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Does philosophy offer cognitive science distinctive methods?

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Abstract
Philosophy has never settled into a stable position in cognitive science and its role is not well understood. One reason for this is that the methods philosophers use to study cognition look quite peculiar to other cognitive scientists. This paper explores the methods of philosophy, laying out some of the main kinds and looking at some examples, and makes some remarks about their value to cognitive science.

Does philosophy have distinctive methods to offer cognitive science? Once upon a time, philosophers agreed at least that philosophy *has* distinctive methods. At various times, analysis of the conceptual framework of cognition or analysis of concepts or assembling reminders of how we use key terms of ordinary language or .... or ... or ... would have been presented as the method(s) in question. More recently, even this has become a matter of controversy. Starting from the heavy pressure that Quine (1952) put on the analytic/synthetic distinction and the concept/fact distinction and that Davidson(1973) put on the idea that there is a serious distinction even between facts and conceptual framework, many philosophers now deny that there is anything distinctive about the methods they use. On this view, philosophy is merely the most abstract kind of empirical theory-building and uses the same methods as other high-level theory-builders (Castañeda, 1980).

This cheery ecumenicism is a bit strange. The methods of philosophy certainly look distinctive and even quite peculiar to the rest of cognitive science, especially to the real experimental theory-builders in the discipline. Maybe a few babies are in danger of being thrown out with the conceptual bathwater. There is more to philosophy than the parts of it that contribute to cognitive science but I will stick to the parts that do.

The first question I will examine is thus:

In the parts of philosophy that contribute to cognitive science, can we identify distinctive methods?

To be distinctive to philosophy as I will understand the term, a method must have three features. It must be:

(a) significantly different from hands-on experimentation, model-building, etc.,

(b) pervasive in and central to the work of philosophers who contribute to cognitive science,

and,

(c) not common elsewhere in cognitive science.

To start, notice a couple of methods would not meet one or more of these requirements:

(i) *Deductive and inductive inferences from premises.* This activity (I am not sure that it should be called a method) is quite different from hands-on experimental work, model-building, etc., and is central to philosophy but it is not at all *distinctive* to philosophy – all rationally structured investigation engages in it.

(ii) *Building cognitive or computational models.* This method is also quite distinct from experimentation and hypothesis-testing but it is not central to most of the philosophy that we find in cognitive science.

Are there any methods that would satisfy all of (a), (b) and (c)? In Section I, I will sketch some of the diverse methods that philosophers in cognitive science in fact use. In Section II, I will focus on thought experiments, one of the most characteristic activities of philosophers in cognitive science, and begin an examination of whether they satisfy (a), (b) and (c). In Section III, I will examine how thought experiments function vis-à-vis experimental science and complete the examination of whether they satisfy (a), (b) and (c).

1. The methods of philosophy

First, a preliminary point about philosophy. There is one philosophical activity that is *highly* distinctive to it: the exploration of norms – ethical norms, political norms, epistemic norms, and so on. To be more precise, philosophers investigate what our norms should be, what norms are justified. Other disciplines investigate what norms people do *in fact* accept, but only philosophy tries to determine what norms we *ought* to accept.

Moreover, philosophy does significant work on norms in cognitive science, epistemic norms in particular. (This might be thought of as a place where ethics [or metaethics] meets the philosophy of science.) All science, indeed virtually all human activity, is governed by norms. How to justify norms is a huge issue and fierce debates rage. How does the normative relate to the natural (Hatfield,1990)? Is there any source of norms independent of what some part of our past has in fact induced into us, evolution, for example, or past scientific practice? (A concept of truth independent of human interests would be an example.) Whatever the answer to the question about sources, is there any way to *justify* norms independently of evolution or past practise? –These are some of the issues in normative epistemology.

The investigation of them is highly distinctive to philosophy; other disciplines take no more than a passing interest in such questions.

It is not obvious, however, that the *methods* of normative investigation differ from the methods of philosophy in general. Even if the *subject-matter* of normative investigations is different from the subject-matter of other parts of philosophy, the former may use much the same *methods* as the rest of philosophy. At any rate, in this paper I will focus on methods used throughout philosophy's contributions to cognitive science, both normative and (largely) nonnormative.[1]

Philosophers use at least four methods in the work they do in cognitive science:

(1) *Investigation of the meanings of words:* what words do mean and what we should take them to mean. This activity, which could be extended to include such activities as the investigation of the semantic properties of different types of explanation, investigation of how various scientific (and perhaps other) activities use a given word, and so on, is conceptual analysis. Thirty years ago it was taken to be the core of philosophical investigation.

(2) *Straightforward scientific method,* but applied to more general and abstract questions than are common in (the rest of) science. Castañeda (1980) is a keen exponent of the idea that this is how analytic philosophy works; he cites Quine, Sellars and Chisholm as exemplars.

If (2) is what philosophers are doing when they do philosophy, they are straightforward empirical theory-builders, merely interested in more abstract and general questions than (other) scientists: the nature of a number rather than the nature of a neuron; how many kinds of thing exist in general rather than how many kinds of elementary particles there are; the relation of object and property rather than the relation of an ecology and its occupants; and so on.

Note that (1) and (2) might not be as different from one another as they first appear. Sorting out and the rational reconstruction of concepts is often part of what is needed to build a theory – indeed, as Quine showed, there is often no clear line between changing beliefs and changing concepts.[2]

The methods of (2) are simply the methods of good theory-building in general and when philosophy uses them, there is nothing distinctive to its methods. If science makes use of conceptual analysis in the way just suggested, then (1) is not distinctive to philosophy either. It too is merely part of the methodology of good theory-building in general. In connection with (1), the most that could be said is that philosophers *pay more attention* to the conceptual toolbox of science than (other) scientists who focus on experimentation, modelling, etc.

Note too that conceptual investigation is itself a *form* of empirical investigation, at least in part. It is not experimental but it is still empirical (experiments are only one kind of empirical investigation).[3] Conceptual analysis of the symbolic toolbox of science involves lexical semantics, the psychology of cognition (how we use concepts and why), and the exploration of what is distinctive to, perhaps even necessary for or of the "essence" of, kinds of things. Lexical semantics and psychology, at least, are straightforwardly empirical.

To be sure, analysis of concepts and other symbolic structures is not *entirely* empirical. When we go to work on the concepts, styles of reasoning, etc., used to investigate some domain, we want to generate *good* concepts, *good* styles of reasoning, etc. That is, we are at least in part interested in *normatively reconstructing* the symbolic structure so that it serves our epistemic interests better, not just in *finding out* what is built into the structure as it now exists. Rational reconstruction is at least as much normative justification as it is any kind of empirical investigation.

What do philosophers use to analyse/reconstruct concepts? This brings us to a third method:

(3) *Thought experiments* The natural sciences make some use of thought experiments, physics in particular (Brown 1991). Famous thought experiments in physics include Schrodinger's cat and Galileo's invitation to imagine a smaller and a bigger piece of matter tied together.[4] The social sciences make some use of thought experiments, too, though less use than physics. In philosophy, they are absolutely central.

In a thought experiment, we imagine some scenario (the contrast is with hands-on experiments using equipment, etc., in which we manipulate a scenario itself, rather than a representation of it; I will call these 'hands-on

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[1] Are any philosophical contributions entirely nonnormative? I doubt it. Virtually all philosophy has a normative element. Even an analysis of a concept is often in part a recommendation as to what we *should* take the concept to mean.

[2] For discussion of these issues, see Kripke 1972, Nozick 1981, Cohen 1986, and Dummett 1993.

[3] I owe my sense of the importance of this distinction to Rob Stainton. Computational modelling is an empirical investigation that is not experimental, for one.

[4] Schrodinger argued that a cat in a box had to be in some determinate state even if we did not know what it was. Galileo's thought experiment was aimed at Aristotle's idea that smaller mass fall slower than bigger ones. If a smaller mass falls slower than a bigger one, then if we tie the two together, the resultant mass ought to fall both faster and slower than the bigger of its components by itself. On thought experiments in science, see Brown 1991, Horowitz and Massey 1991, and Sorensen 1992.

experiments'[5]). In cognitive science, some of the most famous philosophers' thought experiments are Putnam's twin earth, Jackson's Mary the colourblind colour scientist, Dennett's qualia impasses, and Searle's Chinese room. We will examine each of them shortly but first I want to ask some questions about thought experiments in general.

Like analysis of concepts, are thought experiments also empirical, at least in part? Yes; they are merely a particular way of manipulating material stored in memory, material originally gained from experience. Thought experiments are acts of imagination but there is nothing distinctively *a priori* (independent of experience) about them. Thought experiments may be empirical in another way, too. The motive for mounting them is just as much a desire to see how things hang together as when we do hands-on experiments. There are differences between the two, of course, but they do not appear in anything as general as being or not being empirical.

Thought experiments may be central to philosophy's contribution to cognitive science but they play a role in other parts of cognitive science, too. Intuitions of grammaticality are a kind of thought experiment; they play a central role in linguistics, Likewise, some empirical research into reasoning starts with subjects doing thought experiments. The subject is asked to determine whether more words begin with 'r' than end with it, for example, or to determine which is more probable in some situation, A or B, or whatever. Of course, in both these cases the thought experiments are done by the subjects, not by the researchers. Nonetheless, thought experiments are not unique to philosophy in cognitive science.

Again we must be careful. If thought experiments in the hands of linguists and psychologists play a role in finding (or displaying, or limiting) the facts, in the hands of philosophers they also play a normative role. Compare thought experiments in hands-on research into reasoning and thought experiments in a philosophical investigation of reasoning. Psychologists get subjects to do thought experiments to find out how we actually reason: what mistakes we make, what produces these mistakes, etc. When a philosopher runs a thought experiment about reasoning, her interest is different. Her interest is in finding out what *good* reasoning consists in.

So we can say this about thought experiments. In no discipline other than philosophy do they play the central role that they play in philosophy and no discipline other than philosophy uses them to study normative issues. If so, the use of thought experiments as a method is in some measure distinctive to philosophy. In what measure we will discover shortly.

[5.] It is not in fact easy to find a short yet adequate way to mark the distinction. Question-begging options that don't work include: 'real experiment', 'physical experiment', ...

(4) *Philosophical 'therapy'* Another method for doing philosophy in cognitive science is philosophical 'therapy'. This method is associated with Wittgenstein, of course. Here the theorist attempts to display that something taken to be sensible is in fact disguised nonsense. Philosophical 'therapy' and thought experiments are sometimes linked. Sometimes the point of a thought experiment is to show that something could not be as we take it to be. In such cases, philosophical 'therapy' or something very much like it is often the goal. Though some opponents of the computational model of the mind urge that it would be good idea for cognitive scientists to do a great deal more philosophical 'therapy' than they do, the method has not in fact played much of a role in philosophy's contributions to cognitive science and I won't explore it further.

Of the four methods just sketched, only (4) and perhaps (3) in some forms and some applications could satisfy (a) to (c), i.e., could be genuinely *distinctive* to philosophy. (1), (2) and some variants of (3) are also used by other branches of cognitive science, as we saw.

2. How do thought experiments work?

If thought experiments are central to philosophy's contribution to cognitive science, we need to understand how they work. Let's look into some specific examples. We introduced four thought experiments earlier, twin earth (Putnam), Mary the colourblind colour scientist (Jackson), impasses over differences in qualia (Dennett), and the Chinese room (Searle). They are good examples of the genre and have all been widely discussed.

Twin earth experiments go like this. Imagine a person here on earth, Adam, and his completely identical twin, Twadam, on twin earth. Adam and Twadam both use the word 'water' and they use it in situations that are experientially indistinguishable. Yet on earth what is called 'water' is H^2O, on twin earth it is XYZ. Does the word 'water' as used by Adam and by Twadam have the same meaning? Evidently not. Yet everything in their heads is the same. Hence, in Putnam's memorable phrase, "meanings just ain't in the head" (Putnam, 1975).

Here is the story of Mary the colourblind colour scientist. Mary is a wonderful colour scientist. Indeed, she knows absolutely everything there is to know about colour experience. Yet she has never seen a colour. One day the door is opened (or whatever) and she sees colour for the first time. It would seem that she would gain a new item of knowledge: what it is like to *experience* colour. Hence experience is not ... (draw your favourite moral).

A qualia impasse goes like this. Chase and Sanborn both notice that they don't like their favourite coffee as much any more. Chase says that the coffee tastes the same but he doesn't like that taste as much as he used to. Sanborn says, no, he would still like *that* taste as much but the coffee no

longer tastes the way it used to. Since there would seem to be no way in which this putative difference could make a difference to anything, we are invited to ask ourselves whether there is a real difference here.

Searle's Chinese room is probably too well known by this audience to need describing but I will describe it anyway. Someone who knows no Chinese is in a room. Sheets of paper with shapes on them come in through a slot. The person has a huge rulebook linking shapes to shapes. Every time the person finds the shape that has just come in, she moves to the linked shape and finds it on a sheet of paper. She then shoves the new sheet out a second slot. Unbeknowst to her, the shapes going in encode serious questions in Chinese and the shapes coming out are answers to these questions. Moral of the story? What the person who knows no Chinese does in the room is supposedly all that a computer processing physical symbols could do.

The philosophical contributions to contemporary cognitive science contain hundreds of such thought experiments. How do thought experiments differ from hands-on experiments?

What a thought experiment seems to do, in general, is to show that something is more than or different from the way we are inclined to think that it is. Thus, the twin earth example tries to show that meanings ain't in the head. The Mary experiment tries to show that there is something about sensible experience that is more than descriptions. Chase and Sanborne is meant to show that many distinctions that we are inclined to make with respect to conscious states do not reflect any fact of the matter. The Chinese Room is supposed to show that meanings and intentional contents are more than assemblies of physical symbols. And so on.

The general structure of the move seems to be something like this:

'If this [the object of the thought-experiment] is possible [or the case], then X [the target phenomenon] must be like *abc* and/or cannot be like *mno*.'

If so, then the next question is: What contribution do thought experiments make to cognitive science?

3. Thought experiments in cognitive science

Thought experiments play at least four different roles in cognitive science.

1. *Thought experiments isolate crisp examples of a phenomenon under investigation.* The way the Mary thought experiment isolates and displays what it is like to experience something is a good example. The utility of this activity to hands-on experiments is obvious.

2. *Thought experiments tell us what we take something to be like, what some term refers to.* Determining what we mean by a term may seem like quite a modest contribution but it is also a vital one. Studies of empirical values research a while

ago revealed that researchers were using the word 'value' to refer to up to twenty different things (Baier, 1969; Brook, 1975). No wonder everybody was talking past everybody else! We see the same thing today with notions like representation and information. It is important that everyone investigating a phenomenon have some reliable way of identifying and reidentifying examples of the phenomenon they are investigating. Otherwise they do no know what they are talking or that they are all talking about the same thing.

Thought experiments cannot give us a *final* answer about the properties of anything, of course, but they can give us a *first* answer – they can help us figure out what we have in mind when we talk about attention, or consciousness, or recognizing a word, or parsing a sentence correctly, or ... or ... – a first rough account of what we mean by a concept (Flanagan, 1992). We may revise this notion as we come to understand the phenomenon better but we have to start off with some common notion or we will get nowhere.

This function of thought experiments explains something about philosophy that often baffles the rest of the cognitive community: philosophers often care as much about possibilities as actualities. So long as something is possible, often philosophers flatly don't care whether it exists or not. Why? Because philosophers are trying to figure out what we currently mean by some concept, what we take to be the general and characteristic features of things of that kind and what the general and characteristic features *cannot* be: all the thought experiments, (We saw this negative aim at work in the thought experiments we examined.)).

For this concept-fixing task, determining what can and cannot be imagined with respect to things of kind F is not just as good as determining what is actually the case with respect to F's; it is actually better. Better because studying what is actually the case will not tell us what is characteristic of things of that kind. Only determining what can and cannot *be imagined* with respect to things of that kind can tell us that, a point that Kant made over 200 years ago (1781/7, B3).

When thought experiments help us fix what we take something to be like in this way, they are doing something very much like old-fashioned conceptual analysis. The difference is that nowadays we don't expect that investigating concepts in the imagination will give us the final word on what some concept means, just the first word: it reveals the common understanding of the concept from which we are all starting.

Earlier we saw that some thought experiments have something like Wittgensteinian therapy as their goal – weaning us away from tempting but ultimately incoherent ways of viewing something. We can now specify this connection more precisely. As we saw, some thought experiments have a negative thrust, i.e, they aim to show what something is *not* and could *not* be like, not what things of that kind *are* like. But this would be to show that there is

something wrong with how we picture or think about the thing in question – precisely the aim or at least one aim of Wittgensteinian therapy.

Thought experiments play a role both in (3) hypothesis generation and (4) hypothesis elimination. Recall the Popperian distinction between the context of discovery and the context of justification. On the abductive (Piercean/ Popperian) picture of science that goes with this distinction, science proceeds by generate-and-test. First we generate hypotheses; this is the context of discovery. Then we eliminate as many of them as we can by testing; this is the context of justification. At the end, only a few or, in the ideal situation, only one hypothesis is left standing. Thought experiments play a role in both contexts.

3. *Hypothesis-generation*

The 'generate' side of generate-and-test is highly independent of data collecting, hands-on experiments, or anything else that involves direct observation and/or manipulation of the world. Indeed, hypothesis generation is pretty much a pure act of the imagination. If so, some thought experiments are a way – usually a fairly abstract and sketchy way – of generating hypotheses.

The hypothesis generating function of thought experiments displays more clearly something we saw in connection with analysis of concepts earlier: how thought experiments are different from hands-on experiments. Think of a possibility-space. Hands-on experiments are usually designed to uncover which of the possibilities in that space are actually the case. By contrast, thought experiments do two things. In their conceptual analytic role, they help us forge conceptual tools for identifying and reidentifying items in the possibility-space. And in their hypothesis generation role, they help us generate ideas for how things might hang together, for what might actually be going on among the items in the space that are actual, a new way of picturing or thinking about the phenomena under investigation.

From all this, we can conclude two things. On the one hand, thought experiments are quite different from hands-on experiments. On the other, they play a key role in generating concepts for hands-on experiments to use and hypotheses for hands-on experiments to test. We are not at the end of the matter yet, however. Thought experiments also play a role in the context of justification in cognitive science.

4. *Hypothesis elimination.* Thought experiments not only aim to help us develop tools to structure a search space and to identify possibilities. They also aim to eliminate ersatz possibilities, to downsize the search space to the genuine possibilities. If so, they play a role in the context of justification, though one quite different from the role that hands-on experiments play. All four of the thought experiments we examined had such an aim.

Earlier we saw examples of how linguistic intuitions

play a role in the context of justification in linguistics and how carrying out tasks in the imagination plays a role in the context of justification in psychology. Here is an example from physics, the famous thought experiment of Galileo's against Aristotle. Said Galileo, if a smaller mass A falls slower than larger mass B, as Aristotle says, then it would follow that an object C made up by joining A and B together will fall both faster and slower than B. This, Galileo thought, eliminated Aristotle's hypothesis and eliminated it as even a possibility. Or Schrodinger's cat. This thought experiment was meant to eliminate a central hypothesis of quantum indeterminacy theory as even a possibility.

What is interesting about thought experiments is that they do what they do without using observation. We simply imagine a situation or check to see what sounds right. When we have done so, there is meant to be nothing left for observation to do. To reiterate a point made earlier, this is not say that thought experiments are not themselves empirical. Intuitions about what sounds right and wrong are clearly empirical, and so is imagining a scenario. It is just that their empirical source is something other than (current) observation.

Compare imagining a scenario to a proof in mathematics. Justification in mathematics is (often at least) derivational: to justify a proposition, you show that it can be derived from well-accepted axioms (etc.) using well-accepted rules (etc.). Thought experiments do not work like this at all. They *display* something to us, something that was obscure or hidden and is supposed to become clear when we imagine the indicated situation. Since the materials and at least most of the relationships of the imagined situation are derived from experience, thought experiments are thus a *kind* of empirical investigation.

If thought experiments play a role in both the context of discovery and the context of justification in normal science, then use of them is not distinctive to philosophy. In both linguistics and physics, thought experiments play a role in the context of justification. Philosophers' use of thought experiments in normative investigations could have something distinctive to it. (that is the question that we set aside earlier), but when they are used in hypothesis generation and possibility elimination, they seem to function very much the way that thought experiments in linguistics or physics do.

Think of Galileo's thought experiment against Aristotle: if a smaller mass A falls slower than larger mass B, then it follows that an object C made up joining A and B together will fall both faster and slower than B. With this Galileo meant to eliminate an hypothesis as even a possibility, namely, Aristotle's hypothesis. Or Schrodinger's cat. This thought experiment was meant to eliminate a central hypothesis of quantum indeterminacy theory as even a possibility. In a roughly parallel way, intuitions of grammatically are meant to show us what the rules of our

language are, not just help us generate hypotheses about them.

What is interesting about thought experiments is that they do what they do without using observation. We simply imagine a situation or check to see what sounds right. When we have done so, there is meant to be nothing left for observation to do. To reiterate a point made earlier, this is not say that thought experiments are not themselves empirical. Intuitions about what sounds right and wrong are clearly empirical, and so is imagining a scenario.

Compare the latter to proofs in mathematics. Justification in mathematics is (often at least) derivational: to justify a proposition, you show that it can be derived from well-accepted axioms (etc.) using well-accepted rules (etc.). Thought experiments do not work like this at all. They *display* something to us, something that was obscure or hidden and something that becomes clear when we imagine the right situation. Since the materials and at least most of the relationships of the imagined situation are derived from experience, thought experiments of this type are a *kind* of empirical investigation.

Concluding remarks

What have we shown? We set out to see what is distinctive to the methods of inquiry that philosophers use and how these methods contribute to cognitive research. We have discovered two things:

1. Many of the methods that philosophers have claimed as their own are clearly different from hands-on experimental methods, conceptual analysis and thought experiments being the central examples.

2. These methods are not *distinctive* to philosophy, however, because they are used in hands-on experimental science, too.

We have not exhausted the interesting questions about thought experiments and the other methods of philosophy, of course. One additional role that thought experiments play in science is in the context of *interpretation*. Findings in science have to be interpreted – what does a finding *mean*? Thought experiments play a role in this third context, too.

Of course, even if philosophy has no distinctive methods, it does not follow that philosophy does not play any distinctive role in cognitive science at all. In particular, philosophy has some distinctive preoccupations.[6] For example, experimentalists are mainly interested in whether a claim is true. Philosophers are much more interested in what terms mean, in what the possibilities are, etc. (I am reminded of the 50's television show *Dragnet*. As Jack Webb used to say, "just the facts, ma'am, nothing but the facts". A philosopher would be much more likely to ask, "Wha'd'ya mean, ma'am, wha'd'ya mean?") Second, if an

experimentalist does look at her symbolic toolkit, it is either *in extremis* because the apparatus is letting her down, or an activity of an idle moment. For philosophers, investigating symbolic structures is their main occupation.[7]

References

Baier, K. 1969. What is value? An analysis of the concept. In K. Baier and N. Rescher, eds. *Values and the Future*. Free Press.

Brook, A. 1975. *The Needs and Values Study*. Privy Council of Canada.

Brown, J. 1991. *The Laboratory of the Mind*, Routledge

Castañeda, H.-N. 1980. *On Philosophical Method*. University of Indiana Press

Cohen, L. J. 1986. *The Dialogue of Reason*. Clarendon Press

Davidson, D. The very idea of a conceptual scheme. Proc. Amer. Phil. Assoc. 47, 5-20,

Dummett, M. 1993. *The Origins of Analytical Philosophy*. Duckworth

Flanagan, O. 1992. *Consciousness Reconsidered*. MIT Press.

Hatfield, G. 1990. *The Normative and the Natural*. MIT Press

Horowitz, T. and G. Massey. 1991. *Thought Experiments in Science and Philosophy*, Rowman and Littlefield.

Kant, I. 1781/7. *Critique of Pure Reason*, trans. Norman Kemp Smith. Macmillan, 1927

Kripke, S. 1972. *Naming And Necessity*. In: D. Davidson and G. Harman, eds., *The Semantics of Natural Languages*. Reidel

Nozick, R. 1981. *Philosophical Explanations*. Harvard University Press.

Putnam, H. 1975. The meaning of meaning. In: *Mind, Language and Reality: Philosophical Essays*. Cambridge University Press.

Quine, W. v. O. 1953. Two dogmas of empiricism. In: *From a Logical Point of View*. Harvard University Press, 1961, pp. 20-46.

Sorensen, R. 1992. *Thought Experiments*, Oxford University Press.

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[6] Jerzy Jarmasz crystallized this point for me.