because it was the first hybrid created. This in no way detracts from Fairchild's contribution: for his work in transferring pollen from one species to the stigma of another, raising the resulting offspring and distributing them among his customers, he can indeed be considered "the father of the flower garden". Whether his creation was looked upon with horror by his contemporaries is not clear. But in the long run it cannot have been, because the flower spread, and hybridization to produce new garden varieties became quite commonplace.

It's not really a surprise that hybridization was shocking to the religious sensibilities of the eighteenth century, but to contend that Fairchild's legacy for an annual sermon — on "The Wonderful World of God in the Creation or on the Certainty of the Resurrection of the Dead proved by Certain Change of the Animal and Vegetable Parts of the Creation" — was given to assuage his guilt in creating an interspecific hybrid is going perhaps a bit far.

Leapman's book concludes with a short foray into the genetic-modification debate. His discussion is thought-provoking, and by reminding us that modification exists in the garden as well as the farm, it reveals a somewhat alarming side of the current public debate. The question, "who needs a blue rose?" would not have occurred to Fairchild and his contemporaries, who — although deeply religious and believers in God's design — were intensely curious about the world around them.

Despite a hard-headed, ostensibly agnostic and seemingly pragmatic outlook on life, people still seem to yearn after an 'organizer' or a higher 'intelligence' who has set up nature in a fixed design with which we meddle at our peril. It is an easy option to leave it all to a designer, but much harder to examine evidence impartially and rationally and to think carefully about alternatives. The easy option can lead to a frightening fundamentalism, whereas the second is the responsible route. Sentimentality about nature and its products would have seemed very strange to Thomas Fairchild. ■

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More from the garden

The Tulip
by Anna Pavord
Bloomsbury, £30

Millions of Monarchs, Bunches of Beetles: How Bugs Find Strength in Numbers
by Gilbert Waldbauer
Harvard University Press, $24.95, £15.50

Science in culture

Collisions and encounters

Science, representation and art at CERN.

Martin Kemp

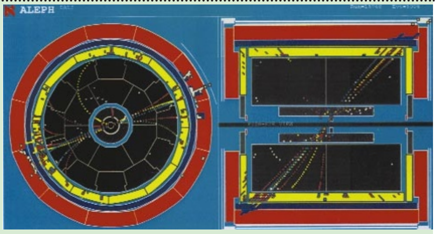
Hugely complex issues of representation lie at the heart of communication in modern physics, whether person-to-person or at the interface of humans and machines. It is potentially exciting, therefore, that a group of European artists are currently involved with scientists at CERN, the laboratory for elementary particle research in Geneva. The project, "Signatures of the Invisible", moved into gear at the start of this year under the direction of the film-maker Ken McMullen, as a collaborative venture of the London Institute (a conglomerate of colleges of art and design) and physicists at CERN. During this year, 11 selected artists will spend periods at Geneva in dialogue with scientific collaborators.

Whatever visions and skills the individual artists may bring to the project, they will be hard-pressed to match the optical, perceptual and geometrical sophistication of the programme DALI, devised by the CERN physicist Hans Drevermann for the depiction of the reactions between elementary particles in the ALEPH detector. The question he has posed himself, in the face of the vastly increased complexity of events recorded in the CERN detectors, is whether "a fast, efficient and unambiguous transfer of data to the human brain via visual techniques [is] still possible for complicated events". The task he has set is to adapt various techniques of two- and three-dimensional rendering and methods of schematic and abstract projection in combination with diagrams to provide "new visual representations" that are "better tuned to the capabilities of human perception" than existing methods.

Broadly speaking, four types of representation are potentially available. The most obvious and traditional — depending ultimately on the Renaissance methods of rendering objects systematically in space — use techniques of 3D projection and rotation to convey an intuitively clear picture of the detector as if cut away to reveal the events within. The second type of projection is derived from perspective projections, exploiting the characteristic that the size of detector and event unit are decreased the further they are from the centre (the so-called 'fish-eye' projection; see figure).

The third representation exploits the cylindrical geometry of the detector and event, leading to intuitively understandable projections resembling a cut through the cylinder, or to more abstract schemes. These may involve the unrolling of the cylinder or the deforming of a wedge from the circle into a rectangle. Such methods aim to enhance aspects of comprehension in selective ways that schematize normal visual appearance yet still play to our customary modes of perception and understanding.

The fourth representation resembles the kind



CERN

'Fish-eye' representation of an ALEPH event.

of map projection devised by Mercator. This method involves technical abstraction in which aspects of the data are plotted visually in arrays that are analytically powerful but essentially unsuitable for presentation to non-specialists, as they cannot be intuitively understood through everyday acts of perception and cognition.

Such acts of picturing, if they are to be as effective as possible in conveying complex events, operate at the limits of visual legibility, as point size and linewidth must be as small as possible to cope with the large information content of the events. This, in turn, drastically affects human colour perception, and the choice of foreground and background colours thus becomes crucial.

Computerized pattern recognition and analysis programmes achieve results that go beyond what human vision can accomplish, yet Drevermann is firmly committed to methods that will enable our senses to compete when utilizing the minimum point size and linewidth that can be discerned in various media. Why bother, if the ability of computers to read data and interpret numbers is so powerful? First, because communication between scientists is very effective using visual means; these means become even more desirable if scientists are to communicate with a lay audience — of huge significance, given the need for continued public funding. Second, because even the most powerful computers and programmes need to be validated by the scientist, using the most powerful computational device of all, the human brain.

The blending of intuitive perception of the visual with intellectual analysis of the data provides a vital tool of verification. It is at this point of blending that certain processes of understanding may mysteriously occur, often unbidden. Means of communication and modes of understanding operate by symbiosis. As Drevermann has said: "It was not my initial goal to generate pictures of large publicity value nor pictures that were appreciated by artists. This came as a surprise. However, it seems that the scientific value of the pictures has improved, since I am aware of their non-scientific value."

From this starting point, it will be fascinating to see how the encounters at CERN between art and science will bear fruit. (See http://alephwww.cern.ch/DALI/.) ■

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