determinants of design and is, as often as not, posed by the designer's own perception rather than arising entirely from a given condition, even in engineering.

This became even more obvious when the important joint between column and beam had to be explored. Rice was convinced of the importance of detail after his experience of working with Jørn Utzon in Sydney. This detail should, however, somehow show evidence of its making in order to make people 'feel comfortable'.

> 'I had been wondering for some time what it was that gave the large engineering structures of the nineteenth century their special appeal. It was not just their daring and confidence. That is present in many of today's great structural achievements, but they lack the warmth, the individuality and personality of their nineteenth century counterparts. One element I had latched on to was the evidence of the attachment and care their designers and makers had lavished on them. Like Gothic cathedrals, they exude craft and individual choice. The cast-iron decorations and the cast joints give each of these structures a quality unique to their designer and maker, a reminder that they were made and conceived by people who had laboured and left their mark.'
> (Rice, 1994, p.29)

Soon after winning the competition, Rice went to a conference in Japan and visited what remained of the buildings of the 1970 Osaka World Fair. There he saw a vast space frame with large cast-iron nodes which had been designed by Kenzo Tange as architect with Koji Kameya and Professor Tsuboi as engineers. He at once realised that cast steel had exactly the qualities he was seeking.