Date and create

Blind Data: Celebrating Science and Design
Dana Centre, London
10–11 February. See go.nature.com/QhPGsZ

The offspring of a speed-dating mixer between young scientists and designers is exhibited at London's Dana Centre this week. On display are prototypes of three designs that communicate the broad themes of energy and recycling, synthetic and systems biology and imaging. The winning entries were selected from the ideas of 30 pairs of graduate students who were introduced at an interdisciplinary speed-dating event in May last year.

Installations in the *Blind Data* exhibition include a 'neuroplastic' playground with translucent polymer surfaces that change colour when touched or warmed. The adaptive space mirrors the brain changes that occur when we interact with our environment. Another display shows clothing and furniture that makes use of a living, bacteria-enhanced fabric that can degrade or grow. A third installation translates human facial expressions into fractal patterns on a screen in real time, through which viewers can experiment by controlling their emotions.

The project is a collaboration between the UK Medical Research Council and Central Saint Martins College of Art and Design in London, and follows on from a 2008 initiative that paired five textile designers with five Nobel laureates. One of those was biologist John Sulston, who with designer Carole Collet developed a line of biodegradable garden textiles and furniture that decayed in a manner resembling cell death, Sulston's field of expertise.

This year's student participants learned much from working across disciplines. "There are a lot of rules in something that you would think is a purely creative process," remarked computational biologist Ev Yemini from the University of Cambridge, UK. Working on the emotion-driven fractals project with Céline Marcq of Central Saint Martins, he found that his logical suggestions were often dismissed by his partner because of artistic precedent.

The pair discovered that they had creative thinking in common: "A lot of lab work is intuition," observed Yemini. But the key to their success was good communication. "It's not only finding a way to do things, it's also finding a way to talk to people," explained Marcq.

Sulston welcomes exhibitions that get the public involved in science. Art can be a tool through which scientists can keep an ear open to their constituents, he says. "Science is culture, and we ignore that at our peril." ■

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The virtue of vagueness

Although scientists strive for increasing clarity in their measurements and concepts, it is often uncertainty that spurs new thinking. The haziness of the species notion set the young Charles Darwin pondering evolution. Francis Crick observed that if he and James Watson had worried about how to define the gene in the 1950s, progress in molecular biology would have stalled. "In research the front line is almost always in a fog," Crick wrote in his autobiography. Even today there is no consensus definition of the gene.

In *Not Exactly*, a wide-ranging study of vagueness, computer scientist Kees van Deemter argues that precise definitions may not be meaningful or logical. Through his research background in artificial intelligence — he worked on the TENDUM question-answering machine developed at Philips Electronics in the 1980s — he knows how difficult it is to program computers to speak and write like humans. In the book, he brings a mix of logical, linguistic and philosophical perspectives to the topic of vagueness.

Not Exactly: In Praise of Vagueness
by Kees van Deemter
Oxford University Press: 2010.
368 pp. £16.99

Natural languages — as opposed to the formal languages that are used in logic and computing — are full of imprecision and ambiguity. In English, the adjective 'large' is equally applicable to a spider, an elephant or a planet. Speakers infer the meaning of the word from the context of its usage. Thus 'large' is a vague concept by van Deemter's definition because "it allows borderline cases". Although the term 'obese' would seem to be better defined, it is also vague: the borderlines between underweight, healthy weight, overweight and obese are, to a large extent, arbitrarily drawn.

Borderlines are essential for precision but their definition can defy reason. Much of the book explores the ramifications of the sorites paradox, an ancient Greek conundrum about the size of a heap (*soros* in Greek). Adding one grain of sand to another clearly does not make it a heap. But if you follow the reasoning of Aristotelian logic and Boolean algebra, which allows a statement to be either true or false, no matter how many grains you add, at no point does it become a heap. The threshold cannot be defined through classical logic.

Similarly, an object can retain its identity even though it has undergone many changes. In a 1990 London high court case, a seller of a vintage racing car sued a buyer who had withdrawn from the deal after claiming the car was not authentic because of the successive replacement of its parts. The judge ruled in favour of the seller: "Any new parts were assimilated into the whole at such a rate and over such a period of time that they never caused the car to lose its identity."

There is no satisfactory resolution of the sorites paradox by modifying classical logic, van Deemter argues. Rather than statements being either true or false, what is needed is a logic based on degrees of truth, ranging from zero to 100% certainty.

Allowing for such gradations in boundary definitions can help in decision-making. The author tells the story of the stealing of a diamond from the emperor of China by one of a thousand eunuchs. The single witness exclaims on his death bed only that "The thief is tall." How is the emperor to catch him? A classical logician — who might categorize suspects as either tall or not tall — would define an average height and advise searching everyone who is taller than the average. A logician who allows for degrees of truth might find the culprit more quickly: the taller the thief is, the more likely the witness is to have described him as tall. Therefore, the search should begin with the tallest.

For multiple constraints, the degrees of truth are combined using further logical operations. Such 'fuzzy logic' systems are widely used in computing, for example in providing automated decision-support systems for physicians. But, van Deemter maintains, because these combinations still rely on assumptions of truth or falsity, fuzzy logic cannot address all the ambiguities of natural language, including the sorites paradox.

Not Exactly is often a tough read for those without training in formal logic, although van Deemter intersperses it with lively fictitious dialogues. The book's argument that in public discourse we need more use of vagueness and less of the 'false clarity' of formal logic is convincingly made. In science, vagueness is sometimes a virtue and must be better understood if computers are ever to pass the Turing test for demonstrating human intelligence. ■

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