INTRINSIC (HOMOLOGOUS) vs EXTRINSIC (HETEROLOGOUS) REPRESENTATIONS

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One of the most famous obscurities in Wittgenstein's Tractatus is its dictum on propositional structure in symbolic representation:

3.142 Only facts can express a sense, a class of names cannot.

3.143 That the propositional sign is a fact is concealed by the ordinary form of expression, written or printed.
(For in the printed proposition, for example, the sign of a proposition does not appear essentially different from a word. Thus it was possible for Frege to call the proposition a compounded name.)

3.1431 The essential nature of the propositional sign becomes very clear when we imagine it made up of spatial objects (such as tables, chairs, books) instead of written signs.
The mutual spatial position of these things then expresses the sense of the proposition.

3.1432 We must not say, "The complex sign 'aRb' says 'a stands in relation R to b'"; but we must say, "That 'a' stands in a certain relation to 'b' says that aRb."

Although this thesis is not nearly so cryptic as first impression may judge, it is arguably wrong or at least importantly misleading. Nevertheless, it grapples provocatively with a crucial facet of representation that the literature on cognition has scarcely ever confronted much less made perspicuous, namely, the ontology of structured representations and its match to that of what is represented.

More recently, though articulate theories of articulate representation still remain distressingly nonexistant, Palmer (1978) has proposed in a thoughtful preface thereto that the core difference between analog (imageal) and propositional representations lies in a structural contrast he describes as "intrinsic" vs. "extrinsic." Palmer has indeed touched upon basic issues in this distinction; however, he leaves it largely intuitive except for stating that "Representation is (purely) intrinsic whenever a representing relation has the same inherent constraints as its represented relation" (p. 271)--which I shall argue is somewhat off the mark. Or perhaps I should suggest instead that if this does capture precisely what Palmer means by

his contrast, he has conflated it with a more fundamental sense in which analog/imageal representations are "intrinsic" while propositional ones are paradigmatically "extrinsic." Be that as it may, the juncture of Wittgenstein and Palmer on representational structure well merits explication.

Comprehensive analysis of representation is remote from present intent. Rather, I aim here only to clarify the manner in which complex representations are compounded out of constituent ones. And I shall attend almost exclusively to the paradigm case of this wherein the complexes represented are singular facts (events, states-of-affairs), and will moreover consider only the most idealizedly simple ways in which symbols might accomplish this without apology for how empoverished these may be as models of factive representation in real-world language and thought. The structural issues that emerge from these abstract idealizations lose none of their cogency when embedded in the profuse intricacies of full-blooded human cognition.

Let us commence, then, by envisioning two ensembles of entities that we shall call respectively a "symbol system" and an "object system."

SYMBOL SYSTEM $\Sigma = \langle S,A,B,Q,\ldots\rangle$	OBJECT SYSTEM $\Omega = \langle O,X,R,\ldots\rangle$
The primitive symbol-system constituents:	The primitive object-system constituents:
1. A set $S = \{\underline{s}_1,\underline{s}_2,\ldots\}$ of individual things (symbols) that have various properties and stand in various relations. In the Fig. 1 example, each symbol $\underline{s}_i$ is a distinctive region of the page having a determinate shape, shading, and spatial location.	1. A set $O = \{\underline{o}_1,\underline{o}_2,\ldots\}$ of individual objects that have various properties and relations. In our running example, we will take each $\underline{o}_i$ to be the current temporal stage of some university professor.
2. Variables A and B over S whose values $\{\underline{A}_1,\underline{A}_2,\ldots\}$ and $\{\underline{B}_1,\underline{B}_2,\ldots\}$ are contrastive attributes over domain S--i.e., each $\underline{s}_i$ has exactly one kind-A property and exactly one kind-B property. In Figure 1, we take A to comprise	2. A variable X over O whose values $\{\underline{X}_1, \underline{X}_2,\ldots\}$ are contrastive attributes over O. In our running example, we will take each $\underline{X}_i$ to be a chronological age.

alternative shadings, and B to comprise alternative shapes.

3. A relational variable Q on ordered pairs from S whose values are $\{\underline{Q}_1, \underline{Q}_2, \ldots\}$. In the Fig. 1 example, we take each $\underline{Q}_i$ to be a signed horizontal distance (positive, zero, or negative) that may or may not separate two given symbols.

Other entities in this symbol system that derive from the primitive Σ-elements:

4. Ordered pairs $\langle \underline{s}_i, \underline{s}_j \rangle$ and other tuples of the S-things.

5. Compound properties over S and S x S whose constituents are properties of kinds A, B, and Q. E.g., $\underline{A}_i(\underline{x}) \,\&\, \underline{B}_j(\underline{x})$ is the property of exemplifying both $\underline{A}_i$ and $\underline{B}_j$; and $\underline{A}_i(\underline{x}) \,\&\, \underline{Q}_j(\underline{x},\underline{y}) \,\&\, \underline{B}_k(\underline{y})$ is the property of being a pair whose 1st component has $\underline{A}_i$ and is $\underline{Q}_j$-related to its 2nd component which is $\underline{B}_j$ish.

6. Facts/events/states-of-affairs consisting of one or more S-things having various simple or complex Σ-properties. For example, suppose for symbols $\underline{s}_1$ and $\underline{s}_2$ that $\underline{A}_i$ is $\underline{s}_1$'s property of kind A, that $\underline{B}_k$ is $\underline{s}_2$'s property of kind B, and that $\underline{Q}_j$ is the kind-Q relation in which $\underline{s}_1$ stands to $\underline{s}_2$. Then the Σ-facts include $\underline{A}_i(\underline{s}_1)$, $\underline{B}_k(\underline{s}_2)$, and $\underline{Q}_j(\underline{s}_1,\underline{s}_2)$, i.e., $\underline{s}_1$'s-having-$\underline{A}_i$, $\underline{s}_2$'s-having-$\underline{B}_k$, and $\underline{s}_1$'s-being-$\underline{Q}_j$-related-to-$\underline{s}_2$. These in turn are constituents of compound fact $\underline{A}_i(\underline{s}_1) \,\&\, \underline{Q}_j(\underline{s}_1,\underline{s}_2) \,\&\, \underline{B}_k(\underline{s}_2)$.

3. A relational variable R on ordered pairs from O whose values are $\{\underline{R}_1, \underline{R}_2, \ldots\}$. In our running example we will take each $\underline{R}_i$ to be a signed difference in current annual income.

Other entities in this object system that derive from the primitive Ω-elements:

4. Ordered pairs $\langle \underline{o}_i, \underline{o}_j \rangle$ and other tuples of the O-objects.

5. Compound properties over O and O x O whose constituents are properties of kinds X and R. In addition to conjunctive compounds, these also include disjunctions and negations, e.g., $\underline{X}_i(\underline{x})$-or-$\underline{X}_j(\underline{x})$ and not-$\underline{X}_k(\underline{x})$; however, we shall here have little concern with complex objective properties.

6. Facts/events/states-of-affairs consisting of one or more O-objects having various simple or complex Ω-properties; e.g., in our running object-system example, Prof. $\underline{o}_1$'s being 58 years old, and Prof. $\underline{o}_2$'s making $3,000 per annum more than Prof. $\underline{o}_3$. It will be convenient to speak as though the Ω-system also contains "possible" facts which may or may not be real ones. Thus when $\underline{o}_1$'s kind-X property is other than $\underline{X}_i$, we shall speak of possible fact $\underline{X}_i(\underline{o}_1)$--i.e., the possibility that $\underline{o}_1$-has-$\underline{X}_i$--despite the objective nonexistence of $\underline{o}_1$'s-having-$\underline{X}_i$.

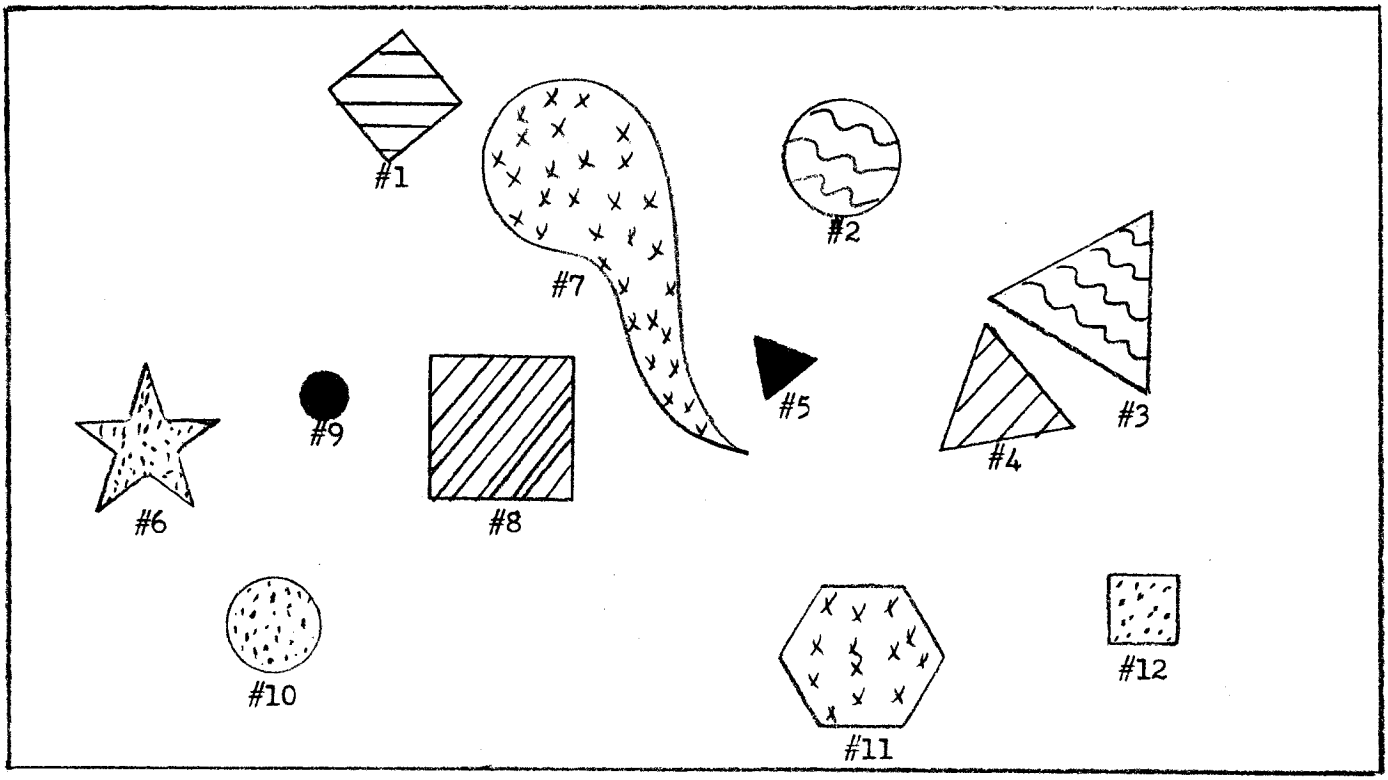

Figure 1. A sampler symbol system. Symbols $\{s_i\}$ qua individuals are the 12 regions of this page bounded by a pigmentation discontinuity. Each of these has various nonrelational properties, inter alia a shading, a shape, and a spatial position specified, say, by the vertical and horizontal distance of the region's centroid from the page's lower left corner. And tuples of these individuals stand in various relations; e.g., one region may be c cm. to the right of and d cm. above another, or may be t times larger than the other in area, etc. The symbol facts are the compound entities described by sentences or their gerundives that tell what regions exemplify what properties. For example, one symbol fact here is region No. 5's being solid; and another which contains the first is region No. 5's being a solid triangle that is 4 cm. above region No. 11.

We now observe two importantly different ways in which aspects of the symbol system can "represent" object-system facts. These representations derive on one hand from mappings of primitives in Σ into primitives in Ω, and on the other from certain structural correspondences between compound representers and representees. Initially, we take the primitive mappings--which I shall call "reference functions" or more briefly reftors--to be arbitrary givens. (If that disturbs you, relax and go with the flow. We can't deal with everything at once.)

Intrinsic Representation (INTREP)

Let ρ_{OS} be some reference function (reftor) that maps each S-thing $\underline{s}_i$ into an O-object $\rho_{OS}(\underline{s}_i)$, assuming for simplicity that $\rho_{OS}(\underline{s}_i) = \underline{o}_i$ for each $\underline{i} = 1,2,\ldots$. And let ρ_{XA} and ρ_{RQ} be reftors such that ρ_{XA} maps each kind-Q symbol property $\underline{A}_i$ into a kind-X object property $\rho_{XA}(\underline{A}_i)$ while ρ_{RQ} maps each kind-Q symbol relation $\underline{Q}_i$ into a kind-R object relation $\rho_{RQ}(\underline{Q}_i)$, again assuming that for each $\underline{i} = 1,2,\ldots$, $\rho_{XA}(\underline{A}_i) = \underline{X}_i$ and $\rho_{RQ}(\underline{Q}_i) = \underline{R}_i$. (These indexing presumptions are not altogether innocuous, since they imply that the property mappings are one-one. But we shall exploit them only to avoid notational monstrosities.)

Then, relative to reftors $\langle \rho_{OS}, \rho_{XA}, \rho_{RQ} \rangle$ and a structural correspondence that I shall not yet verbalize: If symbol $\underline{s}_i$ has property $\underline{A}_j$, the symbolic fact $\underline{A}_j(\underline{s}_i)$ represents the possible objective fact $\underline{X}_j(\underline{o}_i)$. That is, under these referent assignments, $\underline{s}_i$'s-having-$\underline{A}_i$ represents $\underline{o}_i$'s-having-$\underline{X}_j$, or at least would do so were $\underline{o}_i$ to have $\underline{X}_j$. (Idiom expresses this subjunctivity of factive representation by saying that $\underline{A}_j(\underline{s}_i)$ represents $\underline{o}_i$ as having $\underline{X}_j$, thereby suspending judgment on veridicality.) Similarly, if $\underline{s}_i$ stands in $\underline{Q}_j$ to $\underline{s}_k$, the fact of this being so represents the objective relational possibility that $\underline{R}_j(\underline{o}_i,\underline{o}_k)$. Thus if Fig. 1's regions No. 8 and No. 10 are mapped by ρ_{OS} into Tom Nelson and Paul Swartz, respectively, while Stripedness and Being-3-cm.-to-the-right-of are respectively mapped by ρ_{XA} and ρ_{RQ} into 58-year-oldness and Making-$3,000-per-annum-more-than, the pigmentation fact that region No. 8 is striped represents Nelson as being 58 years old, and region No. 8's being 3 cm. to the right of region No. 10 represents Nelson as

making $3,000 per annum more than Swartz.

Under INTREP, symbols $\{\underline{s}_i\}$ pick out objects $\{\underline{o}_i\}$ in whatever sense of representation characterizes ρ_{OS}; symbol properties $\{\underline{A}_j\}$ and $\{\underline{Q}_k\}$ pick out object properties $\{\underline{X}_j\}$ and $\{\underline{R}_k\}$ in whatever sense of representation characterizes ρ_{XA} and ρ_{RQ}; and symbol facts $\underline{s}_i$'s-having-$\underline{A}_j$ and $\underline{s}_i$'s-being-$\underline{Q}_j$-related-to-$\underline{s}_k$ represent real or possible object facts $\underline{X}_j(\underline{o}_i)$ and $\underline{R}_j(\underline{o}_i,\underline{o}_k)$ in whatever sense of representation is defined not merely by the characters of ρ_{OS}, ρ_{XA}, and ρ_{RQ} but additionally by the coordination of Exemplification in the symbol system with Exemplification in the object system.

Extrinsic Representation (EXTREP)

Let property→property mappings ρ_{XA} and ρ_{RQ} be as in INTREP. But now let ρ_{OB}: B→O be a function that maps each symbol property $\underline{B}_i$ of kind B into an object $\rho_{OB}(\underline{B}_i)$ in O, again for simplicity assuming $\rho_{OB}(\underline{B}_i) = \underline{o}_i$ for each $\underline{i} = 1,2,\ldots$.

Then, relative to reftors $\langle\rho_{OB}, \rho_{XA}, \rho_{RQ}\rangle$ and a structural correspondence that I will not yet verbalize: The compound symbol property $\underline{B}_i(\underline{x}) \,\&\, \underline{A}_j(x)$ represents object $\underline{o}_i$ as having property $\underline{X}_j$, and the compound symbol property $\underline{B}_i(\underline{x}) \,\&\, \underline{Q}_j(\underline{x},\underline{y}) \,\&\, \underline{B}_k(\underline{y})$ represents object $\underline{o}_i$ as $\underline{R}_j$-related to object $\underline{o}_k$. Thus in Fig. 1, if ρ_{OB}(Square) = Nelson and ρ_{OB}(Circular) = Swartz, while ρ_{XA}(Striped) = Being-58-years-old and ρ_{RQ}(Is-3-cm.-to-the-right-of) = Makes-$3,000-per-annum-more-than as before, the conjunctive symbol property of being-square-and-striped represents the possible fact that Nelson is 58 years old; and the compound property of being-a-pair-of-regions-whose-1st-component-is-square-and-3-cm.-to-the-right-of-its-2nd-component-which-is-circular represents the possibility that Nelso makes $3,000 per annum more than Swartz.

Under EXTREP, symbols $\{\underline{s}_i\}$ do not themselves, qua individuals, represent anything. Rather, they are locations of representations, including factive ones; and the very same factive representation can recur in arbitrarily many such places. Unlike the ontological homology of INTREP, wherein individuals represent individuals,

properties represent properties, and facts represent real or hypothetical facts under the auto-representation of Exemplification by Exemplification, EXTREP is ontologically heterologous in that objective individuals, objective properties, and objective facts are <u>all</u> represented by symbol properties under the structural representation of Exemplification by Co-instantiation. Accordingly, since I have not yet justified aligning Palmer's "intrinsic/extrinsic" distinction with the present one, INTREP and EXTREP can better be renamed HOMREP and HETREP, respectively.

<u>Ramifications</u>.

So much for the easy part. I shall now try to show that the HOMREP/HETREP difference is of fundamental importance for the functioning of representations in cognitive processes (or at least for our theories of how cognitions engage the world), even though this is far less straightforward than it appears in my initial presentation of it. Eventually, we shall appraise the claims of Palmer and Wittgenstein with which we began.

On the face of it, the stark ontological contrast between HOMREP (INTREP) and HETREP (EXTREP) has consequences that are direct and profound: HOMREPs are constructively inflexible and location-bound, whereas HETREPs are adjustable and recurrent. For under HOMREP, reftors $\langle \rho_{OS}, \rho_{XA}, \rho_{RQ} \rangle$ narrowly and rigidly constrain what possible facts in Ω are represented in Σ, and where; whereas under HETREP, reftors $\langle \rho_{OB}, \rho_{XA}, \rho_{RQ} \rangle$ entail representations in Σ of all possible Ω-facts with no inherent constraints on where any one can occur. To appreciate this point without distraction from certain complications that will soon obtrude, suppose that all these reftors are one-one over their ranges, i.e. that $\rho_{OS}(\underline{s}_i) = \rho_{OS}(\underline{s}_j)$ only if $\underline{s}_i = \underline{s}_j$ and similarly for the others. Since it is a non-negotiable brute fact about any given $\underline{s}_i$ in S that $\underline{s}_i$ has just one property of kind A, say $\underline{A}_j$, it follows that from all the kind-X fact possibilities involving $\underline{s}_i$'s ρ_{OS}-referent $\underline{o}_i$, i.e. $\underline{o}_i$'s-(possibly)-having-$\underline{X}_1$, $\underline{o}_i$'s-(possibly)-having-$\underline{X}_2$, $\underline{o}_i$'s-(possibly)-having-$\underline{X}_3$,

etc., the only one represented in the Σ-system is o_i's-(possibly)-having-$\rho_{AX}(A_j)$. (Thus in Fig. 1, if s_8 and only s_8 signifies Nelson, while Stripedness and Stripedness alone stands for 58-year-oldness, the array of factive representations in Fig. 1 includes representation of Nelson as 58 years old, namely, by s_8's-being-striped, but does **not** include representation of Nelson as having any other age.) Similarly, for any s_i and s_k in S, for some kind-Q relation Q_j it is a brute fact that $Q_j(s_i,s_k)$; and although this fact represents o_i as R_j-related to o_k, it precludes the Σ-system's containing any representation of o_i as standing in any other kind-R relation to o_k.

In a HETREP interpretation of the Fig. 1 symbol system, on the other hand, suppose that ρ_{OS}(Square) = Nelson, ρ_{OS}(Circular) = Swartz, ρ_{XA}(Striped) = Being-50-years-old, ρ_{XA}(Spotted) = Being-32-years-old, and for each number n, ρ_{RQ}(Being-n-cm.-to-the-right-of) = Makes-n x $1,000-per-annum-more-than. Then representation of Nelson as 58 years old by Being-square-and-striped is exhibited twice in Fig. 1, once by region s_8 and again by region s_1, even while the contrastive possibility that-Nelson-is-32-years-old is represented by the Being-square-and-spotted property exemplified by region s_{12}. And Nelson's-(possibly)-making-$3,000-per-annum-more-than-Swartz is represented by the **pattern** property--a structured compound of relational and nonrelational ingredients--exemplified by region-pair $\langle s_8,s_{10}\rangle$, namely, Consisting-of-a-square-1st-component-3-cm.-to-the-right-of-a-circular-2nd-component, even while the counterpart patterns exemplified by other pairings of regions s_2, s_9, or s_{10} with regions s_1, s_8, or s_{12} represent Nelson as differing income-wise from Swartz by various other positive or negative amounts.[1] Clearly there is no

[1]That **all** pairings of squares with circles in Fig. 1 exhibit representations of in-the-main-inconsistent possibilities for the Nelson/Swartz salary-difference fact may seem a bit much to you, especially when you consider that the HETREP principle here extends to pairings of circles **with circles** and squares with squares, so that the shape/separation patterns exemplified by $\langle s_{12},s_8\rangle$ and its permutation $\langle s_8,s_{12}\rangle$ represent Nelson as making $8,600 more than himself and $8,600 less than himself, respectively. But no problem: To remove this representational promiscuity from our HETREP example, we need merely tighten what relations $\{Q_i\}$ on S-pairs represent the object relations $\{R_i\}$. For example, suppose that we add cursive lines to Fig. 1 that connect

some but not all of its bounded regions. Then we can take each $Q_i(x,y)$ in Q to be the relation, x-is-both-line-connected-to-and-n_i-cm.-to-the-right-of-y; whence the only region-pairs in Fig. 1 exhibiting representation of factive salary-difference possibilities are the ones on which we have imposed line-connection.

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limit to the alternative factive possibilities for professors' ages and income differences that can be represented by patterns of shapes/shadings/spatial-separations under HETREP syntax; and any one of these patterns can be exhibited repeatedly, including its propagation throughout sequences of information-processing events. Under HETREP, in apparent contrast to HOMREP, factive representations can be communicated. (To be sure, not all these communicable HETREPs are veridical. But HOMREP mappings do not insure that either, and moreover the theory of cognitive representation does not want all factive representations to be veridical.)

However: The HOMREP/HETREP contrast, which seems so fundamental when formulated austerely, is blurred by observing that any HETREP system has a HOMREP isomorph, and conversely. To convert HETREP to HOMREP, start with the representation of Ω-facts by Σ-patterns under reftors $\langle \rho_{OB}, \rho_{XA}, \rho_{QR} \rangle$ and HETREP syntax, and define η_{BS}: S→B to be the function that maps each S-thing s_i into its value of variable B. That is, $\eta_{BS}(s_i) = B_j$ just in case s_i has B_j. Then if $\rho^*_{OS} = \rho_{OB}\eta_{BS}$ is by definition the composition of η_{BS} into ρ_{OB}, i.e., for each s_i in S, $\rho^*_{OS}(s_i)$ is s_i's property of kind B, reftors $\langle \rho^*_{OS}, \rho_{XA}, \rho_{RQ} \rangle$ together with auto-representation of Exemplification by itself define a HOMREP system which is for all practical purposes identical with the HETREP system from which it derives. (Thus in the Fig. 1 example, there seems little to choose between (a) assigning Squareness to stand for Nelson and Circularity for Swartz, and (b) stipulating that every square region stands for Nelson while every circular one stands for Swartz.) Let us call any HOMREP system that derives from a HETREP one by so replacing ρ_{OB} by $\rho_{OB}\eta_{BS}$ the "HOMREP shadow" of the latter. It will be evident from this construction that every HETREP system has a unique HOMREP shadow.

Conversely, the array of factive HOMREPs established by reftors $\langle \rho_{OS}, \rho_{XA}, \rho_{RQ} \rangle$ can be converted into a HETREP counterpart as follows: Let $B^* = \{B^*_i\}$ be

an array of "individuator" properties over S-things such that each $\underline{B}_i^*$ in B* is a property of exactly one symbol in S, say $\underline{s}_i$, and of nothing else. In particular, we can always take $\underline{B}_i^*$ to be the property, Is-identical-with-$\underline{s}_i$. Then there is a one-one mapping γ_{SB^*}: B*→S whose value for each individuator $\underline{B}_i^*$ is the one thing $\underline{s}_i$ that has $\underline{B}_i^*$. And this γ_{SB^*} translates the factive representations defined by reftors $\langle \rho_{OS}, \rho_{XA}, \rho_{RQ} \rangle$ under HOMREP syntax into the factive representations defined under HETREP syntax by reftors $\langle \rho_{OB^*}, \rho_{XA}, \rho_{RQ} \rangle$ wherein $\rho_{OB^*} =_{def} \rho_{OS}\gamma_{SB^*}$ is the reference function from B* into O whose value for each symbol property $\underline{B}_i^*$ is the object picked out under ρ_{OS} by the one S-thing that is $\underline{B}_i^*$ish. Thus for the Fig. 1 example, wherein $\underline{s}_8$ is the only distinctively bounded region whose centroid is 4.5 cm. above and 6.5 cm. to the right of Fig. 1's lower left corner, the homologous representation of Nelson's-being-58-years-old by $\underline{s}_8$'s-being-striped can in this way be converted to heterologous representation of this same fact by the pattern property, Being-a-distinctively-bounded-region-4.5-cm.-above-and-6.5-cm.-to-the-right-of-Fig.1's-lower-left-corner-that-is-also-striped. Let us call any HETREP system that derives from a HOMREP one by such translation of ρ_{OS} into ρ_{OB^*} (= $\rho_{OS}\gamma_{SB^*}$) a "HETREP image" of the latter, with this image being "prime" when each $\underline{B}_i^*$ is the property Is-identical-with-$\underline{s}_i$. In principle any HOMREP system has many different HETREP images, differing in what properties $\{\underline{B}_i^*\}$ are taken to individuate symbol things $\{\underline{s}_i\}$. But its prime HETREP image is unique, and moreover can be distinguished from the HOMREP original only by the most exquisite logic-chopping. Thus returning to Fig. 1, you will be hard-pressed to discern much difference beyond stilted paraphrase between representing Nelson as 58 years old on one hand by the fact that-region-No.8-is-striped and on the other by the property Being-both-striped-and-identical-with-region-No.-8.

Must we conclude, then, that heterologous representations differ from their homologous counterparts not in substance but merely in style? No way. But to revitalize this contrast we must heed the localized relativity of factive representations to the constituent mappings I have been calling "reftors," and distinguish

standard instances of these from contratypic ones.

There is no limit to what a given symbol system can represent under arbitrary reftor assignments. But in real-world cognitive representations, which are representations <u>for</u> someone, these are not arbitrary. Indeed, they are not assignments at all in the sense of free mapping stipulations. That certain symbol-complexes have specific significations for certain persons at certain times are simply natural facts about these person-stages, brought about by whatever course of bio-psycho-social events have conferred upon them their particular momentary individualities. Assuming that some or all of the things/properties/facts in symbol system Σ represent some or all of the things/properties/possibilities in object system Ω <u>for a particular person-stage</u> <u>P</u> in some fashion that can usefully be idealized as embodying either the HOMREP or the HETREP schema sketched above, the constituent mappings ρ_{XA}, ρ_{RQ}, and ρ_{OS} or ρ_{OB} that ground these representations for <u>P</u> are defined somehow by <u>P</u>'s local attributes--habits, beliefs, values, etc.--that in aggregate determine how <u>P</u> functions as an information-processing system, and which I shall henceforth refer to as <u>P</u>'s "semantic state." And when the significations of Σ-complexes for <u>P</u> are governed by some specific array of reftors (or more precisely by semantic-state characteristics of <u>P</u> on which those supervene), then on pain of ambiguity they cannot also be governed for <u>P</u> by others as well. (Of course referential ambiguities do arise in practice--and far more pervasively so than orthodox accounts of signification acknowledge. But our cognitive ideal is for representations to be locally univocal, or at least not <u>massively</u> ambiguous, for any one person-stage <u>P</u>.) So it is not enough to observe that every HOMREP has a HETREP image, and every HETREP a HOMREP shadow, when it is plain that the conversions just described of one into the other exploited formalistic tricks that may only have contrived reftors ρ^{*}_{OS} and $\rho_{OB^{*}}$ that never figure in the accounts we want to give of cognitive representations. The operative question is whether, when we look just at reftors of sorts that ground HOMREPs or HETREPs that are actually representations <u>for</u> someone, and characterize these in non-twisted ways most appropriate to how they participate

in natural representational phenomena, do HOMREP and HETREP styles of representation still seem largely interchangeable?

The deep issue that has forced itself upon us, namely,

> What is it for particular reference functions of ontic kinds ρ_{OS}, ρ_{OB}, and $\langle \rho_{XA}, \rho_{RQ} \rangle$ to be reftors <u>for</u> some person-stage <u>P</u>; and how does <u>P</u> acquire these?

vastly exceeds present scope. It suffices here to point out that whatever may be the nature and psychonomic regulation of embodied reftors, it is essential for theories of this matter to distinguish <u>standard</u> object→object reftors ρ_{OS} and property→object reftors ρ_{OB} from ones that are <u>contratypic</u> in one sense of this for ρ_{OS} and in another for ρ_{OB}. With representations built on contratypic reftors set aside, the HETREP/HOMREP contrast regains the importance I imputed to it earlier.

I have spoken glibly of "properties" (including relations) in this commentary without acknowledging the profound obscurities that pervade this ontic category. Roughly speaking, properties are those aspects of the objective world that are signified by <u>predicates</u> in our language(s), with each grammatically well-formed, meaningful predicate corresponding to an objective property albeit properties can exist <u>de re</u> bereft of linguistic encoding and different predicates can signify the same property. And although postulating that <u>every</u> (meaningful) predicate picks out a unique property cannot be sustained technically, it does no evident harm to talk loosely this way so long as we avoid unconditionally universal claims about properties. Be that as it may, our concern here is constrictive, not permissive: Regardless of other limitations that should be placed on what we countenance as properties, we want to distinguish ones that are <u>recurrent</u> from ones that are not. Unhappily, this contrast is difficult to make precise even though paradigm instances seem clear enough. As a first approximation, recurrent properties such as Being-striped, Earning-$53,000-per-annum, Weighing-more-than, Sighing-wistfully, etc., are simply ones capable of unrestrictedly repeated instantiation, contrasting with

nonrecurrent properties, such as Being-identical-with-the-Eiffel-Tower and Occupying-spatial-region-(...)-at-time-(...), that are inherently instantiated just once. But disjunctions of nonrecurrent properties, e.g., Being-identical-either-with-the-Eiffel-Tower-or-with-Margaret-Thatcher, also have multiple instantiations. And many conjunctions of recurrent properties may in fact have at most one instantiation even when they could have many. So bare cardinality of extension does not capture the fundamental distinction here. A better approximation is to say that "recurrent" properties are just those that are causal attributes or logical compounds thereof, where a property (attribute) is "causal" just in case it is a value of some dependent variable in a causal law. However, it still remains deeply problematic what generalities are natural "laws" even in a weak epiphenomenal sense, much less which ones are genuinely causal.[2] So let's settle here for saying provisionally that

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[2] I have probed the nature of natural (scientific) laws, causal and otherwise, at considerable length in an unpublished MS entitled "Mentality and the Deeper Logic of Lawfulness"--scarcely sufficient to resolve its major mysteries but enough to illuminate important complexities therein that we still inadequately comprehend. The distinction that I am here labelling "recurrent" vs. "nonrecurrent" emerges there as seminal to causality's ontological foundations.

"recurrent" properties are just those that seem capable of being produced at various locations in space/time by the operation of natural laws, whereas properties that seemingly cannot have their instantiations brought about by production forces are "nonrecurrent." Thus in Fig. 1, region No. 8 was made to be striped by processes that could just as well have imposed some other pigmentation on this same region; but nothing brought about this region's being located where it is. And no production forces can cause anything to be identical with the Eiffel Tower or with Margaret Thatcher.

With this contrast between recurrent and nonrecurrent properties (loosely) in hand, we can stipulate that a property→object reftor ρ_{OB} or property→property reftor ρ_{XA} (or ρ_{RQ}) is "standard" just in case the symbol properties it maps into objective referents are recurrent, and is "contratypic" otherwise. And a system

of factive representations derived from reptors $\langle \rho_{OB}, \rho_{XA}, \rho_{RQ} \rangle$ under HETREP syntax is standard--otherwise contratypic--just if all its reptors are standard. In contrast, an object→object reftor ρ_{OS}, and any HOMREP built on it, is contratypic if it has composition $\rho_{OS} = \rho_{OB}\gamma_{BS}$ wherein ρ_{OB} is some standard property→object reptor and γ_{BS} is the Exemplification function, introduced earlier, that maps any symbol-thing $\underline{s}_i$ in the relevant symbol system into $\underline{s}_i$'s property of kind B. Evidently the HOMREP shadow of any standard HETREP system is contratypic, and the same is true, though not quite so obviously, for any HETREP image of any standard HOMREP system.[3] Conversely, any contratypic HOMREP system is the shadow of a standard

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[3]The proof's core is as follows: Let ρ_{OS} be any standard object→object reftor from which property→object reftor ρ_{OB*} is derived by some function ν_{SB*} mapping symbol-things $\{\underline{s}_i\}$ into individuator properties $\{\underline{B}_i^*\}$ thereof. (ν_{SB*} is the map that translates a HOMREP system built on ρ_{OB} into some HETREP image thereof.) Since ρ_{SB*} is one-one, it has an inverse ρ_{B*S}^{-1} which yields $\rho_{OS} = \rho_{OB*}\nu_{B*S}^{-1}$; hence properties $\{\underline{B}_i^*\}$ must be nonrecurrent on pain of contradicting our stipulation that ρ_{OS} is standard. So any HETREP system built upon ρ_{OB*} must also by definition be contratypic.

HETREP one (proof is immediate from the definitions); and paradigmatically, though not provably without exception, contratypic HETREP systems are images of standard HOMREP ones.

Ignoring cases wherein the partition between recurrent and nonrecurrent properties is blurred, we can now see that (a) even though any contratypic HOMREP system of factive representations for some person-stage P, and paradigmatically any contratypic HETREP one, is functionally indistinguishable for P from its standard cross-type counterpart, (b) the contrast between standard HOMREPs and standard HETREPs for P is as strong and fundamental as I initially intimated. I shall not argue for claim (a) here; its gist is plain enough in the virtual equivalence already illustrated of HETREPs to their HOMREP shadows and of HOMREPs to their prime HETREP images, and anyway our present interest in contratypic representations is only to avoid confounding them with standard ones. Our focus is claim (b), to develop which I commence with some loose stage-setting assumptions that should not be

unduly controversial so fas as they go but which merely hint at more technical stories yet to be told.

Symbolic communication.

Presumably, the psycho-epistemological import of representations for any person-stage P resides in P's reactions to events that embody them. (Let us ignore that how P figures in production of such events is also part of the account.) An "event" in this context is some factive entity consisting of one or more things in or near P having certain simple or complex properties capable of having causal effects on P. And some of these events are message-bearing for P in that they contain, or themselves are, symbolic representations for P of (possible) objective facts. Using the notation for symbols introduced earlier, we can put this by saying that the event of s's-having-A (or s_1's-relating-Q-wise-to-s_2, or etc. for more complex symbol events) is message-bearing for P iff (a) s is part of or in close causal proximity to P (e.g., s might be a chunk of P's brain, or a place on P's sensory surface, or a distinctive region in some display confronting P), while (b) some (possible) objective fact, o's-having-X (or o_1's-relating-R-wise-to-o_2, or etc.) is represented for P either homologously by s's-having-A under reftors that make o and X the respective referents for P of s and A, or heterologously just by pattern-property A under reftors that make o and X the respective referents for P of component properties suitably conjoined in A.[4] Then the message that s's-having-A

[4]Technically, we shall also want at times to let s's-having-A bear its message for P by virtue of containing, as constituent or by supervenience, an embedded event s_1's-having-A_1 that carries this message for P in the more direct sense just described. Thus in Fig. 1, when Squareness and Stripedness respectively designate Nelson and Being-58-years-old, the event of Region-No.-8's-being-square-and-densely-striped carries a heterologous message about Nelson's age in its supervenient pattern-property Being-square-and-(in-some-fashion)-striped.

bears for P--the aspect of this event that does the representing--is either (homologously) s's-being-A itself or (heterologously) just pattern-property A. And what this message signifies for P, i.e. its factive referent, is o's-(possibly)-having-X.

Technical note. You may well protest this terminology on grounds that when s's-having-A is or contains representation of o's-having-X, ordinary language says that the message therein for P is not the symbol-complex itself but the information this conveys to P, namely, that o has X. But failure of this that-clause to pass the substitution-of-identicals test shows that it doesn't refer to the objective o's-having-A fact; so what then is the commonsense message for P in s's-having-A? The quick answer is that it is a propositional meaning which the message-bearer expresses for P. And that, in turn, arguably consists in the symbol-event's causing another event (or complex thereof), centrally located in P, that also is or contains a rather special sort of representation for P of o's-having-X. It would be unwise, however, for technical theories of representation to remain in thrall to this commonsense intentionality idiom. Even if "messages" are paradigmatically propositions, they are still just what do the representing in intentional events. So we can best extend this label to other prima facie factive representations and leave open the question whether those should count as genuinely representational only for person-stages within whom they elicit bearers of propositions.

I now presume--surely without risk of serious dissent--that message-bearing events are often stages of some communication, and moreover that successful communications are vital to the effective management of cognitive affairs. By a "communication" I mean a causal progression comm = $\langle \ldots, e_i, e_{i+1}, \ldots \rangle$ comprising two or more events such that for some (possible) objective fact o's-having-X (or o_1's-standing-in-R-to-o_2, etc.), there is for each stage e_i of comm a person-stage P_i for whom event e_i bears a message whose factive referent (for P_i) is o's-(possibly)-having-X. (For simplicity I formalize comm as discrete even though it might well be continuous.) The most obvious examples are auditory or visual transmissions passing through a public medium from some stage of one person to somewhat later stages of others. But of even greater importance are within-person communications such as mnemonic recall, comprising activation of some representation of the same objective fact that was represented to an earlier stage of this person in some antecedent of the present message-bearer, and organized thinking of sorts that current jargon would call "processing the information that o is X," wherein active representations of o's-having-X are iterated throughout a succession of a person's momentary stages in varied sectors of that person's brain.

The point now to be made is that whereas communication by (standard) HETREP messages is in principle entirely straightforward, we have no grounds on which to

believe that (standard) HOMREP communication is, as a rule, feasible at all. The argument begins by recognizing that the empirical existence of cognitive phenomena shows it to be possible and indeed commonplace for certain recurrent symbol properties $\{\underline{A}_i\}$ to represent certain recurrent object properties $\{\underline{X}_i\}$ for a person-stage $\underline{P}$ by virtue of $\underline{P}$'s semantic state; while moreover these property→property representations also generally persist for the continuant successors of $\underline{P}$ (i.e. for later stages of the same enduring person) over periods measured in minutes or days if not years. The nature of $\underline{A}_i$'s signifying $\underline{X}_i$ for $\underline{P}$ is still deeply mysterious; but with $\underline{A}_i$ and $\underline{X}_i$ both causal attributes, or supervenient constructions therefrom, it is not implausible that explication of this major kind of aboutness will eventually emerge from causal regularities wherein $\underline{A}_i$, $\underline{X}_i$, and other process features covary conditional on $\underline{P}$'s semantic state. So positing the widespread embodiment in particular person-stages of sharable property→property reftors ρ_{XA} (also ρ_{RQ}, etc.) can be viewed as relatively secure.

Secondly, symbol events can bear (factive) <u>messages</u> only for person-stages imbued with semantic states under which particular objects are represented for them by symbol properties, or symbol things, or both.[5] What it is for a symbol property

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[5] More precisely, this must be so if any message can signify a <u>singular</u> fact for $\underline{P}$. Representations of general facts, such as all-$\underline{Y}$s-being-$\underline{X}$s or there-being-some-$\underline{Y}$-that-is-an-$\underline{X}$, do not need reftors to pick out individual objects; instead, these require some syntax of quantification whose ontology is yet another enigma in the theory of representation.

$\underline{B}_i$, or a symbol thing $\underline{s}_i$, to designate an individual $\underline{o}_i$ for $\underline{P}$ is again an issue about which extant theory says little. Even so, natural language gives us a prototype for each of these, namely, (<u>a</u>) heterological reference by definite descriptions ('the [such-and-so]'), and (<u>b</u>) homological reference by the sites of deictic[6]

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[6] "By deixis is meant the location and identification of persons, objects, events, processes and activities being talked about, or referred to, in relation to the spatio-temporal context created and sustained by the act of utterance and the participation in it, typically, of a single speaker and at least one addressee." -- Lyons, 1977, p. 637.

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demonstratives ("indexicals") whose purest instances are 'here', 'now', 'this', and perhaps 'I'. Let us write *the*, *this*, etc., for conjectured recurrent properties on symbol domain S that play the same syntactic role in representations by symbol system Σ as 'the', 'this', etc. somehow bring off in the cognitive use of English. Then in light of prototype (a), ignoring a nasty little complication to be acknowledged shortly in a technical note, recurrent property B_i should refer to object o_i for P if B_i is the conjunction of *the* with some recurrent symbol property B_i' that signifies for P a property Y_i (paradigmatically a recurrent one) that is had by o_i and o_i alone. (This may not be the only way in which recurrent symbol properties can refer to individual objects for P, but it is comfortably a way.) And in light of prototype (b), symbol thing s_i might designate object o_i for suitably tuned P when s_i has the feature *here* while o_i is a vaguely long column of spacetime locations surrounding s_i with roughly the same spatial coordinates as s_i, or when s_i has the feature *now* while o_i is a vaguely wide sheet of spacetime locations surrounding s_i with roughly the same temporal coordinate as s_i, or when s_i has the feature *this* conjoined with a symbol property B_i' signifying an object property Y_i for P while o_i is the most prominent thing in s_i's here-and-now that has Y_i.

Instead of saying that it is symbol thing s_i which refers, homologically, to o_i in prototype-(b) cases, we can alternatively view this as heterological reference to o_i by a compound property B_i^* of s_i whose constituents include being at a certain specific spatiotemporal location. But such a B_i^* is flagrantly non-recurrent; so to incorporate deixis in standard representations, we must ascribe the reference to s_i itself rather than to a property that includes being located at s_i's particular site.

Technical note. Modeling heterological reference to objects by recurrent symbol properties as, paradigmatically, cases wherein the property B_i that stands for o_i is a fusion of *the* with some recurrent property B_i' signifying an object property Y_i that individuates o_i requires that the manner in which

the conjoins B_i' to constitute B_i be stronger than bare conjunction, at least so long as we try to make Co-exemplification suffice for HETREP's syntax of predication. For were the complex property that heterologically represents the-Y_i's-having-X_j to be just a conjunction *the*$(x) \& B_i'(x) \& A_j(x)$ wherein B_i' and A_j respectively signify Y_i-ness and X_j-hood, the identity of this conjunction with *the*$(x) \& A_j(x) \& B_i'(x)$ implies that it should also represent the-X_j's-having-Y_i. Similarly, the simple model of deixis just sketched implies that if symbol s_i has all three properties *this*, B_i', and A_j, then s_i's-having-A_j represents (the-Y_i-thing-most prominently-here-and-now-for-s_i)'s-having-X_j even while s_i's-having-B_i' represents (the-X_i-thing-[etc.]-for-s_i)'s-having-Y_i. These implications are not plainly incoherent, but neither are they ones to accept gladly. So the syntax of representation needs be able to combine symbol properties using different degrees or styles of binding whereby, e.g., $(B_i' \& \text{*the*}) \& A_j$ is not the same as $B_i' \& (\text{*the*} \& A_j)$. In all likelihood, we shall find that the recurrent symbol properties jointly instantiated by symbol thing s_i (here *the*, B_i', and A_j) cannot generally be co-exemplified by s_i as a whole, as are shadings, shapes, and sizes in Fig. 1, but must be localized in disparate parts of s_i, akin to the separate locations of content terms and syntax markers within a spoken or written sentence. And if that is so, the additional structure beyond bare mereological summation (which is surely insufficient) required to unite these parts into a distinguished whole will surely include all the binding differentials we need. But virtually all details in this matter remain obscure, and their challenge is formidable.

It should now be evident why HOMREP communications are nearly impossible, contrasting with the comparative ease of HETREP ones. Consider the ideally simplest case: It is clearly feasible for each e_i in a process sequence seq $= \langle \ldots, e_i, e_{i+1}, \ldots \rangle$ of message-bearing events to have form $e_i = s_i$'s-having-B-and-A wherein A and B are recurrent symbol properties common to all. And if the message borne by each e_i in seq to its recipient P_i is just this recurrent property-complex $B \& A$, with B and A respectively designating some object o_i and property X_i for P_i, all that remains to make seq a communication wherein $B \& A$ heterologically represents the same objective fact o's-having-X for each P_i, i.e. to have $o_i = o$ and $X_i = X$ at every stage, is suitable semantic-state similarity among these P_i--as is especially likely when they are neighboring stages of the same continuant person. Alternatively, however, consider what should happen if the message borne by e_i $(= s_i$'s-having-$B \& A)$

is for each $\underline{P}_i$ the event $\underline{s}_i$'s-having-$\underline{A}$. That is, suppose that $\underline{s}_i$'s-having-$\underline{A}$ homologously represents for $\underline{P}_i$ some possible fact $\underline{o}_i$'s-having-$\underline{X}$ through $\underline{A}$'s signifying $\underline{X}$ while $\underline{s}_i$ designates $\underline{o}_i$ by virtue of, say, $\underline{s}_i$'s property $\underline{B}$ having composition $\underline{B}$ = *$\underline{\text{this}}$*&$\underline{B}'$ for some $\underline{B}'$ signifying an objective feature $\underline{Y}$ exemplified most prominently in $\underline{s}_i$'s here-and-now by $\underline{o}_i$. Then almost certainly each $\underline{s}_i$ will pick out a different $\underline{o}_i$, if any at all, for each different $\underline{P}_i$ no matter how similar are the latter's semantic states. (A special exception--probably of some importance in cognitive practice--is that if $\underline{s}_{i+1}$ is in the immediate vicinity of $\underline{s}_i$, the $\underline{Y}$-featured $\underline{o}_i$ that is most prominently here-and-now for $\underline{s}_i$ may also be so for $\underline{s}_{i+1}$.)

The essence of this point is perhaps most commonsensically apparent in examples wherein the message-bearers are everyday mental events: Suppose that as you reach for the money you have called from your bank's autoteller, an onlooker grabs it and flees. At the moment of this encounter you perceive '$\underline{\text{this guy is stealing my money}}$', with dots demarking your perceiving's propositional content in counterpart to the quotation marks we would use for describing your possible verbalization thereof at the time. Were this very same content to be re-activated when you report your loss to the police, you would again be thinking '$\underline{\text{this guy is stealing my money}}$', with resultant incitement of you to actions that would now be grossly counterproductive. Instead, what you need in the mnemonic stages of this intrapersonal communication are occurrences of a propositional content something like '$\underline{\text{the}}$ [such-and-so] $\underline{\text{stole my money}}$', wherein '$\underline{\text{the}}$ [such-and-so]' is a recurrent concept pattern that designates the original thief regardless of his displacement from any present site of this concept's arousal.

Of course, the sketch just given of HETREP messages that communicate vs. HOMREP ones that fail is $\underline{\text{extremely}}$ simplistic. For one, apart from the persistence of graphic records and auditory tapes, message transmissions in which the symbol pattern is literally constant throughout are probably relatively uncommon. (Even so, that does not degrade HETREP communication if, when the message $\underline{A}_i$ borne by

$\underline{e}_i$ for $\underline{P}_i$ is succeeded by message $\underline{A}_{i+1}$ borne for $\underline{P}_{i+1}$ by $\underline{e}_{i+1}$, the relevant components of $\underline{A}_{i+1}$ have the same referents for $\underline{P}_{i+1}$ as do the corresponding components of $\underline{A}_i$ for $\underline{P}_i$. Besides, cognitive information processing does not generally want its representations to have identical significations over all stages of the process, anymore than it has much use for inferences whose conclusions merely repeat their premises. It does, however, need nominal concepts that can retain fixed reference across multiple propositional embodiments of them no matter how varied the predications.) And on the other hand, standard homological representations of singular facts need not be quite so ephemeral as I have been proclaiming. This is because were sophisticated deixis able to target its reference with fine discrimination over a broad spatiotemporal range of locations relative to its here-and-now--a dubious premise to be sure--then deictic features of the symbol things $\{\underline{s}_i\}$ in a homologous-message sequence $\langle \ldots, \underline{s}_i$'s-having-$\underline{A}, \ldots \rangle$ might lawfully change just enough from one $\underline{s}_i$ to the next, compensating for the shift in location, to give each $\underline{s}_i$ the same referent.

However, a more central reason why my linguaform example of HOMREP communication failure should be received as heuristic provocation rather than deep illumination is that sentences using deictic nominals may well be misleading as a prototype of homological representation even though their communication problem seems typical enough. In a continuation of this essay which is impractical to include here, I argue that homological representations paradigmatically differ from heterological ones by a congeries of intertwined contrasts in which the distinction I have taken as definitive, namely, style of reference to particulars, is only one strand; and while it is useful to polarize these by the HOMREP/HETREP categories, the instances those subsume do not always foursquarely cleave to one and aschew the other. In particular, though linguistic indexicals valuably alert us to the existence of deixis as a cognitive phenomenon, they are but vestiges within verbal representation's otherwise resplendent heterology of the contrasting HOMREP mode whose

full glory shines forth in what commonsense intuitively classifies as "depiction." The structural divergence between these two modes of representation equips them to play strikingly different roles--complementary, not competitive--in the psychodynamics of cognition; and what is most salient in those differences is not so much the extent to which they provide for representation of singular facts by recurrent symbol patters as the manner in which that patterning is compounded from its representational constituents.

Yet I must now break off, despite our having scarcely begun to survey the larger wilderness of structural issues in representation. In particular, I must defer honoring my opening promise to clarify Palmer's intrinsic/extrinsic contrast by assimilating this to the HOMREP/HETREP distinction. (in this essay's continuation, I point out not only that the "inherent constraints" taken by Palmer to define intrinsicality are consequential only when embodied in representations that are homological in their reference to particulars, but also that the ontology of Palmerian intrinsic representation confronts us head-on with the enigmatic homology of supervenience that appears central to depiction.) But at least we can reprise Wittgenstein on factive representation.

According to Tractatus 3.142-3.1432, any "propositional sign" of a fact must itself be a fact. And there is indeed an important truth in this. For although ordinary language allows factive entities to be referenced by nominal phrases that reveal little if anything about their objects' constitutions (e.g., 'Custer's predicament at Little Big Horn', 'the Iranscam facts not yet disclosed', 'the events leading to the shuttle explosion', etc.), any representation of o's-having-X that is informative in the sense of presenting something that can be known, or believed, or at least conjectured must be a compound wherein representations both of o and of X are conjoined by some structure that represents the exemplifying which o putatively does to X. But Wittgenstein is wrong to suppose that the symbol structure which goes proxy for the structure of the fact represented must be identical with

its objective counterpart. As we have observed, factive representations can be homologous in this respect; but they need not be so except insofar as ones that are standardly heterological can generally be redescribed by formalistic tricks as contratypically homological. And as has also been pointed out, representation of localized facts not by other location-bound facts but by recurrent symbol patterns is essential to the practicalities of processing cognitive information through space and time.

So Wittgenstein's dictum on factive representation is one of his ladders that must be thrown away once climbed (cf. Tractatus 6.54). But the vista on representational structure to which this leads richly rewards the ascent.

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Editorial Note
In the second paragraph of p. 20 above WR refers to "a continuation of this essay which is impractical to include here."

The continuation in question is contained in the following pages 20-29, although it is not complete.

Page 20 of the continuation, which follows now, is the same as page 20 of the article above, except that after the phrase "In the remainder of this essay ..." (marked with an asterisk) it gives the continuation, or at any rate, most of it.

s_i for P_i is succeeded by message A_{i+1} borne for P_{i+1} by s_{i+1}, the relevant components of A_{i+1} have the same referents for P_{i+1} as do the corresponding components of A_i for P_i. Besides, cognitive information processing does not generally want its representations to have identical significations over all stages of the process, anymore than it has much use for inferences whose conclusions merely repeat their premises. It does, however, need nominal concepts that can retain fixed reference across multiple propositional embodiments of them no matter how varied the predications.) And on the other hand, standard homological representations of singular facts need not be quite so ephemeral as I have been proclaiming. This is because were sophisticated deixis able to target its reference with fine discrimination over a broad spatiotemporal range of locations relative to its here-and-now--a dubious premise to be sure--then deictic features of the symbol things $\{s_i\}$ in a homologous-message sequence $\langle \ldots, s_i$'s-having-$A, \ldots \rangle$ might lawfully change just enough from one s_i to the next, compensating for the shift in location, to give each s_i the same referent.

However, a more central reason why my linguaform example of HOMREP communication failure should be received as heuristic provocation rather than deep illumination is that sentences using deictic nominals may well be misleading as a prototype of homological representation even though their communication problem seems typical enough.* In the remainder of this essay, I shall argue that homological representations paradigmatically differ from heterological ones by a congeries of intertwined contrasts in which the distinction I have taken as definitive, namely, style of reference to particulars, is only one strand; and while it is useful to polarize these by the HOMREP/HETREP categories, the instances those subsume do not always foursquarely cleave to one and aschew the other. In particular, though linguistic indexicals valuably alert us to the existence of deixis as a cognitive phenomenon, they are but vestiges within verbal representation's otherwise resplendent heterology of the contrasting HOMREP mode whose full glory shines forth in what commonsense

intuitively classifies as "depiction." The structural divergence between these two modes of representation equips them to play strikingly different roles--complementary, not competitive--in the psychodynamics of cognition; and what is most salient in those differences is not so much the extent to which they provide for representation of singular facts by recurrent symbol patterns--as we shall see, pictures can do that too--as the manner in which that patterning is compounded from its representational constituents.

Fulsomely homological representations.

Homology of representation in both the limited sense introduced above and its elaboration now to be developed makes possible the repleteness of pictorial representations to which Goodman (1967) has alerted us. Briefly, Goodman's observation is that considerably more representing takes place at some symbol sites than at others--as commonsensically illustrated by the densely abundant information contained in a map or photo compared to the sparce propositional content in a comparable spread of language text. To fathom this situation, we need a locution for conjecturing what objective facts may be signified by varied unspecified messages at a given symbol site s, or which would be facts so signified were all messages borne by s veridical. So let us say

> Definition 1. Symbol thing s conveys o's-having-X (for P) iff, for some not-necessarily-proper part or tuple of parts s_* of s, and some recurrent property A of s_*, o's-(possibly)-having-X is represented (for P) either homologically by s_*'s-having-A or, heterologically, just by A. (Recall that symbol property A is in principle logically complex, so that in particular, when s_* is a tuple of s's parts, A may well be a recurrent pattern in which are compounded both relational and nonrelational features of s_*'s components.)

This definition envisions that the same symbol thing s can simultaneously convey a multiplicity of facts. But it also allows this to occur trivially in that for

any array $\underline{s}_1,\ldots,\underline{s}_n$ of scattered message sites each $\underline{s}_i$ of which conveys some $\underline{o}_i$'s-having-$\underline{X}_i$, the mereological sum $\underline{s} = \underline{s}_1 \oplus \ldots \oplus \underline{s}_n$ of these sites conveys all of $\underline{o}_1$'s-having-$\underline{X}_1$, ..., $\underline{o}_n$'s-having-$\underline{X}_n$ no matter how arbitrarily aggregated this $\underline{s}$ may be. When we wish to rule out multiple conveyences that are trivial in this sense, we can stipulate that the symbol site in question satisfies

Definition 2. Symbol thing $\underline{s}$ is representationally unitary (for $\underline{P}$) iff $\underline{s}$ has no non-null disjoint parts $\underline{s}_1$ and $\underline{s}_2$ such that for each factive possibility conveyed (for $\underline{P}$) by $\underline{s}$ is also conveyed (for $\underline{P}$) either just by $\underline{s}_1$ or just by $\underline{s}_2$.

However, we shall not become sufficiently technical in this matter to require careful enforcement of Def. 2.

We now examine the prospects for facts that are logically complex being conveyed co-incidently with the more elementary factive possibilities from which they derive. For openers, consider conveyence of conjunctive, disjunctive, and negative facts as schematized in Column α of the chart immediately below. (Here and henceforth, read 'conveys' simpliciter as elliptic for 'conveys for person-stage $\underline{P}$'.)

	α	β
Conjunction:	Symbol-thing $\underline{s}$ conveys $\underline{o}$'s-having-$\underline{X}$-and-$\underline{Y}$.	$\underline{s}$ conveys $\underline{o}$'s-having-$\underline{X}$ and also conveys $\underline{o}$'s-having-$\underline{Y}$.
Disjunction:	Symbol-thing $\underline{s}$ conveys $\underline{o}$'s-having-$\underline{X}$-or-$\underline{Y}$.	Either $\underline{s}$ conveys $\underline{o}$'s-having-$\underline{X}$ or $\underline{s}$ conveys $\underline{o}$'s-having-$\underline{Y}$.
Negation:	(Presumption: There is a symbol property $\underline{A}$ and a part $\underline{o}_*$ of $\underline{o}$ such that were $\underline{o}_*$ to have $\underline{A}$ then $\underline{s}$ would convey $\underline{o}$'s-having-$\underline{X}$.) Symbol-thing $\underline{s}$ conveys $\underline{o}$'s-lacking-$\underline{X}$.	$\underline{s}$ does not convey $\underline{o}$'s-having $\underline{X}$.

Each such α-representation is conjugate with the more primitive representational possibility shown beside it in Column β; and since neither precludes the other, a competent theory of factive representation should have something to say about the circumstances under which they co-occur.

For theory-of-representation elegance, it would be pleasant to find that each line of this chart is a biconditional, i.e., to have that whenever a representational event occurs in one of these forms its conjugate also obtains. But this is patently not so, at least if the testimony of language can be trusted. Explicit definition of simple terms to replace elaborate phrases is above all a technique that frees linguistic representations from mirroring their referents' compositional details. (Imagine how unworkable it would be for a jeweler to represent some gem as a diamond if this message had to articulate all the conjunctive/disjunctive minerological conditions that constitute Diamondhood.) And depictions, too, can convey conjunctive/disjunctive facts without co-incidently representing any of their conjuncts/disjuncts. (Thus while intuition can accept that an Alberta highway map which represents Ponoka as an encorporated municipality in population range 2,500-5,000 may also convey Ponoka's-being-encorporated and Ponoka's-having-population-between-2,500-and-5,000, it rejects that this map further includes representation of Ponoka as having any of the legal properties that constitute being encorporated, or that it conveys Ponoka's having any specific population in the range 2,500-5,000.) As for Negation, although clear violations of α/β equivalence are hard to find in depiction, inconsistant predications (i.e. α without β) are child's play for language.

Yet lack of equivalence need not be failure of one-way implication. The examples given show that a representational event having one of charted forms α can occur in the absence of its form-β conjugate, but they do not impugn the converse entailment. Might it be that whenever s conveys both o's-having-X and o's-having-Y then it also conveys o's-having-X-and-Y? Or that whenever s conveys

o's-having-X then it also conveys o's-having-X-or-Y? Or that when s does not convey o's-having-X (even though it would do so were it to contain a certain feature that it in fact lacks) then it conveys o's-not-having-X? In linguistic representation, it is evident that $\beta \Rightarrow \alpha$ too fails for Disjunction and Negation, and the same also holds for Conjunction even if less obviously so. (For were the site of, say, sentence 'John is tall and John is blonde' to convey John's-being-tall-and-blonde in addition to John's-being-tall and John's-being-blonde, it would prima facie need to contain a verbal pattern signifying Tall-and-blondeness predicatively attached to a single nominal designating John.) But $\beta \Rightarrow \alpha$ does seem true, or at least not plainly false, for all the charted conjugates when those representations are depictions. This intuitive contrast in $\alpha//\beta$-concomitance between words and pictures is what I now propose to explain through an expanded differentiation between homological and heterological representations.

Recall that even from the outset we have observed not one but two respects in which a factive representation's alignment with the state of affairs it signifies might be heterological rather than homological. The one heretofore emphasized is the match/mismatch in ontological kind between the relata of reference to particular objects. But that derives more fundamentally from a match/mismatch of logical structure, namely, whether the symbol syntax that represents an object's exemplification of its properties is itself Exemplification or something else such as Co-instantiation. And this is only the most prominent of logical connections whose integrations of complex objects may or may not have homological--"same logic"--counterparts in representations thereof. These lie at the outer edge of what we can speak of intelligibly, but are implicated in our propositional use of language by aspects thereof traditionally classified as "syntactic" and "logical".[7] In the

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[7] The extent to which elements of logical structure are genuine objective realities in a tough sense of existence, rather than Kantian impositions of mind on our conceptions of the world, is deeply problematic. For ontological chastity we should probably analyze the aboutness of structured representations in terms of their relations not to complex objects but to certain canonical representations in thought. But that is essentially what we do anyway when we use our ideation and its linguistic encoding to represent realities as represented by representations.

inventory of these that I now proffer, each is described for uniformity as a relation. But our main evidence for them comes through linguistic operators that convert their operands into phrases purporting to signify entities so related to the operands' referents.

VARIETIES OF LOGICAL CONNECTION

Containments.

A. An individual thing's possession of its properties. Corresponding linguistic operators: Copulative verbs ('is', 'has', and others) which combine nominal and predicative phrases into description of a putative fact wherein the nominal's referent possesses the property signified by the predicate.

B. An individual thing's mereological inclusion of its parts (similarly though not quite identically, a set's inclusions of members and subsets). Corresponding linguistic operators: Nominal conjunctions and collectives (as in 'John and Mary' and 'the totality of cetaceans') which carry references to a plurality of things into reference to the minimal thing of which the former are all parts.

C. A conjunctive attribute's inclusion of its conjuncts. (Similarly, the factive relation of o's-having-X-and-Y to o's-having-X.) Corresponding linguistic operators: Adjective conjunction (as in 'is tall-and-blonde') and predicate conjunction (as in 'is tall and is blonde') which carry descriptions of properties into description of the weakest property that contains each of the former as a conjunctive component.

Abstractions (superveniences).

D. A disjunctive property's extrusion from any one of its disjuncts. (Similarly, the factive relation of o's-having-X-or-Y to o's-having-X.) Corresponding linguistic operators: Adjective disjunction (as in 'is tall-or-blonde') and predicate disjunction (as in 'is tall or is blonde') which carry descriptions of properties into description of the weakest property that is necessarily possessed by any object that possesses one of the former.

E. A determinable property's distillation from any of its determinates, e.g., the relation of Red to Crimson, Square to Rectangular, and Running to Running-swiftly. [No recognized linguistic operator except fragmentarily in the grammar of predicate modifiers; but were one to exist, it would carry description of a property into description of a more determinable, or more determinate, version of the former.]

F. A pattern's emergence from the relational and nonrelational properties of the pattern-possessor's parts, e.g., the supervenience of a chess board's Checkeredness upon the local colorations and distance relations of the board's bits. [No recognized linguistic operator; but were one to exist it would carry predicates of a special complex sort into descriptions of a pattern property that supervenes upon the configuration of properties described by the former, or would carry descriptions of a pattern into description of a more molecular property configuration from which this pattern is a molar abstraction.]

Exclusions.

G. The co-occurrence incompatability of a property with its negation. Corresponding linguistic operators: Attribute negation (as in 'is non-blonde') and predicate negation (as in 'is not blonde'), which carry description of a property into description of the weakest property that cannot co-occur with the former.

H. An attribute's preclusion of co-occurrence with any of its parallel contrastive alternatives, e.g., a height's prevention of anything that has it from also having any other height. [No linguistic operator; but were one to exist it would carry description of a property into description of a distinguished contrast ontically parallel to the former, such as 'being of height one cm. greater than h inches tall' rather than merely 'not being h inches tall'.]

This listing makes no claim to exhaustiveness, and is simplistic enough to goad any conscientous philosopher of language/logic/ontology to disputatious wrath. But looking beyond problematic details, its larger point is simply that when a symbol site s conveys facts involving one or more of these logical linkages, it is possible but far from necessary that this object structure will be represented in s by the very same structure of symbol ingredients. Somewhat more specifically, each of the couplings just listed creates a corresponding prospect for homologous representation as follows:

VARIETIES OF REPRESENTATIONAL HOMOLOGY

A. Instantiation Homology. Representation of o's-having-X by s's-having A, where s designates o and A signifies X.

B. Part/Whole Homology. Representation of o_1's-being-part-of-o_2 by s_1's-being-part of s_2, where s_i (i = 1,2) designates o_i.

C1. Co-instantiation Homology (factive). Representation of o's-having-X_1-and-X_2 by s's-having-A_1-and-A_2, where s designates o and A_i (i = 1,2) signifies X_i.

C2. Co-instantiation Homology (attributive). Representation at symbol site s of a conjunctive property Having-X_1-and-X_2 by a conjunctive feature A_1-and-A_2 of s such that A_i (i = 1,2) signifies X_i.

D1. Disjunction Homology (factive).
D2. Disjunction Homology (attributive).
} Same as C1/C2 with conjunction replaced by disjunction. Arguably, D2 is a special case of E immediately below.

Note. Factive homologies C1 and D1 are the corresponding attributive homologies C2/D2 conjoined with instantiation homology A. The remaining homologies described here are attributive homologies which similarly have factive extensions.

E. Homology of Determinate/Determinable Abstraction. Representing at symbol site s a determinable object-property X by a determinable feature A of s which abstracts from a more determinate property A* of s that signifies a correspondingly determinate object property X* from which X abstracts in the same manner of supervenience that A abstracts from A*. (Yes, I am well aware that "same manner" here is flagrantly obscure. More on it below.)

F. Homology of Pattern Abstraction. Representing at symbol site s an objective pattern property X by a patterning A of s that supervenes on a configuration A* of s's parts' properties which collectively signify a configuration X* of object properties upon which X supervenes in the same manner that A supervenes upon A*. (This is really just a species of genus E, but one well meriting explicit recognition in its own terms.)

G. Negation Homology. Representing at symbol site s a lack-of-X property by the absence from s of a feature A that would signify X were A present at s.

H. Contrastive-alternatives Homology. Representing at symbol site s an objective property X by a feature A of s that is one in a set $A = \{A_i\}$ of parallel contrastive alternatives such that for some set $X = \{X_i\}$ of objective parallel contrastive alternatives, each A_i would signify some property in set X were A_i present at s. (This is the essence of what Goodman, 1967, has described as symbolic "density," albeit symbol-features $\{A_i\}$ here need not be strictly dense in Goodman's sense if the object-properties they respectively represent differ discretely.)

From the evidence of language, factive representations using none of these homologies not merely exist but flourish. Indeed, except for A and perhaps B where indexicals are involved, all verbal representations appear non-homological in every one of these respects. And that includes attributive co-exemplification even though conjunctive predications seem at first impression to satisfy C2. For example, 'John is short and fat' evidently signifies Short-and-fatness by bringing together a word designating Short with one designating Fat. However, the juxtaposition of these predicate components is only an adjacency of patterns in disjoint parts of the sentence site, not a literal co-exemplification of attribute representations as would be exhibited, say, by region No. 12 in Fig. 1 were Short and Fat respectively signified there by Spotted and Square. This subtle heterology is profoundly

nontrivial; for it confers upon language a capacity for conjunctive predications incomparably broader than the range of attribute conjunctions that can be homologically represented by symbol features that are literally co-incident. (Exercise: Try to think of, say, 10 symbol properties in Fig. 1 or some extension thereof such that even every pair of these, let alone any larger selection, can be jointly exemplified at the very same symbol site rather than just neighboring ones.)

Representational homology's conspicuous absence from language (which may not be quite so absolute as I have intimated, and about which we have a little yet to say), contrasts massively with its pervasiveness in depiction--at least according to liberal intuitions about what pictures are able to show us. Indeed, although it is exceedingly difficult to diagnose with much assurance what any given picture-like display communicates even to onesself much less consensually to others (which is one reason why I shall avoid illustrating my abstract suggestions about depictive representation with specific examples), I propose as a heuristic first-approximation that the set of messages conveyed for P by a representationally unified symbol s be considered "ideally depictive" (with s itself the picture) just in case every one of homologies A-H is utilized somewhere within the representations for P sited at s. Unhappily, precisely what it means to affirm or deny that a given representation is homological in some of these respects, especially E and F, is far from clear. Yet E and F, with grounding in B, are above all the essence of what intuitively counts as picturing. So we need to look more closely at how supervenient properties can be superveniently represented.

To catch hold of this issue, consider again the prospects for verbal representation of some disjunctive attribute, say Being-either-all-red-or-all-green, which I shall call 'Rorg' both to make clear that we are treating this as literally a single determinable color (suppressing the "This-is-red-or-this-is-green" construal of 'This is red or green') and as reminder that verbal representation of a disjunctive property needs not include representations of the latter's disjuncts. Now: Why does

it seem absurd to suggest that Rorg might be signified by a verbal pattern that is a disjunction of two others, one signifying Red and the other Green? The obvious answer, that no words are disjunctions of other words, will not do at all. For arguably, just the opposite is true insomuch as any verbal pattern an authoritative English lexicon would treat as a word is a determinable with many determinate variants just as wordish as the former. Thus, the lexical English trigram 'red' is abstractable from, inter alia,

RED red red *red*

and can be viewed as a disjunction of its more determinate orthographic alternatives. There is no evident reason why the latter should not also count as words in their own right even if they are all synomymous with their common determinable. But if so, then surely it should be possible in principle for one of these more determinate words, say 'red', to signify (for some P with unusual language training) a property other than Red, say Lumpy, even while lexical 'red' and its other determinate variants retain standard English significance. And in that case, if symbol site s contains the sentence 'Bub's nose is red', s conveys (for P) by this determinate pattern the factive possibility that-Bub's-nose-is-lumpy even as s also conveys Bub's-nose-being-red by exemplifying the more determinable word pattern 'Bub's nose is red' supervenient upon the former.

If we accept that a symbol site can contain different verbal messages at different levels of pattern abstraction, however, we must also be receptive to the prospect that disjunctive object-properties are homologically signifiable by disjunctive word patterns. For if a word site has the property, say, of Being-'red'-patterned, then it also has (among infinitely many other disjunctive superveniences) the property of Being-either-'red'-patterned-or-'green'-patterned. And if the latter can be made to signify anything at all for a P to whom these two lexical words respectively designate Red and Green, its referent would most naturally be Rorg. For someone to whom English has such multi-leveled significations, a symbol site s containing

Two structurally diverse schemes of representation using the Fig. 1 symbol ingredients

HOMOLOGICAL REPRESENTATION		HETEROLOGICAL REPRESENTATION
SYMBOL SYSTEM	OBJECT SYSTEM	SYMBOL SYSTEM
	Objective things	
Region #8	→ Reagan ←	being square
Region #4	→ Thatcher ←	being triangular
Region #11	→ John Paul ←	being hexagonal
Region #9	→ Quine ←	being circular
Region #?	→ ? ←	being ?-ish
	Objective properties	
being striped	→ being a politician ←	being striped
being spotted	→ being an actor ←	being spotted
being solid	→ being a philosopher ←	being solid
being checked	→ being a cleric ←	being checked
being lower than	→ being older than ←	being lower than
being right of	→ weighing more than ←	being right of
being hexagonal	→ being catholic ←	having area from 5.0 to 10.0 cm^2
being triangular	→ being protestant ←	having area under 5.0 cm^2
being square	→ being fond of horses ←	having area over 8.0 cm^2
	Objective structure	
Exemplification	→ Exemplification (property-having) ←	Co-instantiation