

What has a teddy bear got that a computer hasn't?

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If Beethoven can soothe me and move me, why not my PC also? What do my cats give me that my computer doesn't? When a woolly toy outperforms a computer, serious thought has to be given to why.

The recent advances in Artificial Intelligence, networking and miniaturisation suggest to me that we might be able to build better, and hopefully valuable, relationships between people and computers. I'll present three illustrations all of which show the importance of learning. You may want to relate topics discussed in one to all three.

1 - Squealing

I try to avoid babies - unpredictable at both ends! Let them take their chances with the wolves! Will it be suckled or supper? For an



incubator there is nothing so extreme - in fact no variation at all from the constant, 'optimum' conditions. Strange when babies are different.

A baby is almost certainly adapted to daily variations in temperature and light, mothers coo and chuckle to their offspring. Is a constant system the best? If not then we can think of the use of easily available technology to introduce variations in the behaviour, and improvements to the observational and analytical capabilities of incubators.

We already have the technology to make a pocket sized device to discriminate between the sound of coughing and choking. This technology is pre-programmed, having trained in the laboratory. However there is now the possibility of allowing the machine itself to draw deductions. Well I really mean lots of them, sharing notes. For example there are symptoms, such as pre-cursors to a fit, that human observation might easily miss.¹ A large number of automated readings can be used to train neural networks or used as the input to a pattern analysis system. In the first case we may obtain results but never know how cause and effect are linked, a possible problem because of the 'need to understand' especially in a medical context. In the second case we are more likely to discover patterns and build theories but then have to develop recognition algorithms.

Once we have a well tuned observation system capable of identifying benefits we can start allowing alterations to the 'optimum'. The Sun went round the Earth for thousands of years and has only changed places in the last few hundred. So a little bit of twiddling the knobs, lateral thinking and other heresies can be introduced if we know that the results can be monitored. What other heresies? Allowing the incubator to 'take a view' on how to care for the child and 'compete' (statistically) with all the other incubators. Who knows what environmental effects are beneficial - Sound? Light? Movement? Paediatricians can't agree on the use of mother's milk and have been surprised at least twice by previously unsuspected advantages and disadvantages. Which follows which? Hunch, theory, science, practice or experience?

2 - Sobbing

You don't have to be woolly-headed to wonder that a teddy bear, a 0Mhz 0Mb device, has a better record of looking after people's psychological needs than anything in silicon. Humans need companions, confidence and a feeling of security. Teddy bears don't walk-out and leave you with two kids to bring up on your own, develop drug habits or die slowly from cancer.² Pets have an advantage of being a bit more responsive. They react to being spoken to

as if they understand what you say to them and have their own personalities. Pets can be very strong motivators for the despondent and disregarded. So aside from the purely intellectual challenge of building a computer that people stroke and give their affection to, there is a need, increasing I fear, for a shoulder to cry on, a source of homespun wisdom, and the warmth of non-human company. There are two distinct functions where 'CompuTed' could be used. Firstly as a health monitor and secondly as a consultable, consoling companion:-

The number of people reaching old-age is increasing. Simply, the longer a person is independent the less will be the burden of care. Anything that can assist with simple tasks such as answering the phone, use of technology such as shopping by phone, or spot a crisis such as a fall will improve the quality of life by maintaining independence and safety. (Pages could be written on specific uses of technology in this sphere, here I'm concerned with the approach to its implementation.) This application is very similar to the incubator one. However the scope of operations is much wider and the system would be expected to have voice communications and an extremely diplomatic personality. There is no doubt that part of the mission of the device would be designed into it in the factory to maintain tight restrictions on critical care functions such as controlling the release of medication.

There is nothing hidden about the agenda of a teddy bear or a pussy cat. My cat doesn't hide the fact that he's a furry fridge magnet, but he'd never consider stopping me having just one more glass of whisky. Yet he's somehow very persuasive when it comes to getting his own way. "NO!" becomes "All right - Just this once". Writing to agony aunts, reading horoscopes, and listening to preachers are examples of looking for luck or hints to make the future turn out all right. Surely we can provide a similar, but personalised service with the technology that will shortly be at our disposal?

The archetypal ELIZA³ showed how it was possible for an extremely simple program to behave 'realistically' and carry on an engrossing conversation. Our task is admittedly much more difficult. We'll have to provide a voice interface that can interpret language and intonation and distinguish the owner's voice. We'll have to build a very adaptable system that will learn what is appropriate in its unique and private circumstances. If personalisation wasn't enough, we have to be able to adapt to changing moods. We need a response mechanism that is subtle, non-threatening and perhaps vague. To get the full 'teddy bear effect' we also need a physical package that is at least strokeable and has some animal features. Learning and adapting is the key to being able to deliver these features - the computer learns the interface rules rather than the human.

3 - Soaring

With suitable hill and breeze you can fly a radio controlled sailplane. Once the basic operating conditions are appreciated then the feedback in the control loop is purely visual, so we know that the only necessary real-time input to a soaring control system is motion measurement. There are limits of flying ability and a restricted airspace but these are constant parameters. (You can't glide uphill or fly through the ground.) Ocean-going ships have steering systems that take into account wave action to economise on fuel. In short, the hardware side of things is possible and similar control problems have been solved. So how do we upgrade a sailplane autopilot from straight-and-level to ride the breeze more efficiently? Instead of a left-right/up-down control, the pilot has a good/bad control which feeds back to the 'intelligence' doing the flying. In this way the conditions-action-result patterns can be learnt. Once again an efficient learning mechanism is needed.

Here is the pay-off: Consider the human-machine relationship that results. We now have sailplanes that fly themselves and perform freely but only as a result of training by the pilot. The individual has worked with the machine to cure its bad habits and to improve the skills of the plane itself. The detailed experience and knowledge of the plane may easily exceed that of the tutor. The precision, anticipation and ability to get the most out of the energy in the air may be superior to that of the human on the ground. What better way of forging a bond

between man and machine, the pride of the teacher seeing their unique pupil perform or compete on their own; the result of many hours of careful training.

Relationships

Imagine a car design/styling/market research program that mutates while being watched by dozens of potential customers with VR headsets. If the headsets contained a camera looking at the eyes of the watchers to measure the pupil dilation (a sign of sub-conscious interest) then the development of the design would evolve 'democratically' and in real-time. While this is an example of the activities described in the illustrations there is hardly any personal relationship being created⁴. Contrast this with a design team meeting where ideas and suggestions are to some extent 'owned' by their proposers or detractors. In the latter case there is *recognition*. This is an essential part of any relationship. For example my cats are tuned to the jingle of my keys and come to meet me when I get home - I'm *worth* something as patron saint of pussy cats! I'm somebody not just anybody.

Does my computer need me? Want me? Wait for me to come home? No of course not. Does it soothe me with beautiful music? Give me valuable advice? No. Hardly surprising that I'm not particularly attached to it. At the very least my computer should perk up when I use it and shrink into a corner if a stranger does.

Confidence

The continuing controversy about the causes of cot deaths⁵ is an example of how seemingly insignificant and combined environmental effects can have serious consequences and how statistics are manipulated into cut-throat theories. Humans can't escape searching for certainty. Curiosity about cause and effect leads naturally to a search for signs, and the lodgement of striking ones. History probably began as a collection of signs, comets, birds flying south and so on. So for the incubator and the teddy we really would be taking a chance with our collective psyche to allow a computer to mysteriously nurse-by-wire.

Music is a powerful channel of communication that can affect our moods. If we don't have a proven scientific theory then we might be worried about undesirable effects appearing unexpectedly. To say "it seems to work most times" is just going to make us worried about the

other times. Even assuming that I've filled in a questionnaire about how I feel about various pieces of music am I really in safe hands if the computer is in a position of influence?

But what about the sailplane? In this illustration we see technically aware people happily using serendipity to create a machine with almost a 'mind of its own'. If instead of sailplanes we trained wheel chairs, would **you** feel happy at the top of a flight of stairs seated in a wheel chair trained by somebody else? Well I'm sure you could bring yourself to accept it. Guide dogs for the blind are trained by others before being handed over to their keepers. So a highly successful precedent exists.

What about the wolf?

The cartoon in the first illustration is easier to recall than most of the words. It serves one purpose of being a memorable marker⁶. The image is deliberately chosen to be shocking in meaning but not in presentation. This is not an empty gimmick: You almost certainly attached no wickedness to the wolf and viewed it as a human sitting down to dinner. You might be tempted to take a fluffy Polar bear home for your children. I expect she thinks the same about you! The strange thing is that we seem to want to put loving human characteristics onto some of the most vicious carnivores on the planet. Soft and huggable seem to be the necessary attributes.

I have to leave designing the first cuddly computer to someone else, but in the meantime I'd like to see a computer game involving training wolves to hunt and become man's-best-friend as perhaps a thousand previous generations have done. It would certainly be an interesting research project - voice tone interpretation, learning the significance of clues in communication, analysing motivation - on both sides of the screen. Naturally the game would be personal, activating when it detected its 'master'. Perhaps this could then become the basis for taming phobias or even more sophisticated psychological uses.

Another suggestion. This time looking at things the other way round - taming teenagers: How about trying to develop a system to deal with poor school performance, anti-social and self destructive behaviour of teenagers? Not an expert system based on a fixed amount of expert opinion but a evolving system that learns from

its consultations to improve its conversation, persuasion and quality of its 'wisdom'. The current state-of-the-art Natural language processing is probably sufficient to deal with the interface. This leaves the challenge of analysing motivation, building behavioural models for the human and the computer, then making it rewarding to spend time with the computer.

Now listen! If the wolf can be made into a guide dog then we can tame our fears of computers. Part of the process is training ourselves and building trust in our own achievements. The rewards of a trainer for some of us and the safety of dedicated and trustworthy carers for others.

Postscript

Are computers always going to be soulless tools, awkward boxes or aggression centres? Surely we can develop computers as trusted, dedicated companions. If human needs are not being cared for by humans then lets us use the rapidly advancing technology of artificial intelligence. More games computers are sold than business computers, and I suspect that the true usefulness of many of those never appears on a bottom line. If we are bold we can experiment without having a theory for an excuse. If we provide approachable interfaces, we can expect people to get closer to the tools and support they need. If we can provide very basic comforts and even basic learning abilities, people will queue up to cuddle up.

I have chosen my three illustrations to show a wide range of combinations of tasks, number of communications channels, active participants, relationships, shared knowledge, and environments. I have only been able to hint at some aspects. If space permitted these could be categorised and expounded in more detail - a task I shall have to leave in this instance to you, dear reader.

1 *Reliable pre-cursor signals are the holy grail of earthquake prediction.*

2 *Apparently 1 in 3 mothers will be bringing up children on their own at some time. 1 in 5 families have a single parent. According to the Office of population censuses and surveys, 1 in 7 people have had some mental health problem in the last year.*

3 *ELIZA: An experimental program that simulated a psychoanalyst. In fact it basically rephrased key words used by the subject in question form.*

This simple strategy was amazingly effective although far from perfect.

4 *But there is some collective relationship just as 'society' has a relationship with 'television' or 'the royal family'.*

5 *In short: Does an arsenide used to fireproof mattresses 'cause' cot deaths? If so then it appears to be a complex and chancy process. Statistics, theories and vested interests compete and there appears to be no such thing as a clean fight.*

6 *A practice used in illuminated medieval parchments - I suspect as memory jogging aids since even priests might be poor at reading and managing written records. We salt our everyday communication with signs from body language to imagery in words to the clothes we wear. Communicating computers take note!*

What shall I wear today?

