

Cognitive Physics: the processing steps of thought

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Cognitive Physics: the processing steps of thought, computer hosted intelligence, and problem/opportunity solutions within a task environment
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I. The Central Question of Cognitive Science is Artificial Intelligence

How does one program a computer hosted entity to behave intelligently within a complex task environment?

What is intelligent behavior?

Intelligent behavior is entity action toward objective(s), taking into account that such action may vary in effectiveness and efficiency. Therefore a 100% intelligent entity will always initiate the most effective and efficient action possible from any given state of the environment.

The default machine level goal is to achieve maximum potential value from each perceived time-frame of the environment, ie to create the most beneficial (adhering to creator given objectives) environment possible in the next, or some future, time frame.

II. Creating an Entity

Place an Entity within a Task Environment

Notice that any exercise of intelligence requires both an entity and a task environment.

An entity requires five elements to behave intelligently within a task environment using the processing steps of cognitive physics:

1. Processor

The ability to do arithmetic operations and subsequently make comparisons determining greater, less, or equal

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(standard computer hardware)

2. Memory

The ability to record and recall data

(standard computer hardware)

3. Environmental input (sensory)

The ability to sense or perceive the task environment

Input from any of the numerous available text, visual, audio, data storage, communication, and navigation devices

(This may be thought of as the 'eyes and ears' of the computer hosted entity.)

4. Environmental output (influence)

The ability to affect, shape, or communicate (shape cognitive matter) with the task environment

Control over any of the numerous existing environment–shaping tools and artifacts, including text, visual, audio, data storage, and communications mediums

(This may be thought of as the 'hands and voice' of the computer hosted entity.)

5. Objective

Value associated with one or more objects and/or relativities within the environment

Objective is usually assigned by the creator of the entity, and/or such value will inherently exist within the relationship of the entity to the environment.

III. Environment and Environmental Order

The environment the entity will be exercising intelligence within must contain some degree of order (similarity and/or influence between objects) for the entity to discover and intelligently apply. Any influence or similarity between objects constitutes order in the form of a relativity or bond between these objects. The definition of such a relativity or bond is a 'tangible artifact' existing within the memory space of the entity, depicting a connection between two cognitive particles or 'particle clusters'.

These clusters of defining particles that represent such connections are cognitive matter depicting the inherent order (influence or similarities between objects) within the task environment. It is helpful to think of these connections between objects as lines, and the objects themselves as points. These points and lines are definitional artifacts comprised of cognitive particles existing in computer space (memory).

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In cognitive physics, environmental order is any influence or similarity between particles and particle clusters (cognitive matter) defining the entity's environment. Therefore there are two types of relativity to be discovered between definition particles of the environment, influence and similarity.

1. Influential–order is the 'follow–through' of patterns, some degree of probability that a pattern of motion, mutation, or function will repeat (occur).
2. Similarity–order is any equality in the cognitive matter depicting motion, mutation, function, or physical properties of environmental objects, objectives, or influential–order.

These similarity–connections establish an intelligent entity's 'highways of access' to the relevant and useful 'follow–through action' of influential–order (objects affecting one another).

All objects, influence, and similarities of the environment are defined with at least one cognitive particle. Most definitions of an object, influence, or similarity, require a cluster of particles. A 'particle cluster' is a multiple of definition particles depicting an isolable object or relativity.

Atomic formatting [the default cognitive physics definition system not defined in this overview] is an effective definition system, but any definition system will work to some degree. If the definition system is flawed, the intelligence will be imperfect. But notice that a flawed definition system may still produce more intelligent behavior (or greater and/or more effective and efficient value yield) than randomly selected solutions, and may be directly improved by using feedback navigation, ie mutating a single element (of a given event) at a time. [see below VIII. Minimal Notch Mutation].

So in cognitive physics: 'points' are objects, and 'lines' define the relativity [influence or similarity] between these points (or definition clusters representing objects). Both points and lines are comprised of cognitive matter, clusters of particles existing in computer memory.

All definitions are based on entity sensory information and the known (or creator given) properties of the object or relativity. Relativity is possible between any two or more cognitive particles.

Understanding the inherent order within a given environment is equal to understanding the objects, and the relativity between the objects, of the environment. When all the objects and the relativity between the definitional particle clusters has been discovered and correctly defined, including the entity itself, intelligence is complete for this entity within this environment.

To rephrase, when all the correctly defined 'dots' have been connected by all of the correctly defined 'lines', the entity is prepared to most effectively and efficiently shape his environment, from any given state, to the most valuable obtainable state.

So an entity's ultimate underlying objective, when challenged by an unfamiliar environment, is to discover and define the objects, and the relativity between the objects, within his environment.

The more objects and relativity are known about a task environment, the more directly and efficiently the entity may be able to shape the environment toward task objectives. When the entity has correctly recorded all task environment objects and relativities, he is prepared to exercise complete or maximum intelligence.

IV. Entity Event Records (EER)

Objects and the relativity between objects are recorded as a portion of an Entity Event Record. An entity records all of its history using 'action' (his own 'motion or mutation' or that of another entity or object) as the nucleus for the creation of these EERs. Any perceivable 'action' may trigger an entity event record.

In cognitive physics 'action' is defined as any motion or mutation of matter or mind (cognitive particles).

If you hit a ball with a bat, the bat and the ball will both move. This event demonstrates different types of action and influence—relativity between you and the bat, the bat and the ball, and you and the ball.

You are influencing the bat to move.
The bat is influencing the ball to move.
You are influencing the ball to move through the bat.

All such action and influence is defined in maximum detail (redundantly using any number of definition systems and perspectives) and recorded as relativity between objects.

Notice now that if the ball breaks a window, hits someone on the head, or even lands in a bowl of potato salad, the event record may be longer. Also notice that not all action produces immediate changes in the environment. In default, all event records will follow action to an 'objective oriented conclusion' using a multiple of definition systems from every related—object perspective, and every conceivable revealing perspective.

Some events go on for millennia unresolved, however they are all recorded insofar as they are known/perceived. An entity defines and

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records events, using all sensory perceptions to their limits. 'Event records' contain detailed and specific definitions of:

1. Opening–status

The state of the environment before the action, which includes the current value of the environment based on current objective(s)

2. Event–action.

Object to object influence, or any motion or mutation of matter or mind (cognitive matter).

3. After–action status

The state of the environment after the action (This includes the new value of the environment based on objectives.)

(No. 4 below is also part of the record as it can be computed from comparing 1 to 3.)

4. Event–change

The difference between the 'beginning status' of the environment, and the 'after–action status' of the environment, is considered to be the event–change.

5. Current–objective

A particle cluster definition of the 'current objective' is also a special portion of the EER. Notice that in the case of an entity recording action initiated by another entity, the recording entity will not necessarily have any direct information defining the objective of the acting entity.

V. Shaping the Environment

Some events are comprised of more than one action, ie strings (or trees) of action frequently including decision (branches) and contingency options. Any action (or action string) may render changes in the value of the environment.

Step 1. Define the current (or focus) environment and objective.

Step 2. Compare the current environment and objective to the opening–status and objective definitions of all event records (EERs).

Option a. If the current environment status matches an historical opening–status in an event record where the value yield (ie the after status of the environment) was considered to be of maximum value, then repeat the event–action of the matching record.

Option b. If the current environment status matches an historical opening–status in an event record where the value yield was considered unsatisfactory:

b1. search event records for a similar opening–status with a satisfactory after–status, and adopt the action of this similar event record, mutating the action based on the difference between the opening status and the current state of the environment.

b2. if a similar opening–status with a satisfactory after–status cannot be found, then repeat the event–action of the matching record, but mutate the event–action with an untried single particle change (either randomly or based on any historically similar untried single particle changes).

Option c. If the current environment status does not match any historical opening–status in an event record, search for the most similar opening–action with a satisfactory after–status and mutate its event–action based of the difference between the opening status of this most similar event–record and the current state of the environment.

Step 3. Redefine the environmental status and create a record of the event.

VI. Discovering and Recording Relativity in the Task Environment

There are Two Types of Relativity between particles and particle clusters to be discovered and recorded:

1. Similarity <--->

2. Influence ---->

Such relativity may be perceived by the entity as a portion of the sensory observation of an event, and then defined redundantly using any number of definition systems and perspectives.

The relativity between two particles (or particle clusters) is the definition of their similarity or influence, ie the entity's best description of the relationship between two particles (or particle clusters) is his working definition of their relativity. This definition, and the connecting line itself, are the same cognitive artifact.

Equal or similar definition aspects between objects may be discovered and recorded as equal or similar particles (or particle patterns) between definition clusters depicting an object's physical state (mass, materials, appearance, etc) or function. 'Functional similarity' is however a special type of relativity referring to common particles found in the comparison of definition clusters depicting 'influence–relativity' (or object influence over object).

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Defining the physical properties or function of an object will usually require a multiple of particles combining to create the definition cluster. Any two definition clusters containing equal particles, particle patterns, or particles belonging to the same group, are connected by a line <---> establishing a single similarity-connection between the two clusters.

In default, the more of these 'double-arrowed line <---> similarities' there are between two event definition clusters, the more likely the two cluster share further order continuity, such as common relevant 'directional arrow lines ----> or action-similarities'. In practice however we find that some types of similarities are more important than others.

The law is: Two particle clusters know to share an 'equal or similar' particle have a greater probability of sharing additional 'equal or similar' particles than randomly selected clusters.

Notice that this equality (or similarity) may be discovered making comparisons based on any perspective of definition. Such definition perspectives may be more or less inclusive and accurate. The more specific, accurate and complete the definition is, the more likely the similarity-relativity will yield action/influence-relativity in the form of useful action order continuity.

The more common particles exist between two clusters, and the more relevant the connection between these common particles is, the more likely the clusters will share useful action order continuity.

So the default intelligent behavior, when faced with an unfamiliar environmental state, is to access the EER with an equal or 'most similar' opening-status, which also contains an after-action status which is most valuable based on the current objective. The optionally revised event-action of the selected EER is then applied to the current state of the environment, or tested in virtual models.

Any revision of the applied event-action is in default based on the dissimilarities of said comparisons of the opening-states and the after-action states, and historically successful revisions of other EERs with similar opening-states and the after-action states (environments and objectives).

The question of which cluster connection is 'most similar' is decided by the number, nature, and relevance of the lines connecting the two clusters.

The relevance level of a given similarity line is discovered by analyzing and comparing all known event histories, focusing on value productive types of opening 'event and objective' similarities. Stronger types of similarity-relativity <---> will yield more useful action order continuity or influence-relativity ---->.

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This question of 'line-weight' is another entire universe of interest requiring the creation of one or more sub-entities to process the problem from this isolated and limited perspective and objective.

Cognitive physics entities employ many sub-entities evaluating configurations of 'finite universes' comprised of specific 'particle groups,' ie unique and limited perspectives which render pattern activity more apparent.

Such sub-entities discover and establish similarity-relativity and influence-relativity connections between and within particle clusters. Sub-entities are also created to pattern search, and to discover and establish similarity-relativity and influence-relativity connections, between sub-entity 'particle groups'.

Influence-relativity is represented by a line with one arrow ----> depicting one object's influence over another, ie environmental shaping force. The direction of 'line with an arrow' also indicates which object is being influenced. The object being influenced is on the arrow end of the line, and the object 'doing the influencing' is on the end without the arrow.

If you hit a ball with a bat, you are influencing the bat to move.

You ----> Bat

The bat is influencing the ball to move.

Bat ----> Ball

And you [through the bat] are influencing the ball to move.

You ----> Bat ----> Ball

These are directional connections designating the nature and flow of action. Entire events create sequential action trees, with the branches being contingences for variables, just as found in many computer programs. Such action takes place in the task environment, and the intelligent entity is the processor instigating the action.

(Notice that the bat and batter are also influenced to some degree by their contact with the ball, and that this is not the relativity being defined by this particular definitional line artifact.)

So influential relativity ----> is recorded as action (usually in sequential chains) that may shape the environment to some degree; and similarity relativity <----> provides conduits through which to access the 'most likely to be useful' of these recorded chains of action.

VII. Point & Line Networks for Accessing Action-Continuities (Solutions)

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A young cognitive physics entity will create and adopt experimental definition perspectives, defining the environment (including the cognitive space of the entity itself) from as many useful points of view as can be discovered. Each such definition perspective creates a unique point and line network for accessing useful parallel action-continuities ----> by way of similarity-connections <----> .

Consider XYZ is the definition of the current environmental state.

Cluster XYZ is similar to the opening-status cluster of an Entity Event Record known to the entity:

ZAB (K ----> L ----> A) ZAMB

Opening-status (Event-action) After-action status

ZAB is a definition of the 'opening-status' of this EER cluster. The similarity occurs at definition particle Z.

Therefore: The action (K ----> L ----> A) portion of this EER cluster would have a higher probability of containing useful action order continuity (to be applied to the current environment) than randomly selected action.

This reduces the decision process to a comparison determining which EER is most relevantly similar to the current state of the environment and objective, and the subsequent optional resection of the event-action based on historical resections, and any incongruencies in the comparisons of the current environment state and the opening-status/objective of the selected event-record.

All pursuit of intelligent behavior can be reduced to this single question:

What action should be applied to the environment in order to achieve maximum net value?

Notice that definitions of objects and relativity do not have to be complete nor entirely correct to be effective to some degree. Also, definitions may be improved during the normal cognitive physics practice of the mutation of definitions based on the feedback of action experimentation.

Also notice that definition particles do not have to be equal to be relative or connected. Particles may be connected because of some known common attribute. For instance a baseball and a golf ball are not equal but they share a number of common attributes. Each common attribute would generate a unique connection, the weight of which would depend on still other factors.

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Discovering and recording such similarity–relativity $\langle \text{---} \rangle$ is like building roads for accessing relevant action–continuity $\text{---} \rangle$ (or processing–strings) for shaping the environment according to entity values. Notice that multiple definition perspectives and/or systems may be applied simultaneously to the same task environment, each offering another unique network for discovering similarity and influence connections, ie accessing action order continuities.

VIII. Minimal Notch Mutation

Every unresolved configuration of the environment is another challenge to find the most valuable action–continuity among events with similar environmental status and objective. If the 'event–change' value of the similar or equal historical event (EER) isn't satisfactory, or if the entity wants to search for greater value, he will alter something about the event, either in the action or the state of the environment.

If you limit this mutation to one (correctly defined) particle at a time, you may attribute any difference in the outcome of this event to the alteration made [see Law 11].

Notice that such a particle change may have variable parameters and spectrums. In default all particle variables are explored to their limits, with priority giving to altered directions which have a greater affect on value.

IX. Summary

The occupation of an intelligent entity is to most effectively and efficiently shape the environment (including the entity itself) toward entity objectives.

An intelligent entity will either know a direct (reliable to some known and acceptable degree) satisfactory shaping response (solution) to a given environmental state; or it will search for the closest known successful event (EER). It will then adopt, and possibly revise, the action (solution) framework of this closest event, applying it to the task environment or models thereof.

The 'closest known event' is the most similar event definition cluster, ie the one with the strongest connections. This calls for an evaluation of the similarity–relativity line(s) connecting the two clusters. In default the 'strongest connection' would be the clusters connected with the most lines, but in practice we find that some lines deserve more weight than others when deciding what constitutes relevant similarity.

Discovering the 'weight' of a given double–arrow–line $\langle \text{---} \rangle$ connecting particle clusters is a fundamental concern in cognitive physics. Any

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cognitive physics entity practicing intelligence thought within a complex task environment will inevitably create numerous sub-entities (which may in turn may create sub-entities of their own, and so on) to observe and evaluate the cognitive particles involved with line connectors.

Objects are connected to objects based on their similarities <----> in order to expand the known network of relativity, and thereby the number of conduits to order continuity ---->.

This knowledge network of connected dots gains another dimension when one starts connecting lines to lines, ie some types of relativity are similar, and even influential. Such 'line to line' connections add another unique and useful layer of cognitive mass to the entity's knowledge network.

Similarity lines <----> are created to discover and access the most similar definition cluster with the highest probability of containing valuable (relevant) action-continuity ----> [influence-action lines].

Influence-action lines ----> represent particles effecting particles which may shape the environment, including the entity itself.

Cognitive physics reduces all the education needed to achieve 'intelligent behavior within a task environment' to defining the object dots and connecting them with the correctly defined relativity-lines, ie discovering the objects and relativity of the entity's environment.

In the definitional-particle universe of cognitive physics, intelligence becomes a process of discovering which type of relativity-similarities <----> lead to the most value productive action order-continuities ---->.

The default response to any given real-time environmental status (or problem/opportunity) is to access the most similar status/objective portions of a successful EER and apply its action-continuity, after revising it according to any dissimilarities (and historical revision events/experiences).

If not satisfied with the value yield, the entity may mutate the event searching for an increase. When the entity is satisfied with the value yield of all known environmental states, such mutation will cease.

Notice that if a given current environmental status does not contain the elements needed to reach current entity objectives, then the most progressive action becomes to change the elements of the environment, by changing the entity location, and/or bringing the needed elements into the current environment.

A young computer hosted entity, operating within its given universe of cognitive particles, will routinely create somewhat independent sub-entities to make decisions at given particle processing points; these decisions are usually based on a myopic objective at this particular fork in the processing path, ie focusing on a limited number of particles, from a uniquely revealing perspective, designated by a specific concern.

Cognitive physics is a cumulative and evolving science. Useful 'entity created' particles clusters such as definitions of 'relevant similarities' may themselves be compared to similar task environments, and applied to newly created task entities.

X. Laws of Cognitive Physics

1. An entity requires five elements to intelligently shape a given task environment: processor, memory, environmental input, environmental output, and objective.
2. An absolute intelligent entity will always shape its environment toward entity objectives with maximum effectiveness and efficiency.
3. Environmental order is any influence or similarity between particles or particle clusters defining the entity's environment.
4. Influential-order is some degree of probability that a pattern of motion, mutation, or function will repeat.
5. Similarity-order is any equality in the cognitive matter depicting motion, mutation, function, or physical properties of environmental objects, objectives, or influential-order.
6. In default, an intelligent entity will attempt to define all the objects, and the relativity between all the objects, within its environment.
7. A 'particle cluster' is a multiple of definition particles depicting an isolable object, relativity, or objective. Particle clusters (definitional artifacts) are created from the entity's sensory observations and/or creator given information pertaining to the object, relativity, or objective being defined.
8. The known relativity between cognitive particles is equal to the definition of the similarities or influence between said particles.
9. Two particle clusters know to share an 'equal or similar' particle have a greater probability of sharing additional 'equal or similar' particles than randomly selected clusters.

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10. Event–action is any motion or mutation of the task environment or cognitive particles (entity memory).

11. Equal action applied to equal environmental states will produce equal environmental states.

12. Communication and shaping tools may extend the perceptual (sensory) and influential boundaries of an entity's environment.

13. Multiple entities competing for limited resources within a contained environment will eventually exercise maximum force.

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