The Emulating Interview... with Rick Grush

Przemysław Nowakowski

Przemysław Nowakowski: **Could you briefly describe your conception of emulation? Do you think it can provide basics not only for a theory of perception, but also – for instance – for a conception or an inference?**

Rick Grush: My conception of emulation is fairly simple: emulation is representing something by using a model to stand in for it. This happens all the time: we use flight simulators as models for airplanes, we use chess boards to try out moves before we commit to making our official move. What these cases have in common is that some active agent is interacting with one thing, a model or emulator, in the same way that it would interact with something else, the represented entity. You interact with a flight simulator the same way you would interact with a real aircraft, you interact with the unofficial chess board (the one you use for trying out moves) in the same way you would interact with the official chess board.

The basic idea is that this phenomenon applies also to the brain itself – it constructs models of the body or the environment that it can then interact with in order to represent the body or environment.

There are many complications beyond this simple idea, of course, such as what things are modeled, how models are built and what it means to use something 'in the same way' as something else.

As for the second part of the question, yes, I think there is an application for conception and inference. Obviously one common use of a model is precisely to make inferences – the reason I try out possible moves on a 'model' board is it to draw inferences about what moves might be good or bad if I were to try them out for real. Of course the model by itself doesn't make the inference, I have to know how to use the model correctly, and I have to interpret the results correctly -- I can't take the result of a possible move I try to be a memory of some past state of the chess board, or a perception of its current state, or a guess as to the state of a different board. I have to know, in some sense, that in this situation the state of the model is representing a hypothetical state of affairs, and this is not something that the model itself makes apparent.

As for conception, I don't know. Addressing this topic would take a long time. Let me just say that I believe that articulated emulators can be usefully taken to be conceptual, in the sense that the articulants have many features of concepts. But I won't go into this any further. The issue of what concepts are is a tricky one, and to be honest, one that I am not that interested in getting mired in.

You seem to criticize enactivism quite often. How would you, then, place your conception of emulation among the ideas of enaction, embodiment or situated cognition?

What these views and mine have in common is in their departure from certain ways of thinking about cognition and representation. We don't view cognition and representation as primarily a matter of logic, or language like strings of symbols, and we take cognition to be connected to and based upon embodied motor engagement.

The main difference is that these other views are often anti-representational in nature, and they also often claim that cognition is really not in the head.

My own position is that given an appropriate understanding of what representations are, (not sentences, but, more like models), we can make perfect sense of the idea that the brain represents. Furthermore, this notion of representation is as connected if not even more so to motor behavior than the other views. It also shows how representation and cognition can all take place entirely in the brain. I'm not saying it always does: we can and often do use external models. My point is weaker. Namely, that representation and cognition are often internal to the brain.

Do you see room in your conception of emulation for any special idea of bodily awareness?

The short answer is yes, of course. One of the main areas for application of the emulation theory concerns emulators of the body, and so in fact I do believe that body awareness involves emulators.

How are emulators in the body involved in one's bodily awareness? When I work on role of the body in cognition, I find that the same body emulator is involved in cognition, the perception of objects and others, and also in bodily awareness. What do you think about this? Do you work on this question? Are you in a position to give a more detailed response to this phenomenon?

Motor emulators contribute to bodily awareness in the same way any emulator contributes to awareness, like an environment emulator contributes to awareness of the environment. If perception is a controlled hallucination process, then there is no perception without hallucination, no perceptual awareness without hallucination. Emulators are what the hallucination is made of. That emulator is running, and this is what we are aware of. It counts as perception, as opposed to imagery, if the hallucination is controlled by sensory inputs. If it is not, it is imagery or something else other than perception. The story is the same regardless of domain, body environment, or whatever.

It is not typical for an American philosopher and cognitive scientist to be interested in Husserl's works. You yourself refer to Husserl, and not to works of American phenomenologists, like Dorion Cairns. Can you tell us why you have been inspired by Husserl?

Several years ago I became interested in the topic of temporal representation. I began to see how I might address this sort of representation from within my emulation framework. This required significant refinement and extension of the emulation theory itself, of course.

That was the theoretical cognitive neuroscience end. Of course I also wanted my position to be philosophically responsible, and as a matter of fact Husserl's work on time consciousness is probably the single most important investigation of this topic in the history of philosophy.

I don't think it is that unusual for American philosophers of cognitive science to be interested in Husserl. In fact, it has become somewhat trendy the last 10 or 15 years. The problem is that in most of these cases Husserl is treated very superficially. But my goal was not to be trendy, but rather to gain some real insight, and this requires taking the original texts seriously. I'm not saying I agree with everything Husserl says. Of course not. But his work is deep and groundbreaking, and one gains a lot by really learning the thoughts of someone of this magnitude. For me, it is a valuable starting point.

In the previous version of your web page you named your view – quite boldly and interestingly – transcendental idealism (a neuronal version). This name however didn't show up in next versions of the page – have you changed your opinion on that?

No, I haven't changed my opinion of that. I consider myself a transcendental idealist. Though that phrase means different things to different people. What I mean is simply the idea that the world *as we experience it* is largely a construction. I am not a direct realist. This, by the way, is another difference between my own position and that of most enactive/embedded

people. They tend to be direct realists (as part of their anti-representationalism).

Some people tend to equate transcendental idealism with a very radical metaphysics, and I don't think it is necessarily that radical. For example, if we take modern physics seriously, then the universe as physics says it is is very dissimilar to, even in its most basic structure, the way we experience it as being.

What is your opinion about the role of philosophy in science? Would you agree with the suggestion that in light of the present state of science, philosophy has nothing less, if not even more to do? What in your view has philosophy today to offer the field of cognitive science, and what kind of philosophy would you suggest here?

I think philosophy has a huge role to play. First off, I realize that it is very common these days for philosophers to defer to scientists about many things, but my own experience is that scientists themselves are quite fallible, and are often not the best sources for understanding even their own results. For example, my BBS article from a few years ago had scientists as commentators, and a good many of them made horrible errors of reasoning, failed to understand the relation between what I was saying and their own work, and were generally confused. Not all of them of course. But the point is that just because someone is a scientist, it does not follow that what they are saying, even when it comes to their own work, is right or even makes sense.

There will always be a role for conceptually clear thinking about any topic, including empirical work. And in some cases at least, philosophers can contribute to this endeavor.

Second, scientists are often unaware of issues that philosophers have good training in. To take one interesting example, psychologists and neuroscientists do not ask, and in fact don't even understand, the question: What is a mind? I've asked many scientists this question, and they just look

puzzled. If you ask a biologist what life is, they understand the question perfectly. They don't give you an easy answer, because it is a complicated question that doesn't admit of an easy answer. But the point is that they know perfectly well what the question is.

But psychology, etymologically the study of the mind, has lost sight of the mind. They study things that minds do, such as vision, or how many items can be held in short term memory. But blind people have minds, and having a smaller or greater short term memory capacity doesn't remove one's mind. So these studies aren't telling us anything about what minds are. This is, I suppose, a philosophical question. Certainly it is theoretical, and at the very theoretical end of the continuum, far away from empirical.

There have been different interpretations of amodal emulators. Sometimes they are understood as motorical emulators and other times they are understood as providing some kind of conceptual information. How would you respond to this?

I'm not sure what to say about things being 'conceptual'. This means so many different things to different people that no matter what I say I'll be misunderstood. So I hereby pass on the question.

OK. We want to know what make emulators amodal? You can think of concepts in the Fodorian sense of concepts.

I take it that calling an emulator "motor" is a specification about what it is representing -- it is representing some aspect of the motor system, like bodily dynamics.

But on my theory, whether an emulator is modal or amodal is not a matter of what it is representing. It is a matter of whether it is representing the target domain, whatever it is, in terms of some modality of sensory input or not. So a motor emulator would be modal if it is representing the motor system directly in kinaesthetic and/or proprioceptive terms, but it would be amodal

if it is representing it in terms of joint angles and muscle tensions or whatever, and then the motor imagery was produced from this by a separate system that translated the amodal representation into a modal input.

So on my account, being amodal does not necessarily mean motor or conceptual. It means specifically that it is not in terms of a specific modality of input.

Consider the representations that a flight simulator uses in its computing software. Those representations are not modal, and it is also not obvious to me that they are conceptual or motor. They are representations of the position and speed, of the virtual aircraft, plus the environment, wind speed and weather etc. This information is then translated into various modal terms; as a video display that the pilot in the simulator uses, instrument readings, and so on and so forth.

I think one reason people find my usage of the term confusing is that most people equate “modal” with “perceptual”. But I think this is a mistake. As I use the terms, modal means tied to a given sensory modality, like vision or audition. But on my view, much of what we perceive is not coming directly from a modality. We perceive causation, for example, but all vision actually provides is one colored shape contacting another colored shape. As you can see, I am Kantian. As for Kant, the Categories are not modal, they are not given to experience through the senses. But they are part of perception. How? Because they are provided by the mind. They are perceptual in the sense that they are part of our perceptual content, space, time, causation. But they are not modal (as I use the term) because they are not provided through any particular sensory modality.

How do you understand the difference between amodal and multimodal information? Speaking more generally, is it possible to interpret the results of research on multimodal perception in fields concerned with emulators and their conception?

Here's an analogy based on video games. Some video games are designed such that the computations under the hood are in terms of the very things that are presented visually. Pong or Pac-Man, for example, represents the domain as a 2 dimensional space, and this translates directly into the scene presented to the player. But consider contemporary games, like Halo or Counter-Strike. In this case, the representations computed by the game engine are about what objects are where they are in a 3 dimensional space. This includes where the player is and how the player is oriented, what those objects are doing, and so forth. A separate mechanism then has the job of taking this representation at any instant and deciding what things look like and sound like from the player's point of view. And this is then presented on the screen and through the speakers.

My description takes the game engine of Pong as modal. It computes and represents what is happening in the realm of the game with the visual schema that the player is presented with in the visual modality. Halo, by contrast, has an amodal engine. The computations that determine what is happening in the game realm are not based on a visual or auditory representation of the scene. They are based on objects being at specific locations and doing things at those locations. This is not represented modally at all. It is largely spatial, things are assigned locations in 3 dimensional space. But it is not visual or auditory.

A *multi-modal* system would be one that lacks an amodal representation, but supports more than one modality by mapping directly from one modal representation to a different modal representation, without ever constructing or using something that isn't in one modal format or another.

Do you regard the mind-body problem (relation) as still a crucial issue in the domain of cognition?

No. I think it's an interesting metaphysical problem. For example, I believe that the mind is an abstract entity defined implicitly by the contents it graspes (I think I'm in the same group as Kant and Dennett on this front, though

of course there are many differences). And so on my view, it is a mistake to identify the brain with the mind. But this doesn't impact what I think about cognition. As far as issues about cognition and problem solving go, they can be studied apart form these metaphysical issues.

I believe that cognition is often extended, but this is trivial. It's been known for millennia that problems are usually solved with external aids, and if cognition is problem solving, then it's often extended. The subject though, or, one's mind, well that's different. But my views on that are for another day. One of my doctoral students, Amanda Brovold, is writing a dissertation on subjectivity right now. It is very interesting work.

Some researchers (like Wolpert) integrate the studies on the conception of Kalman's filters in motor control with Bayesian ideas. Do you see a place for Bayesian ideas in the conception of emulation?

They are closely connected. A Kalman filter is one way to implement Bayesianism. It is Bayes applied to filtering. The prior is provided by a model of the system producing the signal. More could be said about this but the basic idea is that are closely related, and in some applications just two different ways of expressing the same thing. Though it should be noted that not all application of Bayes are kalman filters.

Once I was describing the conception of emulation during a seminar, and I was asked about the relation between emulation and attentional processes. Wouldn't you agree that emulation and attention play a similar functional role in the process of filtrating information?

Possibly. Though I believe that there is a lot of emulation going on that is not in focal attention, and some that never is in focal attention. Though it is possible that attention could be the marshalling of a certain sort of emulation process. I think there is some promise to that idea, but I'm not in a position to defend it.

In your BBS text you refer to an articulated model and associative memory in the context of emulators' functioning. But don't you think that for emulation to work, it needs to be linked to more complex conception of memory?

Not at all. One way to implement an emulator is to simply remember a large number of past input-output mappings, and then when one encounters a new input, just produce the associated output. Such an emulator won't be very flexible, of course. But it might be very fast and relatively easy to learn. Other emulators might be linked to more complex sorts of memory, too, and those might have different sets of advantages and disadvantages.

One popular area of interest in contemporary neuro-cognitive literature is to do with representations in and of the body. An important phenomenon here seems to be what we could describe as "out-of-body experience's", which are linked to the damage of the temporo-parietal junction. An important consequence of this disorder also engages with the vestibular system. Do you think there is any chance that this system can contribute to the conception of emulation, and do you see any role of emulation in explaining OBE?

Definitely, though it would take a long time to treat this in detail. The doctoral student I mentioned above, Brovold, is working on themes closely related to this. When her dissertation is finished then I'll know what I think about this topic!

What role do emotions play in conceptions of motor cognition?

I'm not sure emotions play much of a role in motor cognition. At least not an interesting role as far as I can tell. Though I think emulation plays a large role in emotion. For example, Damasio's as-if loops are degenerate cases of emulators. They are simply forward models. But if we enrich his notion of a forward model with the full apparatus of the emulation theory, then we get

a much richer account of what is happening. One of my former PhD students, Lisa Damm, wrote a dissertation on this issue, actually. It may be something she and I co-author something on in the future.

Say you hear a somewhat shallow remark about your conclusions: "but this is not about the PEOPLE...' . Could you suggest any similarly simple but witty riposte?

Well, I do hear that from time to time, and my reply is that sometimes the point is correct and sometimes it is incorrect. When I purposefully engage in imagery to imagine possible courses of action, or use an external chess board to try out possible moves, then it is I, the person, who is engaing in emulation processes. But when there are emulators in my brain of, for example, bodily dynamics used to guide fast goal directed movements, then I, the person, am not doing the emulation. I am just trying to move my arm and grasp the cup, subpersonal mechanisms are doing the emulating.

That's not very witty or pithy, I guess, but that is my take on that issue.

What would be the role of emulation in the perception of music? And could you tell us what kind of music you like listening in your spare time?

I'm not entirely sure whether emulation plays a key role in the appreciation of music in general. Obviously prediction does – the experience of music is clearly related, to some extent, to one's ability to predict what will happen. Among many other things too, of course. Perhaps the greatest connection would be with people who are musicians or composers themselves, since those people would have more developed internal models of the process of music creation. But this is purely speculation. What role emulation plays in music appreciation is an interesting topic, but not one I have much to say about.

As to what sort of music I listen to, I find that I am more drawn to certain artists than specific genres. Within any genre, there are artists and pieces I like and artists and pieces I don't. But to give you some examples: I like Stravinski, Chopin, Allen Holdsworth, Ani DiFranco, Tool, Nine Inch Nails, Eisbrecher (I'm listening to their album *Sünde* as I write this, in fact), Public Enemy, Coldplay. I could go on and on. Music is a big passion of mine.

Thank you for your answers!