Ecological Content

Josefa Toribio

Pragmatics and Cognition, **5**:2, 1997: 257-285.

Abstract

The paper has a negative and a positive side. The negative side argues that neither the classical notions of narrow nor wide content are suitable for the purposes of psychological explanation. The positive side shows how to characterize an alternative notion of content (ecological content) that meets those requirements. This account is supported by (a) a way of conceptualizing computation that is constitutively dependent upon properties external to the system and (b) some empirical research in developmental psychology.

My main contention is that an adequate computational explanation of the behavior involved in cognitive activities should invoke a concept of content that can capture the intimate dynamical relationship between the inner and the outer. The notion of content thus reaches out to include the set of skills, abilities and know-hows that an agent deploys in a constantly variable environment. The assumption underlying my attempt to characterize this ecological notion of content is that cognition is better understood when treated as *embedded* cognition and that the idea of cognitive significance ought to be cashed out in non-individualistic and pragmatic terms.

Biographical Note

Josefa Toribio received her Ph.D. from Complutense University, Madrid. She has worked in the Universities of Madrid, Sussex (UK) and is currently a regular member of the Department of Philosophy at Washington Univeristy in St. Louis. Her fields of interest are the philosophy of language, philosophy of mind and cognitive science. She has published in *Logique et Analyse*, *Consciousness and Cognition*, *Synthese* and *Philosophy and Phenomenological Research*, among other journals.

0. Introduction.

Paramount among the (recent) historical roots of the notion of narrow content is Putnam's (in)famous Twinearth thought-experiment. Putnam (1975) describes a pair of microphysically identical twins who differ only in their absolute relational properties. In particular, some of one twin's thoughts are caused by H_2O, while the other's (on 'Twinearth') are caused by a superficially identical liquid XYZ. But despite their neural and bodily microphysical identity one twin has thoughts that are about water and the other does not. Thus it would seem that thought content is not fully determined by (does not supervene upon[1]) microphysical states of the brain. Thought content looks to be individuated by reference to the subject's environmental context and not by reference to her intrinsic physical properties. This is the main contention of the 'externalist' —one who holds that mental contents are fixed by a subject's relations to external (extra-neural, extra-bodily) states of affairs. This postion, however, can seem unsatisfactory if we also hold that thought content should play a causal role in explaining e.g. the origins of the gross bodily responses which will be shared by the microphysically identical twins. The notion of narrow content is then invoked to plug the explanatory lacuna left by the strong externalist view. The guiding idea is thus that even if Putnam is right and *a* dimension of the content of a thought is relational or externalist (namely, that dimension of content that matters when we want to fix the truth-conditions of the sentence used to express that thought), there *must* in addition be *some other* dimension of content that is non-relational, i.e., a dimension of content that can be fixed regardless of the relations that obtain between the thinker and the external world. It is this narrow dimension of content that matters, it seems, whenever we want to provide psychological explanations (cfr. Fodor 1987: chapter 2)[2]. The stage is thus set for the debate between internalism and externalism.

Let us characterize internalism as the view that holds both that the content of a mental state supervenes on intrinsic physical states of the subject, and that such contents are individuated 'narrowly', i.e., without essential reference to the subject's physical and social environment. The externalist position, by contrast, denies that mental contents supervene on intrinsic physical properties of the subject. The externalist claims that contents are

individuated 'widely', i.e., by reference to the subject's environmental or social context.

I agree with the externalist (See Burge 1979, 1986, 1993; Peacocke 1993, 1994)[3] that psychological explanation (both of the folk and scientific variety) does not require the full classical notion of narrow content. But there is surely something correct about the intuitions which drive the dissenters to a vision of narrow content. What is correct, I believe, is that we do indeed need to avail ourselves of some kind of non-relational account of what it means to have a thought with a particular content if we are to provide good scientific psychological explanations. In this paper I will try to steer a middle way. I will argue that narrow content —or, at least, the *standard* notion of narrow content developed by Fodor— can't fulfill the function for which it was designed, i.e., that narrow content is not, after all, an adequate theoretical tool for the purposes of scientific psychological explanation. I will then defend a different notion of content, neither narrow nor traditionally wide, that seems better to meet our psychological explanatory needs.

Along the way I will invoke two additional theoretical tools. The first is a way of conceptualizing computation that is constitutively dependent upon properties external to the system (Section 3). The second is some empirical research in developmental psychology that aims to vindicate a similar approach for understanding psychological development (Karmiloff-Smith 1986, 1992; Rutkowska, 1990, 1991, 1993a, 1993b). I will introduce these empirical results in Section 4. With these tools in hand, I will argue (Section 5) for a new notion of content: one that is methodologically more appropriate for the purposes of scientific psychological explanation. This is the notion that I shall dub **ecological content**.

The discussion thus involves both a negative and a positive claim. The negative claim (Sections 1 and 2) is that neither the classical notions of narrow nor of wide content are suitable for the purposes of psychological explanation. The positive claim (Sections 3, 4 and 5) is that there exists an alternative notion of content that meets those requirements.

1. The Nature and Role of Narrow Content.

There are at least two features of narrow content on which everybody seems to agree. First, narrow content strongly supervenes on intrinsic, non-intentional, physical properties of an organism. It is precisely that feature which makes narrow content *narrow*[4]. The second relevant feature is that narrow content is invoked mainly, if not exclusively, for predicting and explaining behavior.

Given just these two features, one might well ask what makes narrow content 'content' at all. But interestingly enough this issue is usually finessed by making a general assumption: that whatever is going on in the head of a subject such that we invoke it to account for her behavior deserves to be treated as a contentful state of some kind. The image of the mind as a computer undergirds this assumption. According to a classical version of the computational view, intentional states are supported by states that involve symbols of a *mental* language or *Language of Thought* (Fodor 1975). My belief that there is an apple pie in the fridge involves my being in some kind of computational relation to the *mentalese* symbols corresponding to "There is an apple pie in the fridge". The content of such an intentional state is just the content of that chain of symbols in *mentalese* and the fact that it is a belief — instead of a desire or a doubt— is determined by the nature of its computational relation to the rest of my mental states and / or my behaviour. The symbols of that mental language possess a combinatorial syntax and are physically implemented by the brain.

Thus, even if we don't offer any theory about what narrow content actually *is* or about what makes narrow content 'content', the following can be said: narrow content serves the purposes of scientific psychological explanation. It picks out intrinsic states that play a causal role in the generation of behavior, and it is thus capable of figuring in causal-explanatory accounts of intentional action. Narrow contents thus satisfy the demand that *scientific* explanations should be *causal explanations* and that only intrinsic properties can be causally explanatory. The justification of this view, in turn, flows from the physicalist bias of standard scientific methodology, i.e., the idea that the causal powers of any event are completely determined by its physical features. As a result, only content that is individuated in terms of a system's intrinsic properties is deemed adequate for a *scientific* explanation of behavior.

Add a computationalist spin to this physicalistic bias and the nature of narrow content finally emerges. According to the computational theory of mind, cognitives capacities are to be treated as information-processing operations and to be characterized in computational terms. Computational processes are defined, in turn, in terms of operations on representations. Input-representations stand for arguments in a function. Output-representations constitute the values of the computed function. A representation is thus a very special kind of physical configuration, a physical configuration that has a syntactic vehicle and a semantic content. The important point is that, although computer processes are only sensitive to the syntax, a computing device can be designed in such a way that the production of syntactic states respects the semantic interpretation. Under such conditions, the semantics does indeed supervene on the syntax. But even so, there remains a (fatal) problem afflecting any attempt to then identify some more specific syntactical state (e.g. a particular pattern of activity in a neuronal population) with a certain semantic content. The problem is nicely described by Ned Block who comments that: "syntactically identical objects can play very different functional roles, and be associated with very different recognitional capacities" (Block 1991: 39). In the same vein Stalnaker claims that the

> [Physical or syntactical properties of a thought token] surely will not be sufficient to determine even the narrow content of the thought token. Presumably, the same particular physical event or state that is a particular thought that water is the best drink for quenching thirst might, if the functional organization of the thinker were different enough, have not only a different wide content, but also a different narrow content.
> (Stalnaker 1990: 135)

In other words, the properties that seem to account for a state's narrow content and that would justify its intentional (i.e., semantic) role for the internalist are not syntactical properties of individual thought tokens. The upshot, it seems to me, is that even if we accept that the mental states must supervene on a system's intrinsic physical description, we must still recognize that specific mental states are not constituted by syntactic properties. Instead,

the individuation even of narrow contents will depend on further facts concerning the large scale functional organization of the system. Such a concession, however, immediately paves the way for an even more radical proposal: the proposal to extend the supervenience base to include not just facts about the larger scale details of the inner economy, but to include facts about what might be termed the local ecological economy. This would include both the organism itself and certain aspects (this restriction to be discussed later) of local environmental structure. This is the proposal to be pursued in Sections 3-5. First though, we should notice a few more problems with the traditional notions of both narrow and wide content.

2. Narrow Content, Wide Content and Scientific Psychology.

Can any kind of narrow content really fulfill the explanatory role for which it has been created? In other words, can the causal explanation of an agent's behavior consist in the specification of the role played by her internal states as specified by an *internalist content-involving description*?[5] By an internalist content-involving description I mean the kind of description that would be cashed out in terms of the system's intrinsic properties characterized independently of the system's interaction with its environment. One problem is that whenever we try to *formulate* such descriptions, we lose the very *narrowness* that we were trying to capture. This is because psychological explanations invoke mental states with particular intentional contents in order to explain or justify a given course of action. The individuation of a mental state as an allegedly explanatory state with such-and-such a particular content is then achieved in part by appealing to properties of the external objects and events that are implicated in a particular behavior. But, if this is so, then those content-involving descriptions can't really be of a purely internalist kind; they can't be narrow content-involving descriptions.

At this stage, a distinction might be drawn between narrow content as explanatory of a subject's *attempt* to do something and narrow content as explanatory of why that attempt succeeded, if it did succeed, or failed, if it failed. The subject's external environment is indeed relevant to explaining the success or failure of any attempt to perform a given action. An internalist

interested in the explanatory aspect of narrow content might claim that narrow content matters also if we want to explain the success or failure of the actions performed by the subject in its environment. Let's call this internalist's goal oriented position a Type 0 claim[6].

It seems to me, however, that Type 0 claims need not be a threat to the kind of position I am going to defend. Legitimate as they are, Type 0 claims aim to address an issue different from the one I am concerned with in this paper. The evaluation of the appropriateness of the notion of narrow content that I am concerned with here is tied to the explanation of a system's *behavior*, i.e., the explanation of why someone tried to do something. This is the central issue for psychology. The explanation of the success or failure of such attempts is obviously important from some other points of view (e.g., from an evolutionary point of view) but it is not important from a psychological perspective. In the next section, I shall mention David Papineau's concern with this problem, but for now, the following should be clear. Type 0 claims concern why a subject achieves or fails to achieve a certain goal, while the claims that are relevant for the discussion at hand concern only the actions displayed by a subject in pursuing a goal.

A sensible internalist, concerned with this second issue, would agree that to explain behavior, we must know what in the subject's external environment is being represented to that subject. But this internalist will insist that it is still the subject's inner states rather than anything outside her head which determine the behavior psychology needs to explain. In other words, the sensible internalist will still insist that the subject's internal and narrowly individuated states determine her beliefs and therefore explain her behavior. Let's call the sensible internalist's weakly environment-invoking position a Type I claim.

In reply to the sensible internalist, let me say the following. Remember that I am arguing against the *explanatory adequacy* of a given concept, namely, narrow content, for scientific psychology. My worry is thus that the exchange between subject and environment might at times be so complex, and the dynamics of the overall coupled system so different from the dynamics of either component alone, that it is often much more *methodologically fruitful* to take the dynamics of the whole (subject *cum* local environment) as the basic explanatory unit in psychology. Let's call this stronger position a Type II claim.

Next, suppose we take computational psychology as representative of scientific psychology. The sensible (Type I) internalist insists on the individualistic character of the concepts involved in adequate computational *explanations* of behavior. The issue is thus whether the concepts involved in computational explanations ought to have such an individualistic character or not. This question probably can't be resolved without providing a full account of the notion of explanatory adequacy and a description of how that account fits into the framework of computational psychology. But even without such an account, some interesting examples can be provided to help distinguish the different issues involved in Type I and Type II claims[7].

Think of Scrabble-playing strategies[8]. While playing, we may physically arrange and rearrange the letter tiles as a way of prompting recall of candidate words. A computational psychology concerned with the explanation of this kind of behavior might usefully characterize such external manipulations as a means of providing inputs to prompt a pattern-completing associative memory. Such a picture is, however, nicely compatible with the weak Type I model. For the Type I internalist needs only think of the world as a source of inputs and an arena for action. She can agree that the possibility of individuating the computational states of cognitive systems is relative to the properties of the world that they inhabit. But this is to say that the world *determines* the agent's cognitive states (via the inputs), and not that external features can play any role in constituting such states.

The stronger Type II theorist aims to show that sometimes such a division between world and agent is not productive; that it is not always methodologically appropriate for psychological purposes. Think e.g. of swimming. It is not just that we hit the water and trigger a swimming routine. Instead, we produce a movement, the water flow changes and that alteration calls forth a new movement, and so on. Now, maybe you could analyze this case as a complex combination of inputs prompting inner states which prompt actions. But it may be much more explanatorily fruitful to treat brain, body and water here as a complex coupled whole with its own intrinsic dynamics.

Kirsh and Maglio's thorough analysis of expert performance on the computer game Tetris (See Kirsh & Maglio 1994) provides a neat example of such a Type II claim. Tetris players have to place blocks of different geometric shapes (Zoids) into compact surfaces (rows). When a row is completed, it

disappears from the screen and new zoids begin to fall again —from the top of the screen— at a speed that increases with successful performance of the game. While falling, the player can operate on the zoid —rotate it, move it to the left, to the right, or drop it directly to the bottom of the row. The purpose of the game is thus to match zoid-shapes and row-shapes under —severe— time constraints. What Kirsh and Maglio have shown is that advanced players of Tetris, although able to mentally rotate a zoid so as to better determine its shape, often prefer to rotate the zoid *physically* (this is an option in the game), because this *external* manipulation is both faster and more reliable[9].

Physical Zoid rotation, Kirsh & Maglio suggest, is best thought of as a proper part of a distinct computational sub-routine invoked during expert play. The fact that this sub-routine incorporates a "call to the world" is less important than the fact that it constitutes a computationally unified whole. The density of information flow within the sub-routine (including the operations performed in the world) is so great and so temporally complex that the decomposition of the system into biological wetware and local environment structure is less revealing, from a computational point of view, than the decomposition into a set of sub-routines one of which is partly constituted by operations performed out in the real world.

What these experiments suggest is that some cognitive states may be best characterized in terms of world-involving skills or abilities rather than merely in terms of the inner brain structures underlying performance. The question is thus whether the best unit of analysis for understanding cognitive organization is always the bare biological device or whether it is sometimes the agent plus a select chunk of the local environment (See also Hutchins 1995). The kind of research just discussed suggests that sometimes, at least, the latter option is explanatorily attractive. Type II claims are thus not claims about the *nature* of the computational processes involved in psychological explanations. They are claims about the methodological advantages of looking at coupled systems whose overall dynamics are taken as explanatorily central. As should become clearer later in the paper, my contention is that the characterization of computational descriptions that is most fertile for the explanation of psychological phenomena is externalist in this Type II sense (cfr. Peacocke 1994).

The contention is that an adequate computational explanation of the behavior involved in many cognitive activities should invoke a concept of ecological content —one that captures the intimate dynamical relationship between the inner and the outer. If that notion of content is to play its explanatory role, then we should characterize it in such a way that it couldn't be ascribed to an agent except insofar as the agent is embodied and embedded in a particular environment. It follows that the notion of content will not be narrow in the standard individualist sense. I thus aim to defend a notion of content that is neither traditionally narrow nor traditionally wide, yet which serves the purposes of scientific psychological explanation in a way consistent with both the supervenience constraint and the insights concerning embodied and situated cognition. It should already be clear how ecological content differs from standard narrow content. What about wide content?

Wide content, as explained in the Introduction, is basically a *semantic* device for the individuation of propositional attitudes, i.e., it is the *semantic* component required in order to fix e. g. the truth-conditions of the sentences used to express different beliefs. Notice, then, that the notion of ecological content —insofar as it is a notion geared to the explanatory requirements of Cognitive Science— is not a real competitor with traditional wide content. Here is why.

First, to argue the need for a semantic device like wide content is not necessarily to rule out the possibility of also invoking some notion of narrow notion. Indeed, so-called dual factor theories attempt to provide an explanation of the content of our utterances and mental states in terms that thus involve two different notions, each motivated by separate concerns. One notion —the psychologically relevant one— deals with the causal explanatory aspect of mental states and/or sentences. The other deals with contentful mental states and/or sentences as related to propositions, i.e., as objects that can be assigned referential truth-conditions (See McGinn 1982; Block 1986). A notion of content designed to play an explanatory role in psychology thus doesn't necessarily conflict with a notion of wide content: it represents a challenge only for its individualistic counterpart[10].

Second, the friend of wide content is concerned not only to make a constitutive claim about what makes something a state with a particular content, but also to display the *relational* character of the *explananda* of Folk Psychology, i.e., of the kind of psychology concerned with the relationships

between propositional attitudes and actions. Tyler Burge (1986) and Christopher Peacocke (1993, 1994) have been pursuing just such an agenda (See also Hornsby 1986). But the kind of psychological explanation that matters for the characterization of ecological content is not the *folk* variety. It is *scientific* psychological explanation that is at issue. Insofar as wide content is mainly tied up with folk psychological explanations, it need not be in competition with our alternative account.

Third, it might be suggested that the truth or falsity of a belief *does* matter. It matters whenever we want to explain why an agent is successful (or not) in achieving a certain end. David Papineau, for example, has argued that truth values matter whenever we are concerned to explain success and has suggested we treat truth as the guarantee of such success (Papineau 1990). But even if this argument is sound, it doesn't impinge upon the explanatory character of wide content. As I said, wide content is a semantic device that fixes truth-conditions, not truth values. Papineau's view involves a clear shift from the former to the latter.

This is not to deny that truth plays an important role in explaining the success of an agent in achieving a certain goal. But it is to deny that truth plays any role when what we want to explain is not success or failure but —to adopt Papineau's terminology— to explain the *means* adopted by an agent in pursuit of a certain goal. This is because the external properties that determine the truth-conditions of a sentence (as the expression of a thought) are usually microphysical properties of the environment surrounding the individual. Thus, any sentence containing the expression 'water' will have as part of its truth-conditions a possible world in which the reference of the word is H_2O. But these properties need not affect a subject's psychology, if we take it that psychological states are invoked to explain behavior. For if the liquid in Lake Michigan turns out to be made of XYZ instead of H_2O, but nothing other that this microphysical composition has changed, there is no reason to suppose that the behavior of the agents in contact with that substance would change either. These microphysical differences matter for the individuation of wide contents but they don't make any computational difference to the subject and, as such, don't affect what we are calling ecological contents. To further clarify this notion, let us first make a small digression concerning the concept of computation.

3. Computation and Explanation.

A major rationale for the claim that the idea of narrow content is needed for the purposes of scientific psychology is the conviction that scientific psychological explanations will be computational. Computational processes, it is said (Fodor 1981) cannot be sensitive to external properties. Therefore psychological explanations can only involve internal properties. Since my argument aims to both undermine the role of narrow content in psychological explanations and to maintain the foundational role of computation in Cognitive Science, it must invoke a different account, if not of the *nature* of computation, at least of the best way of *conceptualizing* computational explanations.

What is at issue then is whether the kind of properties that are most fruitful for *conceptualizing* computational explanations of behavior ought indeed to be *internalist properties*? Might a suitably externalist account of the computational properties which explain behavior in fact be *better* than an internalist account? A popular way of arguing for such a possibility is to argue for a notion of computational states whose individuation is sensitive to external properties in the sense that, without invoking them in our taxonomy, we couldn't specify the causal organization of the system (Peacocke 1993, 1994). That idea, however, remains a little too close to a Type I claim. The basic individualistic assumption is unaffected: it is assumed that *modulo* its external individuation, the content of a thought still supervenes on the inner vehicles of that thought. By contrast, I aim to argue for a genuinely (Type II) *externalist* account of *computationalism*. We may begin by rehearsing (what I take to be) the main reason why the classic individualistic view of computation has so long prevailed[11].

A key factor underlying this persistence is the long-standing tendency to treat cognition in a completely disembodied fashion. This disembodied approach not only has failures of its own, but has also contributed to a notion of computational organization that systematically marginalizes the properties of the environment in which the system is embedded. But such a disembodied computational approach looks increasingly ill-suited to the explanation of adaptive success. This is reflected although important in certain restricted domains, the disembodied computational approach is no

longer the only model in psychology. Neither is it in the philosophy of mind. Other constructs for understanding cognition have lately been developed in different areas of Cognitive Science. Artificial Life (especially work in robotics and Autonomous Agent theory) is one of those areas (See e.g. Ackley & Littman 1992, Beer 1990, Brooks 1991, Harvey *et al.* 1993, Hinton & Nowland 1987). The notion of representation employed within these models invokes a kind of content-involving computational description that is Type II externalist. In these accounts cognition is *characterized* basically in terms of actions, i.e., in terms of the exchanges between the physical / biological features of an organism and those of the environment in which the organism is embedded and functioning. Where content-involving computational descriptions are suitable for the explanation of such a cognizer's behavior, they involve a notion of content that is partly constituted by the abilities of the systems to interact in specific ways with the world in which they are embedded. The inner states need not constitute any kind of replica or objective model of the world, so much as to engage with those properties of the environment that the system needs to co-opt in the service of adaptive success.

It is worth noticing that I am not thus claiming that a computational description is externalist just because the inputs originate in the world. That claim would be trivial! My claim is that it can be methodologically fruitful to treat certain computational processes as emergent out of the complex dynamical properties of a wider system that actually includes chunks of the local environment. My claim is thus a Type II claim according to which psychological explanation would be better served if we appeal to a dimension of *enacted* content, i.e., a notion of content that supervenes on interactions between the system and its environment (cfr. Varela *et al.* 1991). It is this notion of enacted content that is needed to *explain* why cognitive agents behave in the way they do, and to generate useful *predictions* of their behavior. Given that the explanation and prediction of behavior are the aims of psychology, it is not difficult to see that, once computational descriptions are understood in this externalist way, we have effectively secured their scientific role. In the next Section, I rehearse some of the empirical support for this kind of computational externalism.

4. Perceptual-Cognitive Development.

A variety of psychological and psychophysical experiments look to challenge the individualist philosopher's claim that "whole subjects plus embedding environments do not make up integrated, computational systems" (Segal 1991: 492). For example, the especially crucial role of subject / environment interactions in computational theorizing about human development suggests an explanatory paradigm convivial to the Type II externalist. This research supports the idea that a notion of content fit to play an explanatory role in psychology can't always be defined independently of the properties of the environment with which the organism interacts.

An example. Tracking moving objects, defensive motions, stopping moving objects and reaching for objects of different shapes and weights are all examples of infants' interactions with their environment (Rutkowska 1990, 1991, 1993a, 1993b). We could try to account for such behavior by reference to purely internal states of representation and computation. But in doing so, Rutkowska claims, we would miss one of the main components of the perceptual process, namely, the behavioral component. Purely internalist stories fail, Rutkowska suggests,

> adequately to consider the role of the behavioral component of action in perceptual processing ... Instead [descriptions of objects and their properties] can be viewed more pragmatically in terms of action programs: virtual mechanisms whose operation selectively exploits task-relevant aspects of multiple descriptions ... to support the direct invocation of behavioral procedures ... Making explicit an aspect of the physical world, such as a surface, over many situations does not entail any ability to represent it as a property that is common to that range of situations, let alone potentially applicable to others (Rutkowska, 1993a: 971).

If we opt for this second, action-guided, approach, we will have to acknowledge that visually based representations are not to be conceptualized independently of behavioral processes. One reason is that these processes often change the viewer's relationship to her/his environment, and this in turn changes the information available to visual processing. As these

diachronic processes of change are the outcome of our sensory-motor systems' local interactions with the environment, they invite a computational account based on the concept of *action*. This computational account could not be developed without including as *explananda* descriptions that involve properties that belong to that environment and that are therefore external to the system. But more significantly, what we really need, in order to pursue this computational strategy, is a truly *interactive* account of vision in which "systems ostensibly 'extrinsic' to literally seeing the world, such as the motor system and other sensory systems (auditory, somatosensory), do in fact play a significant role in what is literally seen" (P. S. Churchland *et al.* 1994: 23). Underlying this alternative account of the computational organization and dynamics of mammalian vision is the idea that the visual system is much more intimately integrated with other action systems, such as the motor, auditory and somatosensory systems than was previously suspected (but see Gibson 1979). This integration, however, is not a hierarchical process in which connection to the motor system takes place once the internal representation has been fully constituted. Instead:

> ... motor assembling begins on the basis of preliminary and minimal analysis. Some motor decisions, such as eye movements, head movements, and keeping the rest of the body motionless, are often made on the basis of minimal analysis precisely in order to achieve an upgraded and more fully elaborated visuomotor representation (P. S. Churchland *et al*, 1994: 27)

If this hypothesis is correct —and numerous psychophysical experiments, like the ones developed by Rutkowska, seem to support its plausibility—, then we must begin to re-think our ideas about computation and representation so as to capture the essential interpenetration of sensing, thinking and acting. If computational descriptions are going to play a role here, they will be best conceptualized in terms of externalist content-involving descriptions, since the constitutive parameters that fix the content of those descriptions will belong to the array of relations between the system and properties of its environment. In addition, a great deal of cognition may involve tracking properties of objects in such a way that the internal

representations of those objects are not representations of the objects *themselves*. Instead, it is only the *mode of presentation* of the object under a particular perspective and within a particular behavioral context that counts. The interactive framework for understanding vision proposed by P. S. Churchland *et al.* illustrates this claim. According to Churchland *et al.*, the idea of 'pure vision' —that what is seen is just a pure replica of the world achieved by the *visual system alone*— is a radical oversimplification of the kind of computational strategies used by the brain. In natural cognition, the internal representation of an object is almost always, it seems, mediated by its mode of presentation and by the local behavioral context.

Such being the *general pattern* of explanation for our basic cognitive abilities, it seems likely that we do indeed need a notion of content that (a) is not narrowly individuated (because that leaves out the essential relations between the system and the environment) and (b) is not traditionally widely individuated either (because the relevant relations must be identified by actual patterns of action in, and interaction with, the world —not merely introduced by a passive relation of reference.)

5. Ecological Content.

One type of practical interaction (that has already received useful philosophical attention) is the kind that involves some discriminative ability on the part of the subject. Such discriminative abilities, it has been suggested, are pivotal for the project of individuating the contents of our thoughts. This claim is found in some of the writings of the later Wittgenstein and is central to Dummett's characterization of the nature of a theory of meaning (See Dummett 1975, 1976). Closer to the narrow / wide debate itself, Gareth Evans' (1982) and Cussins' (1992) distinction between non-conceptual and conceptual content represent important steps in an ecological direction. It is also a central issue for recent research programs revolving around the idea of embedded cognition (cfr. McClamrock 1995). I want to embrace the insight provided by these protoecologists —roughly, that the very idea of cognition depends on actions and thoughts being contextually circumscribed in specific ways— in order to further vindicate a notion of content characterized in terms of our discriminative abilities.

At this point, however, the ghost of holism seems to threaten. How are we to circumscribe those immediate circumstances in the world on which our account depends? This same problem also arises for other (related) approaches such as Simon and colleagues' *situated action* view[12]. Notice, however, that, in elevating a notion of discriminative abilities into a central parameter for my notion of ecological content, I need not understand the internal representations of contentful thoughts as *explicit* representations of any kind. These representations need not have any declarative or language-like format. The issue about holism arises mainly when we deal with declarative or linguistic internal entities and when we then try to provide a *systematic* account of how the content of different constituent expressions contributes to fixing the contents of the whole language. If we don't assume language-like representations, the issue of holism can only arise in a rather weak sense, i.e., we might want to demarcate the circumstances that ought to be considered relevant for a certain content ascription. Here pragmatic considerations surely have a role to play, even if such considerations don't fully solve the problem.

Frege's doctrines look to lie at the root of this trend (Frege 1892). Or, to be more precise, Gareth Evans' interpretation of Frege's analysis of identity statements in terms of what he calls the 'intuitive criterion of difference' (Evans 1982: 18-22). The criterion is *intuitive* because, as a content-individuation tool, it relies on abilities that exploit our being connected to the objects of our thoughts without assuming that we have any special conception of those objects, i.e. without assuming that the untutored subject can provide a description of the causal mechanisms underlying those interactive abilities. Dummett —commenting on Frege— makes a similar point when he claims that "all that is necessary, in order that the senses of two names which have the same referent should differ, is that we should have a different way of recognizing an object as the referent of each of the two names: there is no reason to suppose that the means by which we effect such a recognition should be expressible by means of a definite description or any other singular term" (Dummett, 1973: 98). In the same vein, although this time focusing on the *experiential* character of our abilities to entertain different attitudes toward an object, Cussins points out that

> the abilities are not available to the subject as the content's referent, but they are available to the subject as the subject's experience-based knowledge of how to act on the object, and respond to it. The theorist may canonically specify the content by referring to abilities, because the cognitive significance of the content consists in the experiential accessibility of these abilities to the subject in experience-based knowing-how. (Cussins 1992: 655-656)

Using one of Evans' favorite examples, we could thus say that what fixes the content of the experience of hearing a sound as coming from 'over there' is the subject's particular ability to negotiate the domain in which she is embedded (Evans 1982: 154). To 'negotiate a domain' is to be able to cope with a variety of specific situations in a constantly variable environment. It is to have a set of skills, abilities and other know-hows that will enable us to carry out a particular task, where such skills need not include any explicit theoretical knowledge. Even if 'over there' could be substituted *salva veritate* by 'from the North', that doesn't imply that we can describe the subject's experience as hearing a sound coming from the North, i.e., it doesn't imply that the subject possesses e.g. the concept NORTH THERE, or any of the concepts involved in spatial directions. In other words, it doesn't entail that the subject has the concept NORTH in any way that can be assimilated to the possession of theoretical knowledge. The properties that count for the explanation of the subject's behavior are sensory properties that function in a structured way so as to support the various movements involved in the identification of the sound as coming from a particular place.

If we substitute 'content' for 'concept' in the above paragraph, we will have a pretty clear vision of the notion of ecological content. Such content is constituted by the set of skills, abilities, and know-hows that an agent deploys to negotiate a domain. The properties that constitute the state's ecological content include only those properties of the environment that make a difference to the behavior of the coupled system. But these need not be available to the subject as propositional knowledge. From a developmental and an evolutionary point of view, explicit propositional knowledge looks to come much later than such basic abilities to cope with concrete situations in a complex environment. Accordingly, our emphasis is on the agent's capacity to adapt to its immediate circumstances in the world, and not on those more

objective descriptions that a theorist might introduce as representations of those circumstances[13]. The strong assumption underlying my attempt to characterize an explanatory notion of content for psychology is thus that cognition is better understood when treated as *embedded* cognition and therefore that the notion of content ought to be cashed out in non-individualistic and pragmatic terms.

Given the evolutionary considerations just mentioned, it might be inferred that the notion of ecological content is tied to some kind of teleological account of cognition. A word of warning about that. It is certainly no surprise that teleological approaches to content fit rather nicely into my ecological picture. However, as Peacocke (1993: 224-225) has pointed out, it is not true that any plausible externalist theory —and I'm taking the germ of the theory sketched here to be both externalist and plausible— has to be of the teleological sort. A theory based on the notion of ecological content is clearly externalist, but is not necessarily teleological in Millikan's sense, because it doesn't have to depend on claims concerning the evolutionary *proper function* of mental states (cfr. Millikan 1984, 1993).

To clarify just where e.g. Millikan's approach and the ecological approach differ, let me make a very quick remark about 'accidental doubles'. An accidental double is someone who (for example) crawls out of a swamp due to some kind of subatomic miracle and who happens to be molecule for molecule identical to someone else (e.g., me). Millikan's claim is that the states of accidental doubles don't have proper functions and thus that their neural states don't have any content (as content is teleologically defined in terms of proper function and they lack the right sort of history). Equally, the heart of my double doesn't have as its proper function the circulation of blood because it is not there as a result of the appropriate historical causal chain.

But the characterization of content that I defend involves only the current properties, relations, dispositions and abilities of a subject. It doesn't have in addition to invoke the right individual or evolutionary history. If the double that crawls out of the swamp has an experience as of humidity —as I imagine she might— nothing in my account would impede the proper ascription of a particular ecological content. This is unsurprising, since —as remarked earlier— the aim of our analysis is to provide a good theoretical base for scientific explanations of behavior. Such explanations, however, do not look to require an account of the content of our representations given in

evolutionary terms. From the psychological point of view, the agent's representations do not have to be tied to the objective conditions for its survival. The explanatorily central issue is not the identification of proper biological functions, but rather the ability to cope with ecologically relevant environmental situations.

What, though, of the putative non-individualism of our account? In what sense does the stress on abilities to cope with the world comport with the idea that certain properties of the world play a constitutive role in the fixation of ecological content? Recall Herbert Simon's tale of an ant walking on a 'wind- and wave-molded' beach (Simon 1969). The marks on the sand form a complex line. If we take the complex geometry of the line as an aspect of the ant's behavior, an analysis of that line exclusively in terms of the ant's cognition will be completely inadequate. The complexity of the line is (partially at least) due to the physical structure of the beach. The moral of the story (a Type II story) is that an explanation of this aspect of the ant's behavior would be inadequate if it abstracted from the features of the current environment in which that behavior is being displayed. What we add —as John Haugeland (1995) has pointed out— is now the idea that if we want to understand such an agent's behavior, we should treat the agent's internal states and aspects of the agent's local environment as an integrated unit. As he puts it, we would have to regard Mind as "not incidentally but *intimately* embodied and *intimately* embedded in its world" (Haugeland 1995: 36). Ecological content takes this larger whole as the basic unit for psychological explanations.

A nice example, provided by McClamrock, is that of speech perception or, more precisely, what is known as vowel normalization. This example is especially interesting inasmuch as it involves a constitutive claim of much the same kind as I have made regarding the ecological character of content. The example is taken from a study by Nussbaum and DeGroot (1991) and focuses on the fact that "what acoustic pattern counts as a phoneme of a particular type is highly dependent on the surrounding speech context" (McClamrock 1995: 96). What makes an acoustic pattern a particular vowel sound is thus something external to that particular pattern. Phonetic identity depends constitutively upon patterns surrounding that sound. In the same way, properties external to the agent, properties that are environment-involving, can constitute key parameters for the individuation of ecological content.

Those properties are indeed the result of a constant exchange of information between the inner and the outer realm —but that information is not to be cashed out in terms of propositional knowledge. It is not explicit information for the system. It is the kind of information that makes a computational difference to the system without necessarily being explicitly represented by the system.

If we now return to the (in)famous Twinearth thought experiment, the situation can be analyzed as follows. If my Twin and I could notice or reflect upon the difference between H_2O and XYZ, then the content of our thoughts would differ and we would be dealing with good old fashioned narrow content. If my Twin and I could not thus notice or conceive any difference between H_2O and XYZ then, the content of our thoughts would not reflect it and therefore we would be dealing with good old fashioned wide content. But, there is a third possibility, somewhat obscured by the fact that we often fail to distinguish between knowing-how and knowing-that (cfr. Ryle 1963) —and thus fall squarely back into the classical 17^{th} century formulations of the problem[14]. It is the possibility that the kind of difference that matters in this context may be a computational difference that doesn't necessarily involve awareness or propositional knowledge. If, for instance, the density of H_2O were different from the density of XYZ in such a (subtle) way that the motor skills of my Twin and I when swimming had to adjust to that density accordingly, there would still be a computational difference of the ecological kind. In such a case the subject's mental states need not involve any kind of explicit representation of the relevant difference. This is, by the way, one respect in which our position differs from e.g. Fodor's new 'correlational' theory (Fodor 1994). While Fodorian representations are necessarily explicit, the representations invoked in my ecological account are not. They are individuated according to particular abilities and, as such, need not exhibit any language-like format. Instead, these abilities are constituted, in part, by the subject's actual interactions with specific features of the local environment. These abilities are keyed to actual activity in specific task-domains. As a result, the characterizations of content that they provide are not specified by reference to the full gamut of e.g. our water-related dispositions. Instead they include only the dispositions related to e.g. water as the stuff in which I practice specific activities (such as swimming, etc.)

characteristic of my normal ecological involvement with the immediate environment.

In closing, let me emphasize that I have not tried, in this brief treatment, to dispel all possible internalist worries. No doubt the sensible internalist of Section 1 could still argue for a (Type I) individualistic characterization of content that is nonetheless compatible with some recognition of these ecological dimensions. But even if an individualistic interpretation is always possible, it will not always be as fruitful —from an explanatory point of view— or as easily able to display the real world, real-time dynamics of cognition as is the ecological alternative. Let me also add that it was not my aim to provide a fully developed theory of content. My hope was only to provide some notes towards a different way of thinking about the notion of psychological explanation —a way which lays much more stress on the pragmatic, environment-involving, skill-oriented dimensions of real-world cognition. As such, my project is largely independent of (and might even be compatible with) a more philosophically motivated account of content in terms of truth-conditions —just as some account of motion might be given independently of an account of the skills underlying those motions. Whether these two projects may ultimately be reconciled remains to be seen[15].

Notes

1 'Supervenience' is here to be read as *strongly supervening* in the sense of Kim (1984): " ... *the supervenience of a family A of properties on another family B* can be explained as follows: necessarily, for any property F in A, if any object x has F, then there exists a property G in B such that x has G, and necessarily anything having G has F. When properties F and G are related as specified in the definition, we may say that F is supervenient on G, and that G is a supervenience base of F" (Kim 1984: 262).

2 The same kind of strategy had already been followed by Fodor in his classic "Methodological Solipsism Considered as a Research Strategy in Cognitive Psychology" (Fodor 1981). There, however, the vindication of narrow content was tied up with the alleged syntactic nature of computation and with the characterization of psychological explanations as computational explanations.

3 Once a great supporter of narrow content, Fodor himself has also been moving lately in the direction of externalism. His claim is that we can have everything we want narrow content for (intentional psychological laws, and their corresponding computational implementations) without narrow content (Fodor 1994).

4 Following Kim's formulation we can say that necessarily, for any property F in the family of contentful states, if any object x has F, then there exists a property G in the family of physical states such that x has G, and necessarily anything having G has F. The main problem with this characterization is how to interpret that notion of necessity. I don't intend to address that problem here though. Nothing in my argument requires a particular reading of necessity.

5 I borrow the *shape* of this expression from Peacocke (1993), who introduces the notion of externalist content-involving computational description.

6 Thanks to an anonymous referee for pointing this out.

7 See Wilson (1994b) for a possible development of such an account.

8 This example is from Kirsh (1995).

9 The example concerns what they characterize as an *epistemic* action, i.e., an action whose primary purpose is to alter the nature of our own mental states, as opposed to *pragmatic* action, namely, action undertaken because we need to alter the world to achieve some physical goal.

10 I have argued elsewhere (Toribio in press) that dual factor theories of meaning are fatally flawed in at least two ways. First, their very duality constitutes a problem: the two dimensions of meaning (reference and

conceptual role) cannot be treated as totally orthogonal without compromising the intuition that much of our linguistic and non linguistic behavior is based on the cognizer's interaction with the world. Second, Conceptual Role Semantics looks unable to explain a crucial feature of linguistic representation, viz., the special kind of compositionality known as concatenative compositionality. Dual factor theories, I conclude, cannot constitute an acceptable philosophical model of content.

11 Robert Wilson's recent piece on 'wide computationalism' points in the same direction. He argues that " ... the computational argument for individualism should be rejected because ... the assumption that computational processes in general are individualistic is false in light of the possibility and plausibility of wide computationalism in cognitive psychology" (Wilson 1994a: 370). Wide computationalism (a Type II thesis) is, roughly, the view that the computational systems that are interesting for cognitive psychology extend beyond the individual and include parts of the system's environment.

12 I thank Marcelo Dascal for pointing this out.

13 In fact, the very structure of the environment sometimes provides solutions to problems that would be much more complex if we thought of those solutions as solely the result of the cognizer's inner computations (See Ballard 1991).

14 Thank to Marcelo Dascal for pointing this out. Notice, in this context, that although I am invoking the Rylean distinction between 'knowing that' (propositional knowledge) and 'knowing how' (non-propositional knowledge), my own account invokes internal representations and therefore doesn't have the strong behavioristic flavor characteristic of the pure Rylean view.

15 I wish to thank Andy Clark, David Chalmers, Keith Butler, Fernando Broncano, Marcelo Dascal and two anonymous referees for helpful comments on earlier versions of this paper.

References

Ackley, D. & Littman, M. 1992. "Interactions between Learning and Evolution". In C. Langton, C. Taylor, D. Farmer & S. Rasmussen (eds), *Artificial Life II*, Redwood City, CA: Addison-Wesley, 487- 509.

Ballard, D. 1991. "Animate Vision". *Artificial Intelligence* 48: 57-86.

Beer, R. 1990. *Intelligence and Adaptive Behavior*, Academic Press, San Diego.

Block, N. 1986. "Advertisement for a Semantics for Psychology". In P. French, T. Uehling and H. Wettstein (eds), *Midwest Studies in Philosophy, vol. **10**: Studies in the Philosophy of Mind*. Minneapolis: University of Minnesota Press, 615-678.

Block, N. 1991. "What Narrow Content is Not". In B. Loewer & G. Rey (eds), *Meaning and Mind. Fodor and His Critics*. Oxford: Basil Blackwell, 33-64.

Brooks, R. 1991. "Intelligence Without Representation". *Artificial Intelligence* 47: 139-159.

Burge, T. 1979. "Individualism and the Mental". In P. French *et. al.*, (eds), *Midwest Studies in Philosophy, Volume IV*. Minneapolis: University of Minnesota Press, 73-121.

Burge, T. 1986. "Individualism and Psychology". *The Philosophical Review* 95: 3-45.

Burge, T. 1993. "Mind-Body Causation in Psychology". In J. Heil and A. Mele (eds), *Mental Causation*. Oxford: Clarendon Press, 97-120.

Churchland, P. S., Ramachandran, V. S. and Sejnowski, T. J. 1994. "A Critique of Pure Vision". In C. Koch and J. Davis (eds), *Large-Scale Neuronal Theories of the Brain*. Cambridge: MIT Press, 23-60.

Cussins, A. 1992. "Content, Embodiment and Objectivity: The Theory of Cognitive Trails". *Mind*, 101 (404): 651-688.

Dummett, M. 1973. *Frege. Philosophy of Language*. London: Duckworth.

Dummett, M. 1975. "What is a Theory of Meaning? (I)". In S. Guttenplan (ed),*Mind and Language*. Oxford: Clarendon Press, 97-138.

Dummett, M. 1976. "What is a Theory of Meaning? (II)". In G. Evans, and J. McDowell (eds), *Truth and Meaning. Essays in Semantics*. Oxford: Clarendon Press, 67-137.

Evans, G. 1982. *The Varieties of Reference*. Ed. by J. McDowell. Oxford: Clarendon Press.

Fodor, J. 1975. *The Language of Thought*. New York, Thomas Y. Crowell.

Fodor, J. 1981. "Methodological Solipsism Considered as a Research Strategy in Cognitive Psychology". Reprinted in J. Fodor, *Representations*. Cambridge: MIT Press, 225-253.

Fodor, J. 1987. *Psychosemantics*. Cambridge: MIT Press.

Fodor, J. 1994 *The Elm and the Expert. Mentalese and Its Semantics.* The 1993 Jean Nicod Lectures. Cambridge: MIT Press.

Frege, G. 1892. "Über Sinn und Bedeutung". In *Zeitschrift für Philosophie und philosophische Kritik*, NF 100, 1892. Transl. in M. Black and P. Geach (eds): *Translations from the Philosophical Writings of Gottlob Frege*. Oxford: Basil Blackwell, 1952.

Gibson, J. J. 1979. *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.

Harvey, I., Husbands, P. and Cliff, D. 1993. "Issues in Evolutionary Robotics". Sussex: University of Sussex. Cognitive Science Research Papers, TR 219.

Haugeland, J. 1995. "Mind Emboddied and Embedded" *Mind and Cognition: Collected Papers from 1993 International Symposium on Mind and Cognition*. Taipei, Taiwan: Institute of European and American Studies, Academia Sinica, 3-37.

Hinton, G. E. & Nowland, S. J. 1987. "How Learning can Guide Evolution". *Complex System*, 1: 495-502.

Hornsby, J. 1986. "Physicalist Thinking and Conceptions of Behaviour". In P. Pettit & J. McDowell (eds), *Subject, Thought and Context*. Oxford: Clarendon Press.

Hutchins, E. 1995. *Cognition in the Wild*. Cambridge: MIT Press.

Karmiloff-Smith, A. 1986. "From Meta-Processes to Conscious Access: Evidence from Children's Meta-linguistic and Repair Data". *Cognition* 23: 95-147.

Karmiloff-Smith, A. 1992. *Beyond Modularity. A Developmental Perspective on Cognitive Science*. Cambridge: MIT Press.

Kim, J. 1984. "Epiphenomenal and Supervenient Causation". In French, P. *et. al.* (eds), *Midwest Studies in Philosophy, IX,* Minneapolis: University of Minnesota Press.

Kirsh, D. 1995. "The Intelligent Use of Space". *Artificial Intelligence* 72: 1-52.

Kirsh, D. & Maglio, P. 1994. "On Distinguishing Epistemic from Pragmatic Action". *Cognitive Science* 18: 513-549.

McClamrock, R. 1995. *Existential Cognition*, Chicago: Chicago University Press.

McGinn, C. 1982. "The Structure of Content". In A. Woodfield (ed), *Thought and Object*. Oxford: Clarendon Press, 207-258.

Millikan, R. 1984. *Language. Thought and Other Biological Categories. New Foundations for Realism*. Cambridge: MIT Press.

Millikan, R. 1993. *White Queen Psychology and Other Essays for Alice*. Cambridge: MIT Press.

Nussbaum, H. and DeGroot, J 1991. "The Role of Syllables in Speech Perception". In M.S. Ziolkowski, M. Noske and K. Deaton (eds), *Papers from the Parasession on the Syllable in Phonetics and Phonology*, Chicago: Chicago University Press.

Papineau, D. 1990. "Truth and Teleology". In D. Knowles (ed), *Explanation and Its Limits*. Cambridge: Cambridge University Press, 21-43.

Peacocke, C. 1993. "Externalist Explanation". *Proceedings of the Aristotelian Society*, XCIII: 203-230.

Peacocke, C. 1994. "Content, Computation and Externalism". *Mind and Language* 9 (3): 303-335.

Putnam, H. 1975. "The Meaning of «Meaning»". In H. Putnam, *Mind, Language and Reality: Philosophical Papers, Volume 2*. Cambridge: Cambridge University Press, 215-271

Rutkowska, J. C. 1990. "Action, Connectionism and Enaction: A Developmental Perspective". *AI and Society* 4: 96-114.

Rutkowska, J. C. 1991. "Looking for «Constraints» in Infants' Perceptual-Cognitive Development". *Mind and Language* 6: 215-238.

Rutkowska, J. C. 1993a. "Ontogenetic Constraints on Scaling-Up Sensory-Motor Systems". *Proceedings of the Second European Conference on Artificial Life, Vol. 2*. Brussels, May, 24-26, 970-979.

Rutkowska, J. C. 1993b. *The Computational Infant*. Brighton: Harvester Press.

Ryle, G. 1963. *Concept of Mind*. Harmondsworth: Penguin.

Segal, G. 1991. "Defence of a Reasonable Individualism". *Mind* 100: 485-494.

Simon, H. A. 1969. *The Science of the Artificial*. Cambridge: MIT Press. Second Edition, 1987.

Stalnaker, R. 1990. "Narrow Content". In C. A. Anderson & J. Owens (eds), *Propositional Attitudes. The Role of Content in Logic, Language and Mind*. Stanford: Center for the Study of Language and Information), 131-145.

Toribio, J. in press. "Twin Pleas: Probing Content and Compositionality". *Philosophical and Phenomenological Research*.

Varela, F., Thompson, E., and Rosch, E. 1991. *The Embodied Mind: Cognitive Science and Human Experience*. Cambridge: MIT Press.

Wilson, R. A. 1994a. "Wide Computationalism". *Mind* 103 (411): 351-372.
`

Wilson, R. A. 1994b. "Causal Depth, Theoretical Appropriateness, and Individualism in Psychology". *Philosophy of Science* 61: 55-75.