

Reflections on AR/VR from an EM perspective

Problematic issues in design and engineering education

- islands in the manufacturing process
- aspiration to exploit VR
- barriers to use of VR:
 - Cost
 - -interface
 - -pedagogical challenges / challenges to pedagogy

[cf. Warwick report by Rob O'Toole]

Perceptions of the problem

Technology is mature: problems are elsewhere?

Counter-view – problems stem from

- Importing CS conceptual framework
- Construction in CS ill-matched to engineering
- Fundamental rethink of digital elements to do justice to engineering practice and potential
- Complementary rather than consistent with the revolution initiated by automation.

Key concern

- Marrying conceptual with technical
 - Old way of thinking of this in CS
 - WHAT? = declarative vs. HOW? = procedural
 - Evident in geometric modelling
 - FRep (e.g. Hyperfun) vs. STL ("polygonal soup")
- Design paradigm promoted by CS based around specification (even if "Agile") unhelpful
 - Cf. Erkki empirical, observation-led "EM"

What is needed to enable “EM”?

A: New conceptual perspective

- radical empiricism

B: New principles

- ODA perspective

C: New environment/instruments

- Construit / “MCE”

A+B established through prior work of the EM group

C drawing particularly on work of CONSTRUIT!

Broader context

EM = BC fby AB fby C / SW culture = C fby B

Richard Cartwright / Nick Pope

"The modern sw development process is making construals"

"SW development and programming driven by experience"

"How has this come about?"

"Will need for principles become an issue?"

SW culture

Mechanisms to support ODA are proliferating

- Bret Victor,, 'EVE' Chris Grainger
 - Exploratory Explanations
 - Reactive Functional Programming (so-called)
 - dependency via "little functional programs"
 - "What if?" in context of preconceived objects (bridge to classical CS / parametric design)
- ? **Is there any alternative:** question begged by computational stance on universal meaning

Making construals is programming?

- Programming involves 'crafting experience enlisting meanings through association'
- 'it works'- and in some contexts works better than anything EM has offered
- not licensed by any characterisation of programming as a principled activity
- association can be conjured without any presumption of purpose (cf. "free association")
- purpose as making sense / understanding

Essential re-orientation

Suspicious of whole complex of ideas around

- *specification* for a purpose
- *interfaces* for diff users / levels of expertise
- progressive disclosure of *functionality*

Clarity about meanings is alien to making construals

I don't know / I'm not sure / I'm confused / I'm puzzled

I'd need to think about that ... / Let me see ...

Something's not quite right / I don't understand

Construal as “an object to think/converse with”

Pedagogical orientation

- pedagogical frame in which the nature of what is to be learnt / understood / conveyed is clear and unambiguous
 - preconceived semantic framework where know what is to be explored / discovered, as in "guided discovery"
 - hiding complexity from the learner until they are "ready to understand"
- ... presupposing a level of confidence in the correct interpretation / the "right answer"

Pedagogical re-orientation

- Understanding that cannot be abstracted from experience
 - everyday construal of situations
 - learning the nature of cricket from watching it on TV
- experience first - interpretation later {possibly}
- *crafting* experience together with its interpretation and application
- 'open mind' about what is possible: exalted reality as endorsed by radical empiricism

Why invest in this?

A+B not compelling enough: C is essential

- Want to show that A+B with appropriate C delivers more than can be achieved otherwise
- AR/VR is an expensive process that readily exhausts financial and human resources -- as practised currently is infeasible to realise the aspirations for the technology

Addressing the AR/VR challenge

- beneficiaries / adopters / "users (!)" have to be engaged in co-design
- have to be leveraging domain expertise
- want not just to argue speculatively and abstractly that this is desirable but to demonstrate that this is feasible / plausible

Qualities of the construal for VR

economy of definition – concise script

comprehensibility

converse via observables with familiar associations

Collaboration/co-design

supporting ambiguity, concurrency, conflict

negotiation of meanings

Authentication of understanding

Possible studies

- adding labels -- make conditional on "looking at the object"
- Mars probe journey (Track to Mars -- #175)
- anthropomorphic robot 'experience' / cricket match cf. BBC plans
- 'super observation'
 - Speed of travel of Sun pre-Copernicus?
 - Observing distance of planet by measurement?