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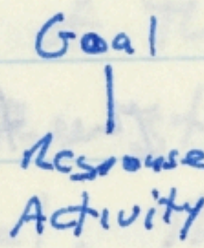
Connections in the MC basically follow the same "H" structure. The topological connections (Quantity & Relation) should be unchanged from the definitions for the M.C. However, the content functions (Quality and Modality) will have different categories, what would these be?

Quality judgments refer to the "matter" of a connection of homogeneous parts. For the M.C., what are these parts?

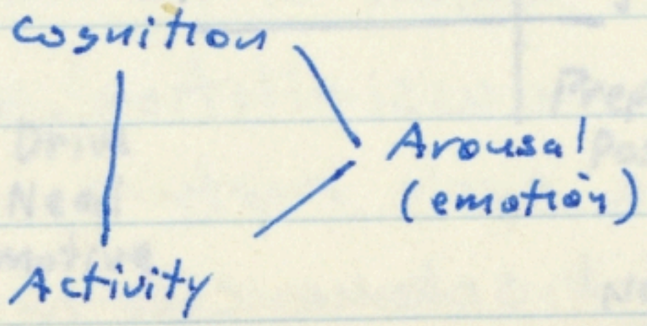
Modality connections are necessary connections involving the manifold of motivation. This manifold is empirical; it seems to me its elements are Attention, Goal, and Response. That would seem to leave for Quality the constituents of Perception, Motor Activity, and Emotion. However, if I'm on the right track, these triplets would need to exhibit the same sort of synthetical relations as exhibited by the Categories of the Understanding. Do they?

Attention can be likened to the incentive object while Response is an organized activity. It seems likely that organized activity viewed as a Goal is Attention (or vice versa)

Response activity $\stackrel{?}{=}$ schemata



Now, what about Quality? Attention is initiated by perception while emotion is initiated by cognition. Emotion establishes a central motive state (goal) which, in turn, leads to arousal and action. We have an input (cognition), an output ~~(motor activity), and~~ (motor activity or reasoning activity). Can we say that a cognition viewed as an activity is an arousal (emotion)?



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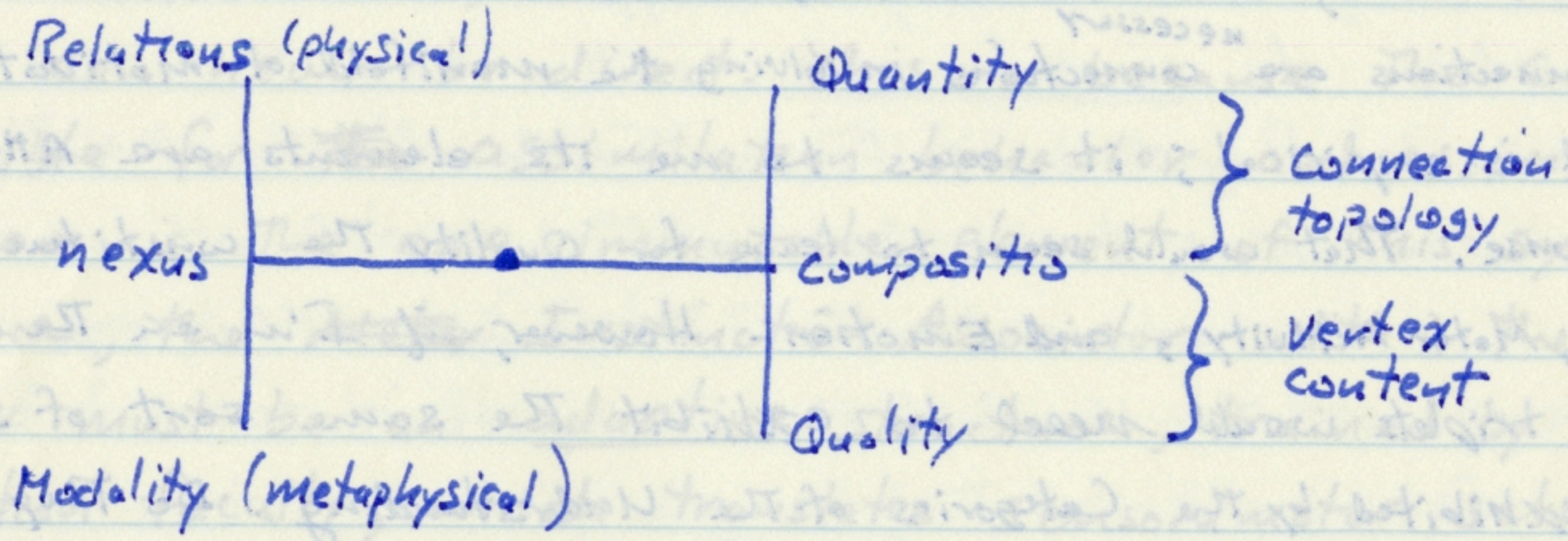
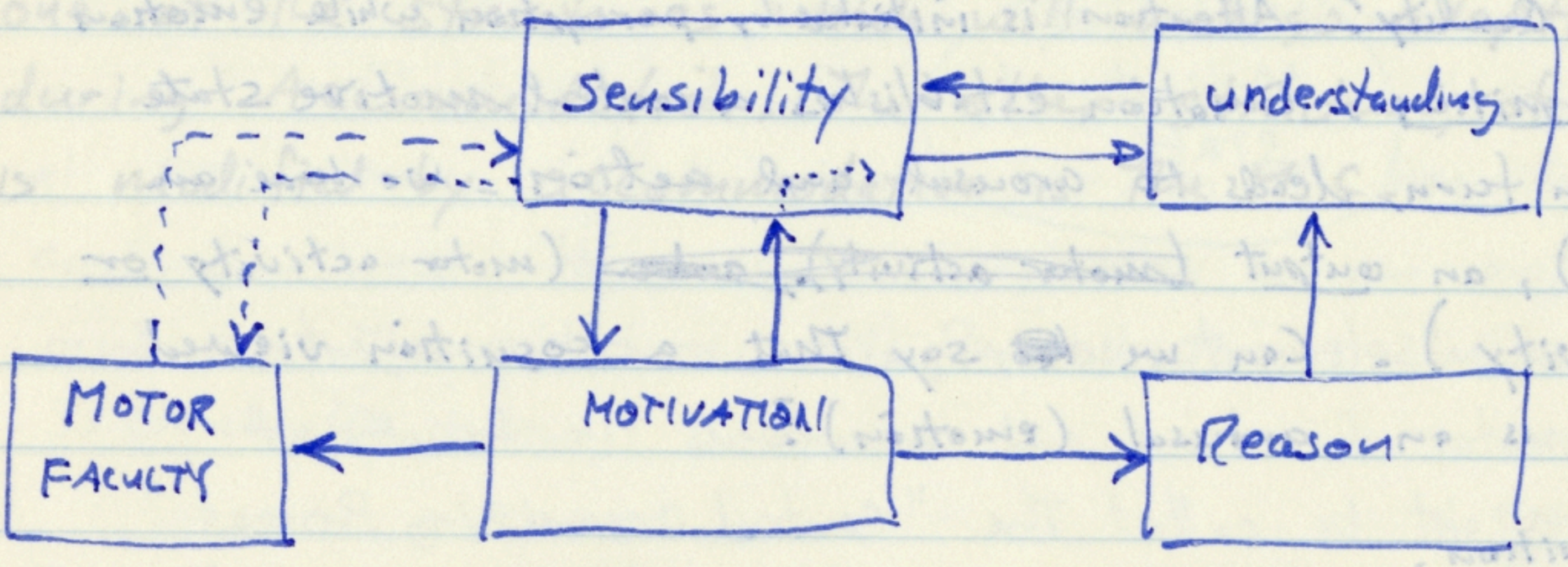
Aaron Brennan and I spent some time today discussing the Motivation system from the standpoint of Kant's connection principle. By way of review, the connection principle describes the possible ways in which a conjunctio unionis of a manifold may be formed. This can be precisely described using an H-figure:



In the M.U., the modalities are "judgments on judgments" while the other three corners are functions or categories of concepts of the understanding.

In considering the Motivation faculty, recall the following simplified architectural block diagram



The motivation faculty is the "control" faculty of the system. It determines, through the Control Motive State, what actions the system will perform and it is responsible for instigating assimilation activities. In simplified form, it is responsible for the stimulated response process

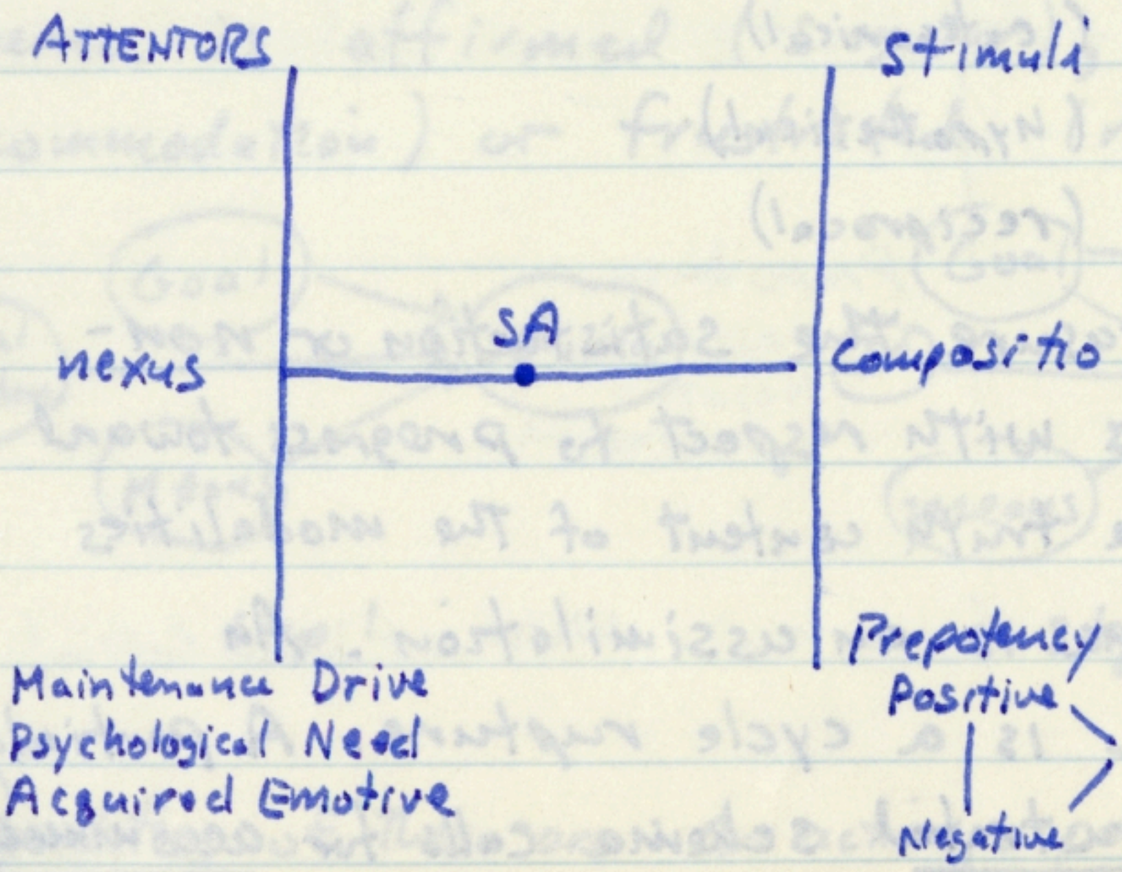
Initiating event (IE) → Situation analysis (SA) → Assimilatory/Accomodating Response Activity (ARA)

In somewhat more detail, this can be represented as

Stimuli → Perceptions → Attention → Appraisal → Emotion → Central Motive STATE → Arousal & Action

SA — ARA

In SA, the compositio elements are stimuli (quantities) and prepotencies (degree of stimulation). The nexus connections are necessary connections to the state of the self in consciousness. These divide into the connection of the stimuli to attention and the corresponding drive or need appraisal. This diagrams out as



ATTENTORS:

(Permanent in time):
Familiar stimulus

(cause and effect):
Change or contrast
- Perceptual
- Previsual

(coexistent in time):
Physical contact or organic need

The primary psychological need is the need for a unity in the manifold of all representations. This will most often take the form of curiosity. Maintenance drives are ~~unique~~ innate needs of the system analogous to hunger, thirst, pain, etc. The acquired emotive drives relate to learned wants, desires, motives, fears, anticipations, etc. which produce ~~assimila~~ accommodation responses (whereas the psychological need produces assimilatory responses).

The ARA is the active response or goal-directed dynamical response mechanism. Its compositio elements are actions. These actions may be motor responses or they may be mental activities. In the case of mental activities (pathway to the faculty of Reason), they may take two forms: Generalizing synthesis or Differentiating Synthesis (corresponding to the principles of homogeneity and variety) In all cases, the quantity connections form schemata of the ~~Motivat~~ organization as a whole thru connection to existing structures

The nexus topological relations are necessary connections among the action elements insofar as these action elements do or do not produce progress towards a goal. Since all actions are future-directed towards the attainment of a goal, the necessary relations are

desired goal	(categorical)
possible means	(hypothetical)
actualized result	(reciprocal)

The nexus content elements measure the satisfaction or non-satisfaction of the achieved results with respect to progress toward the goal. This is analogous to the truth content of the modalities of judgment. A successful schema is an assimilation. An unsuccessful or frustrated schema is a cycle rupture. A partially successful, i.e., a progressive-frustrated schema calls for accommodation.

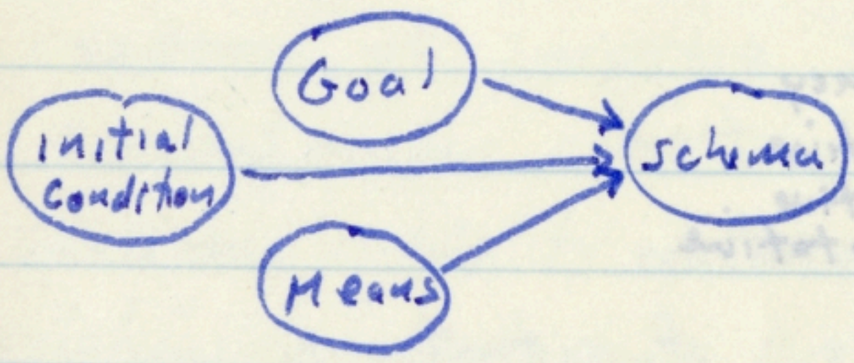
Now, I'm reasonably happy with the nexus ARA categories but I'm less happy with this picture of the compositio. Let's take a look at our "raw materials." Those fall into two classes

1) reflex motor responses
2) concepts of the understanding (including perceptions)
3) Stimuli of the SA

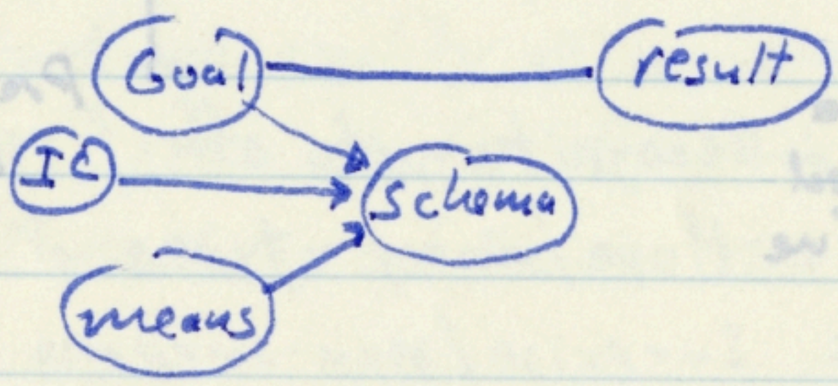
These seem to line up ~~rather one-for-one~~ somewhat with possible means, desired goal, and actualized result, don't they? This seems to indicate the nexus topological relations on the previous page are wrong. Is that the case or not?

I tend to trust the previous topological nexi a bit more than the catalog of compositio elements above since a goal may not require any motor activity to achieve it. The list above is nothing more than the "raw resources" available for composition into a planned schema; they play a role like those of appearances and concepts in the M.U.

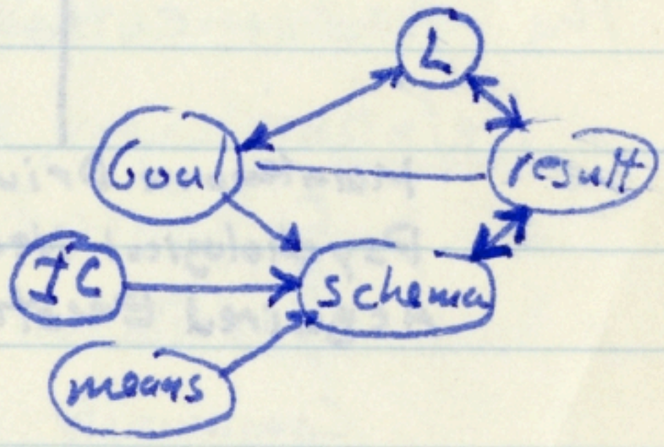
Let's look at the three-step process. Step 1 is analysis wherein the schema is to be regarded as a universal. What is available is some action step, and some desired goal. Step 2 is reflection on the results. Step 3 is synthesis in which the schema is affirmed (singular), adapted (differentiation & accommodation) or frustrated (ruptured).



Step 1



Step 2

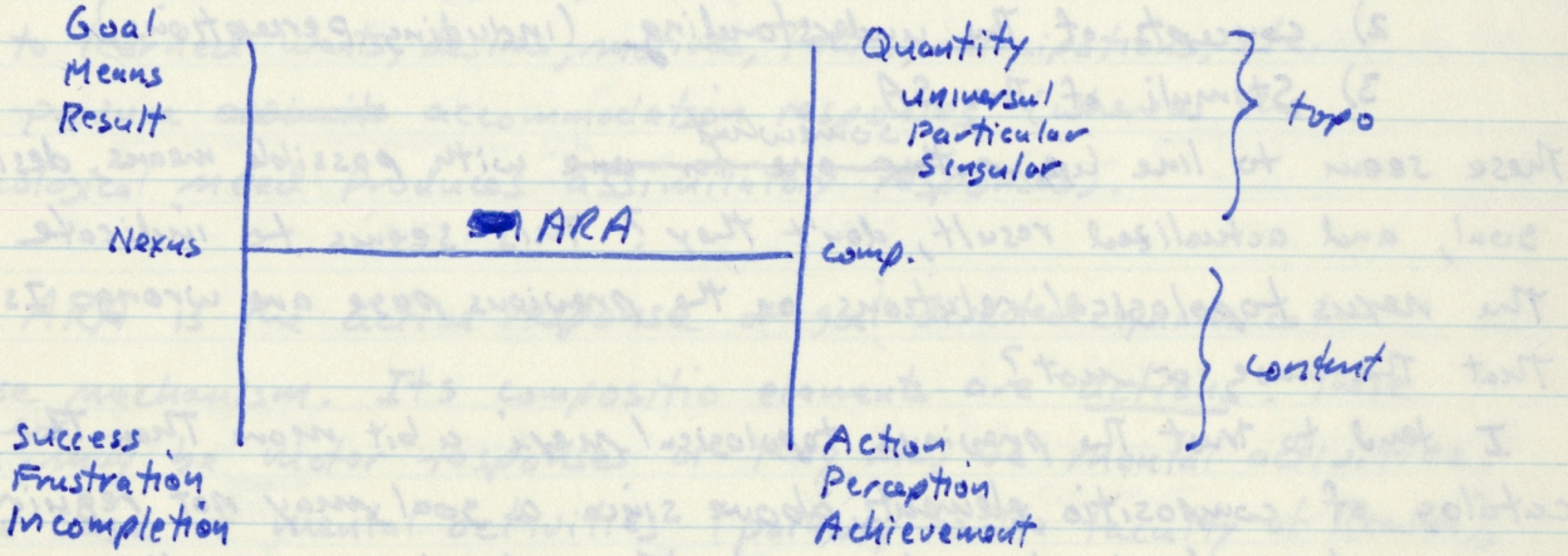


Step 3
(when successful)

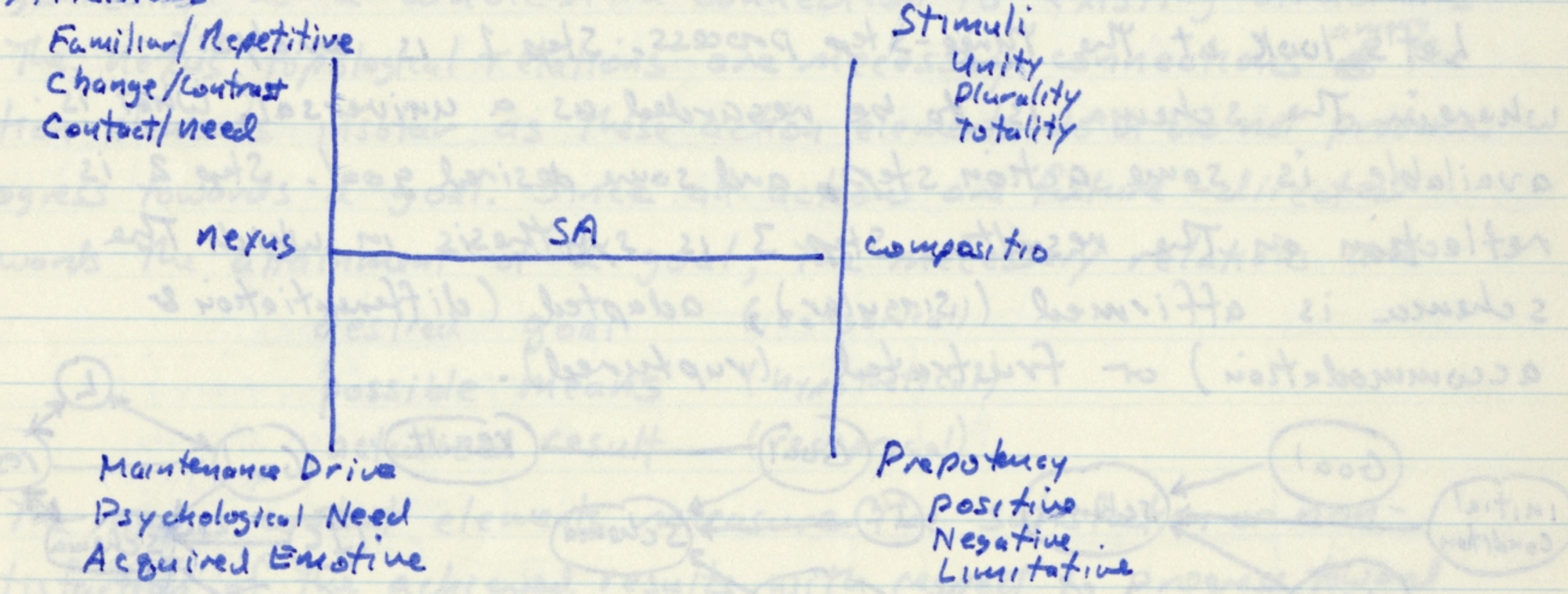
The qualities of these are: An action, a perception, or an achievement

My Thinking here is that actions (outputs) and perceptions (inputs) are opposites. An action viewed as a perception is an achievement

This gives us the following H structure



Repeating the SA structure,



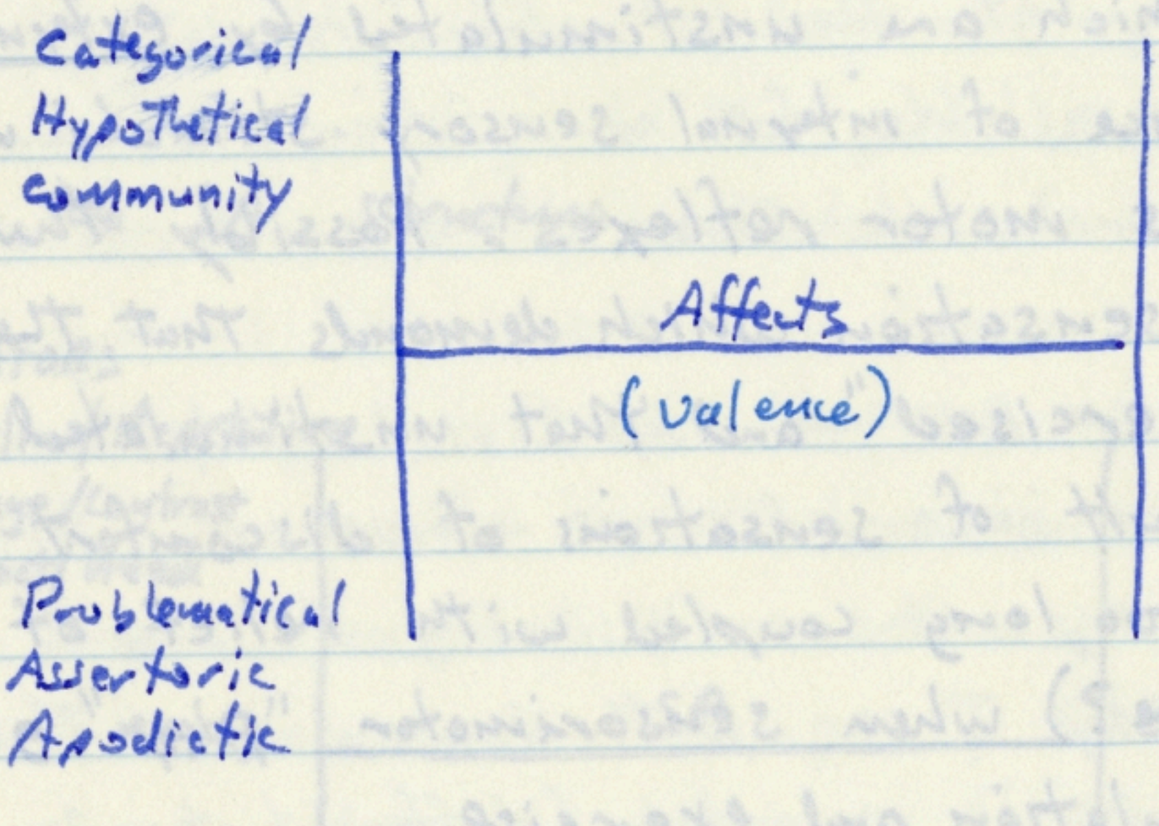
We'll see what Aaron thinks of this tomorrow. Watch out Susan Calvin!

If the foregoing manifolds, along w the M.U., are sufficient, we should be able to produce Piaget's behavioral observations. In particular, early behavior exhibiting <u>expectation</u> and <u>anticipation</u> should be possible (See obs. 1 thru 5 in PIAG2 : pp 8-10).

Another important puzzle involves what appears to be the importance of apparently unstimulated fixed action patterns (FAPs) [KUP9] in the early formation of associations among sensorimotor schemata. Many of an infant's early experiences occur by accidental (c.f., accidentally waving the hands in front of the eyes; this leads to the "discovery" of the hands in the form of associational links between visual and tactile experiences). The existence of FAPs which are unstimulated by <u>external</u> sources implies the existence of internal sensory stimuli which trigger apparently aimless motor reflexes. Possibly there is a sort of "discomfort" sensation which demands that the voluntary muscles be "exercised" and that unstimulated FAPs are merely the result of sensations of discomfort when muscles are inactive for too long coupled with relief of discomfort (and even pleasure?) when sensorimotor "play" gives the muscles some stimulation and exercise.

In her new book, Affective Computing by Rosalind Picard (Cambridge, MA: MIT Press, 1997), Picard discusses various aspects of the role played by emotion in reason. She points out that too little emotion hampers both the reasoning process as well as learning ability. She points out that there is a role for "emotional intellisence" which is complementary to "rational intellisence."

In our model thus far, we have not explicitly incorporate emotion (affectations). However, if we view the affective system as complementary to understanding, we can easily build an "affective manifold" based on the same theory as used in the M.U. It's structure would look like so:



The nexus categories have the following interpretations

Relation

Categorical: Recognition of affective situation

Hypothetical: Hope/Worry - types of affectation

Community: Surprise/non-surprise aspects of situations

Modality

Problematical: Secondary emotional response arising from cognition

Assertoric: Primary (innate) emotional response arising from sensation

Apodictic: Affective state arising from understanding and comprehension of situations.

We can (must) link affectations of the motivational manifold with conceptions and appearances of the understanding in order to get a full (rational + affective) mental comprehension of the world.

Reality check: According to Piaget, during Stage II development a child develops a conception of an affective or subjective permanence of an interesting image (w/o localization or substantiation). When the object "vanishes," the child *hopes* for the return of the interesting image. Can this system of ours do this?

Let's assume the child glances in a particular direction, where the image was last; seen *expecting* it (thru the hypothetical anticipatory concept ~~chair~~ chair) to be there. Further suppose that the image is *not there*. Under valence, we get the community response of *surprise*, the sentience quality of negative prepotency (expected minus actual = negative), the attentor of change/contrast, and the sentience modality of acquired psychological desire. This leads to the *goal* relationship under action.

This is followed by a mental search for a schema which, in the past, has "produced" the desired object (hypothetical in the MU) and the valence of "hope" (hypothetical) that this schema will produce the desired

image. From this hope, the schema becomes an action response under the relation of "means," (quality of "action") (quantity = schema)

This isn't a complete description since some time interval (determined probably by past experience) will pass before the action cycle is declared "frustrated." (modality of ARA).

This description is a bit lumpy, but, depending on the details of the assimilation/accommodation process, it seems that most of the machinery is here. One of the psychological modalities of sentience could easily be "reinforcement," i.e., if the child "sees an image," looks away, looks back and "sees" it again, etc and Then this circular reaction schema is thwarted briefly, the initial circular reaction would take place under the psychological drive to repeat a successful schema? After this cycle is ruptured by the vanishing of the object, an accommodation (three known previous schemata) is attempted. If successful, the schemata becomes "reinforced" wrt the association of schema and result. If frustrated, other schemata are tried until the motivational prepotency achieves a global threshold which ruptures the accommodation cycle.

So, we have to go thru the manifolds twice: one time to attempt assimilation, the next time to attempt accommodation.