The Interface Problem

What it is and how to think about solving it

Aims

1. To understand what the interface problem is
2. Look at some solutions to the problem suggested by Butterfill and Sinigaglia (2014)
3. Look at a criticism of their preferred solution
4. Look at alternative attempts at solutions
5. Reflect on a recurring criticism
6. Consider a completely different approach

A reminder of the reason to introduce motor representation

Mylopoulos and Pacherie (2016) remind us that on the Standard Solution, action can still go wrong under the following conditions:

1. We fail to make the appropriate movement
2. Our action is caused '**in the wrong way**' by our intention

We must make restrictions to '**the right kind**' of cause

- What is 'the right kind' of cause? Plausibly, one which involves 'appropriate' motor representations
- Which motor representations are appropriate? Those motor representations which **match** the intention

1. **The Interface Problem**: how to define the problem

The problem is to explain "how intentions and motor representations, with their distinct representational formats, are related in such a way that, in at least some cases, the outcomes they specify **non-accidentally match**."

Butterfill and Sinigaglia (2014), p131

Match: two (collections of) outcomes A and B **match** in context C just if, either:

1. A-outcomes **constitute** or **cause** B-outcomes (or vice-versa)
2. B-outcomes stand to A-outcomes as "**elements of a more detailed plan** stand to those of a less detailed one" p131

A match is **not guaranteed**: consider action slips, or anarchic hand syndrome.

1. **The Interface Problem**: a persistent philosophical problem

The Interface Problem for action is just one species of a general problem which tackles possible limits to our understanding.

Consider the '**Molyneux Problem**' from Locke's *Essay Concerning Human Understanding* (first published 1689):

Imagine someone born blind suddenly acquiring sight. This person has only ever distinguished cubes and spheres by touch. Molyneux then asks whether such a person "by [their] sight, before [they] touched them, [they] could now distinguish, and tell, which is the Globe, which the Cube" *Essay*, p84

Molyneux thinks **not** (and Locke agrees).

1. **The Interface Problem**: what explains the problem?

Why was the Molyneux problem a problem? It concerns matching two representations with the **same content** but **different format**. In the case of the sphere, **visual** and **tactile** representations.

We have seen the idea that intentions and motor representations have different formats:

- Intentions have a **propositional** format
- Motor representations have a **motoric** format

Can we say in general that a difference in format generates an integration problem?

1. The Interface Problem: why it is a problem 2: format

Admission: I do not understand what it means for two representations to have a different format.

We have defined the difference by ostension, pointing to the map and written instructions. But I find myself unable to generalise easily.

Reprieve: Smarter people than me are still unsure: Christensen (2021) writes that existing characterisations of the differences between 'iconic' and 'discursive' formats "suggest that these putative format types are not well understood" p562

Also, "the efforts to use these conceptions to explain the perception-cognition distinction face serious difficulties" p564

So, since the intention/motor format distinction is based on the iconic/discursive distinction: "there isn't strong reason to expect that such a format divide can be found at the cognition-motor interface" p564

1. **The Interface Problem**: why it is a problem 3: profile differences

Butterfill and Sinigaglia (2014) suggest that differences in **performance profile** between the two representations might show there are format differences, but I think the performance differences are enough on their own to motivate the problem.

There are significant differences between the representations in a few ways, helpfully spelled out by Mylopoulos and Pacherie (2016). They point out that there are:

- Differences in the **kind** of information integrated
- Differences in the **purpose** of the information integrated
- Differences in the **constraints** the information integration obeys

1. The Interface Problem: why it is a problem 3: profile differences

Representation type	Kind of information	Purpose of information	Constraints on information integration
Intention, belief, desire	Conceptual; the kind of information which features in concepts. Rich in one sense, impoverished in another.	To form plans: to be the "terminators of practical reasoning about ends" and the "prompters of practical reasoning about means and plans" p320	Rational constraints; the information integrated must be done so in a way which is responsive to demands of rational planning. Information forms inputs and outputs to practical reasoning processes.
Motor	Purely functional; "objects and situations are represented in terms of those of their properties that are immediately relevant for action" p321	To be 'useful' for the "relevant parameters of the selected motor program", for example "spatial position will be represented in terms of the movements needed to reach" an object p322	Constraints imposed by the motor system and the biochemical structure of the body: isochrony principle, Fitt's law, two-third power law etc. p322

Aims

1. To understand what the interface problem is
2. Look at some solutions to the problem suggested by Butterfill and Sinigaglia (2014)
3. Look at a criticism of their preferred solution
4. Look at alternative attempts at solutions
5. Reflect on a recurring criticism
6. Consider a completely different approach

2. **Possible solution**: content-respecting cause

Perhaps we can say that the representations are matched in virtue of their content, which we have said is typically the same (or similar). Perhaps some process operates which ‘checks’ whether the content is the same, then establishes a causal link.

However, this suggests there is some **translation** between the information contained in one representation and another, despite the various differences outlined previously.

For example, how do we get from the content of a MUG concept to the same content (something which still specifies a mug), now **translated** into a series of spatial coordinates?

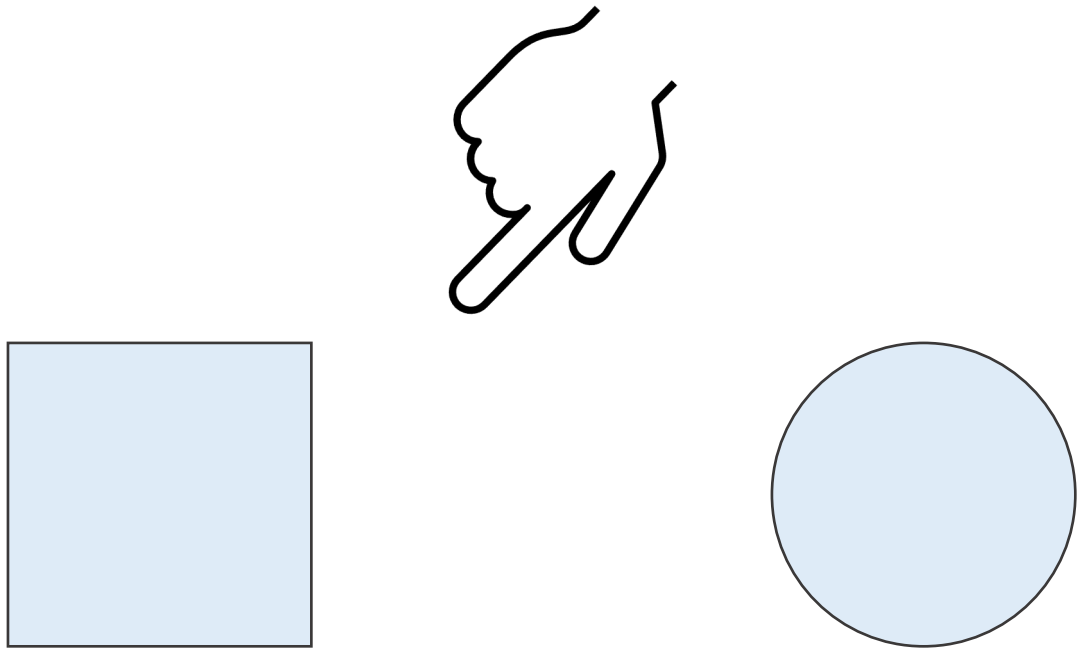
2. **Possible solution**: content-respecting cause

Think back to the map example from previous weeks: how do we check whether the instructions match up to the map? It looks like we would need some way to **translate** between the two.

However, in the case of the interface between the cognitive and motor systems, “nothing at all is known about this hypothetical translation between intention and motor representation, nor about how it might be achieved, nor even about how it might be investigated” Butterfill and Sinigaglia (2014), p133

2. **Possible solution**: deferral to motor representation

The idea: we **defer** to motor representations by way of **demonstrative** concepts in intentions. So, intentions indirectly refer to outcomes through motor representations.



2. **Possible solution**: deferral to motor representation

How might this work in practice?

When you imagine doing an action, you engage motor representations.

Suppose you are asked to go climbing, but you have never been before.

However, you can imagine climbing a route and develop an intention which involves the concept CLIMB with, as its direct content: whatever **that** involves!

In this case, **that** directly refers to the **motor representations** engaged during the imagination, and so indirectly refers to the **outcome** of climbing the wall.

2. **Possible solution**: deferral to motor representation

How does this help?

1. Thinking back to the pointing example: if we were to remove the circle and square, we would be left with just this: 
   - This accounts for the difference in amount of information in the concept of the intention relative to the specifics of the motor representation.
2. It ensures that the motor representation will always track the constraints imposed on intentions
   - Concepts are the basic units used to construct intentions; once the appropriate concepts are selected, the motor representations to which the concepts defer will be locked in place.

Aims

1. To understand what the interface problem is
2. Look at some solutions to the problem suggested by Butterfill and Sinigaglia (2014)
3. Look at a criticism of their preferred solution
4. Look at alternative attempts at solutions
5. Reflect on a recurring criticism
6. Consider a completely different approach

3. **Criticism** of deferral account

Mylopoulos and Pacherie (2016) criticise the deferral account in a few ways, but we will focus on just one, which they take to be the most decisive.

They say that the account suffers from a **selection problem**:

The account “presupposes a translation process, the very thing that they were trying to avoid” p329

They argue that “the agent must have an independent grasp of which motor representation is the appropriate one to select via such deferral”

The problem is, this means that there must be “a way of **translating** between the intention and the motor representation being picked out, in order to establish which motor representation correctly corresponds”

4. **Alternative accounts**
the motor schema view

Instead, Mylopoulos and Pacherie suggest that we can think about **motor schemas** as bridging the gap between motor representations and intentions.

Schemas are both “repositories of information and control structures” p330

- In this sense, they ‘fill in the gaps’ of the intention by providing a wealth of background information which provides parameters for a wide variety of action types.
- They provide “rules describing relationships between initial conditions” and sensory feedback.
- Intentions provide some of the information to “set the values of the schema’s parameters” p333 so that a general concept can cause a specific action via the schema.

These schemas can be innate, or acquired through Bayesian learning, extracting general patterns from specific actions.

4. **Alternative accounts**
the same format view

Ferretti and Caiani (2019) suggest that intentions feature concepts which themselves have a **motor format**.

This is taken generally from **grounded cognition** views, which have been popularised and developed recently by Lawrence Barsalou.

They establish this claim through behavioural, neuroscientific and lesion study evidence.

So, Ferretti and Caiani claim there is no need for mediation, or for translation between intention and action.

5. A **recurring criticism** of these views

Ferretti and Caiani criticise Mylopoulos and Pacherie on the grounds that they have a **selection problem**.

They argue that the motor schema account requires “an independent grasp” of which schema should be selected. For example, the intention “to put the cap on the pen” presumably requires a different schema from the intention “to put the pen down” – but then we surely need to **translate** between the required motor representation and the concept TO PUT before we can select the appropriate motor schema! p309

5. A **recurring criticism** of these views

We might even think that Ferretti and Caiani have a much more pervasive version of this particular problem.

If some action concepts themselves have a motor format, we surely need to answer: how are those concepts **selected** for inclusion in intentions?

Concepts are presumably selected for inclusion in propositions in virtue of their content **matching**, in some sense, the content of the concepts of the surrounding proposition.

But then it looks like, if some concepts are essentially motor representations, we have pushed back the **Interface Problem** to the integration of concepts with other concepts.

Unless we have some method of **translation**, it looks difficult to see how we would have an independent grasp of which concepts are appropriate for inclusion within a proposition.

Aims

1. To understand what the interface problem is
2. Look at some solutions to the problem suggested by Butterfill and Sinigaglia (2014)
3. Look at a criticism of their preferred solution
4. Look at alternative attempts at solutions
5. Reflect on a recurring criticism
6. Consider a completely different approach

6. A **totally different** approach

Wayne Christensen (2020) has suggested that we do away with our aversion to **translation**.

We should confront the issue head-on. Indeed, he suggests that "motor control theorists have commonly assumed that cognitive intentions are translated into motor representations" p558

However, whether they do so, Butterfill and Sinigaglia may feel vindicated by the following statement: "**it is unclear what should be considered translation**, but I will take it that systematic linkage between distinct representational schemes counts" p557

Nonetheless, Christensen attempts to offer a provisional account of translation, and suggests the **Interface Problem** should be seen as a problem of providing a detailed account of the various types of translation and how they are implemented.


The end
We got there!