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Faculty Summit 2010

Natural Interaction Research: Uncertainty ~~in~~ is our Future

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“Natural” User Interfaces

That can mean a lot of things

so it can be hard to pin down a research agenda…

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“Natural” User Interfaces

But there are some common threads and themes
which have common issues…

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In “natural” uncertainty abounds

It comes at us from several directions…

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New input devices / sensors

- often not fully refined
- working from richer underlying data sources

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Even if we create highly refined sensors…

“Natural” generally involves recognition

recognition is hard

good recognizers sometimes have 95% accuracy…

… that’s getting it wrong 1 in 20!

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Even if we were to somehow make perfect recognizers (not likely) …

Human-to-human interaction is a central model for "natural"

but that is chock full of ambiguity and uncertainty

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Human-to-human interaction is naturally ambiguous

- it doesn't have to be (we can be more precise if need be)

Human-to-human interaction is naturally ambiguous

but consider what happens when we aren't…

ATC: Delta 4-5-2 descend to 1-1 thousand

D452: Delta 452 is leaving flight level 2-7-0 for eleven thousand

Human-to-human interaction is naturally ambiguous

but consider what happens when we aren't…

ATC: Delta 4-5-2 descend to 1-1 thousand

D452: Delta 452 is leaving flight level 2-7-0 for eleven thousand

… unnatural

We can be more precise, but we choose not to…
Why?

We tend to think of ambiguity as error or a weakness, but it serves positive purposes

- social discourse is central to natural human-to-human interaction
- and we rely heavily on ambiguity and uncertainty to provide soft boundaries and leave room for negotiation

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To succeed with natural interaction we need to handle ambiguity and uncertainty (well)

- it's not going away
- it *can't* go away and still be "natural"

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To succeed with natural interaction we need to handle ambiguity and uncertainty (well)

… but we don’t currently know much about handling uncertainty

Therein lies the research agenda I want to suggest

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lots of modality and domain specific challenges

But are there specific cross-cutting research challenges?

… let’s look at what needs to be built

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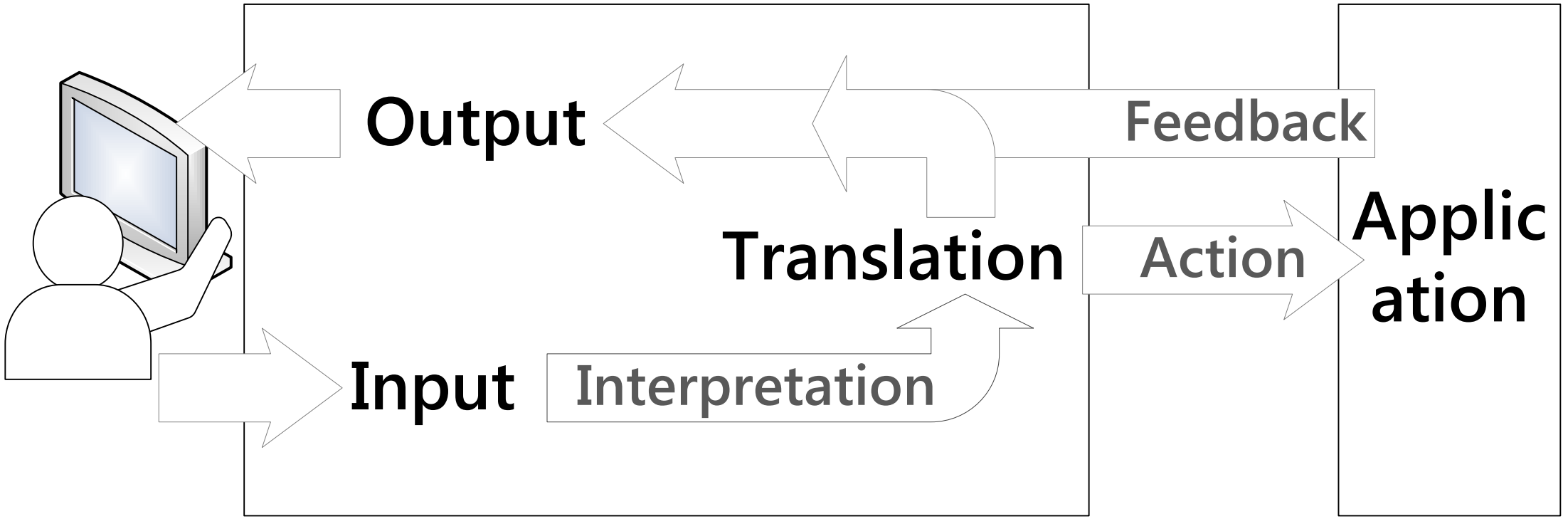
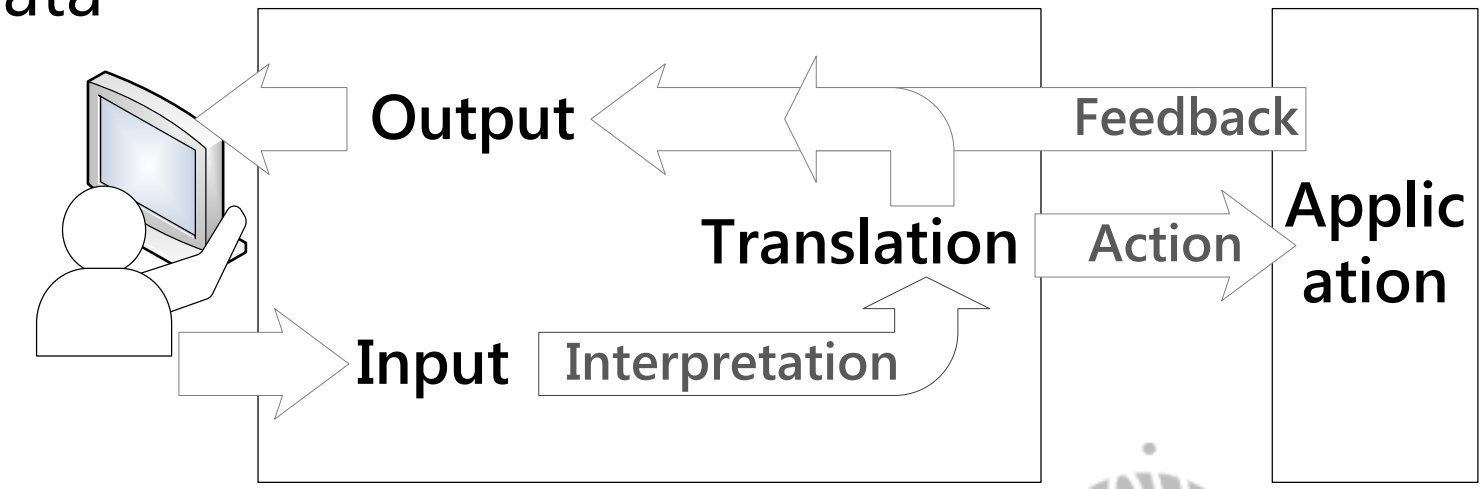
Most interactive systems can be boiled down to something like this:



Based on these components we need (at least):

Representation of Inputs with Uncertainty
Interpretation of Uncertain Input Sequences
Choice of Action
Feedback of Uncertain System State &
Depiction of Uncertain Data



Representation of Inputs with Uncertainty

What's the equivalent of the event model of input?

Interpretation of Uncertain Input Sequences

How do we use information about uncertainty to create robust probabilistic estimates of user intent?

Choice of Action

Given multiple interpretations how (and when) do we choose to act?

Feedback of Uncertain System State & Depiction of Uncertain Data

How do we let the user know about system uncertainty?

How do we unobtrusively get them involved in helping resolve uncertainty in ways that remain natural?

There are also some bigger picture issues

The conventional UI paradigm is very good at what it was invented for

- but direct manipulation (model of editing the objects of interest) may not work so well with uncertainty

- how do we keep it where is works
- but mix it with other styles where it doesn't do as well?

There are many challenges in producing a natural interaction experience…

… dealing with the inherent uncertainty of rich new sensors, recognition, and human beings, offers challenges that cut across many of them

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