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# An Attempt to Generalize AI Part 10: Pattern Instance Construction Alternatives

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This is the tenth in a series of articles attempting an overview of how minds may work and how similar systems could be implemented in computers. Previous articles described a probabilistic hierarchy based on *patterns*. A pattern has a specification describing a set, or population, of *pattern instances*, distributed throughout a hierarchy containing the pattern instances of all the patterns. Each pattern's set of pattern instances is used to obtain statistical information for probabilistic predictions. Each pattern's population of pattern instances is to be described in a very general way, to provide a very general ontology. An exploratory relevance process has been described, which achieves the relevance of the hierarchy by removing low-relevance pattern instances while the hierarchy "grows", so that it will tend to retreat from low-relevance regions and grow into high-relevance ones, and forgetting is part of this process. The way in which patterns relate to pattern instances has been described as being a "constructive" one, in which each pattern is considered as a machine that "builds" its pattern instances. It is not essential for such an approach to be used, however. The only requirements are that pattern instances belong to patterns and that the relationship between a pattern and its pattern instances can be expressed very generally. This article discusses possible alternatives for the relationship between patterns and pattern instances. These are pattern instances being made randomly and selected by patterns, pattern instances being made by some exploratory process and selected by patterns and the connection of pattern instances being influenced by patterns.

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## List of Abbreviations

AI	artificial intelligence
BERP	basic, exploratory relevance process
EFS	evaluation function score
ERP	exploratory relevance process

# 1 Introduction

This article is the tenth in a series about artificial intelligence (AI) and how our own minds might work. The first article, *An Attempt to Generalize AI - Part 1: The Modeling System*, is available at <http://www.paul-almond.com/AI01.pdf>.<sup>1</sup> The second article, *An Attempt to Generalize AI - Part 2: Planning and Actions*, is at <http://www.paul-almond.com/AI02.pdf>.<sup>2</sup> The third article, *An Attempt to Generalize AI - Part 3: Forgetting*, is at <http://www.paul-almond.com/AI03.pdf>.<sup>3</sup>

These three articles described a hierarchy based on *patterns*, which are sets of *pattern instances*, and were intended to give an idea of how humans may model the world, plan actions and discard information from the model when it is no longer useful. The fourth article, *An Attempt to Generalize AI - Part 4: Modeling Efficiency*, which is at <http://www.paul-almond.com/AI04.pdf>, suggested that pattern instances should be allowed to have *incompletely specified pattern inputs*, so that it would be practical for the hierarchy to be “pruned” by some process seeking to maximize its relevance.<sup>4</sup> This required a *completely* probabilistic hierarchy, an issue dealt with in the fifth article of this series, *An Attempt to Generalize AI - Part 5: A Completely Probabilistic Hierarchy*, which is at <http://www.paul-almond.com/AI05.pdf>.<sup>5</sup>

That made a process to provide relevance in the hierarchy feasible. The sixth article, *An Attempt to Generalize AI – Part 6: Measuring Relevance*, which is at <http://www.paul-almond.com/AI06.pdf>, described a back-propagation process for measuring relevance in the hierarchy.<sup>6</sup> The problem is made tractable by the way in which the *action selection process*, described in the second article, *An Attempt to Generalize AI – Part 2: Planning and Actions*, works. The seventh article, *An Attempt to Generalize AI – Part 7: A Basic, Exploratory Relevance Process*, which is at <http://www.paul-almond.com/AI07.pdf>, described the *basic exploratory relevance process* (BERP), which uses this measuring process to direct the growth and pruning of the hierarchy.<sup>7</sup>

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<sup>1</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 1: The Modeling System*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>.

<sup>2</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 2: Planning and Actions*. [Online] paul-almond.com. <http://www.paul-almond.com/AI02.pdf> or <http://www.paul-almond.com/AI02.doc>.

<sup>3</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 3: Forgetting*. [Online] paul-almond.com. <http://www.paul-almond.com/AI03.pdf> or <http://www.paul-almond.com/AI03.doc>.

<sup>4</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 4: Modeling Efficiency*. [Online] paul-almond.com. <http://www.paul-almond.com/AI04.pdf> or <http://www.paul-almond.com/AI04.doc>.

<sup>5</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 5: A Completely Probabilistic Hierarchy*. [Online] paul-almond.com. <http://www.paul-almond.com/AI05.pdf> or <http://www.paul-almond.com/AI05.doc>.

<sup>6</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 6: Measuring Relevance*. [Online] paul-almond.com. <http://www.paul-almond.com/AI06.pdf> or <http://www.paul-almond.com/AI06.doc>.

<sup>7</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 7: A Basic, Exploratory Relevance Process*.

The eighth article, *An Attempt to Generalize AI – Part 8: Forgetting as Part of the Exploratory Relevance Process*, which is at <http://www.paul-almond.com/AI08.pdf>, removed the need for the forgetting process in the third article, instead incorporating forgetting into the BERP, or any other exploratory relevance process (ERP).<sup>8</sup> This was done by modifying the relevance measurement process (RMP) to take account of obsolescence. This article also introduced *ghost pattern instances*. A ghost pattern instance is one that persists temporarily, after “removal” by the ERP, as a simple probability value while it is still needed as a pattern input by other pattern instances. The incompletely specified pattern inputs introduced earlier are now ghost pattern instances. The ninth article, *An Attempt to Generalize AI – Part 9: Improving the Exploratory Relevance Process*, which is at <http://www.paul-almond.com/AI09.pdf>, discussed ways in which the sophistication of the BERP might be increased, giving an improved ERP.<sup>9</sup>

Functioning of the system requires pattern instances to be placed in the hierarchy on an ongoing basis, and pattern instances need to belong to patterns. A way in which this could work was described in the first article, *An Attempt to Generalize AI - Part 1: The Modeling System*.<sup>10</sup> Other approaches could be considered, however, which conform to the same general idea, and this article will discuss them.

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[Online] paul-almond.com. <http://www.paul-almond.com/AI07.pdf> or <http://www.paul-almond.com/AI07.doc>.

<sup>8</sup> Almond, P., 2010. *An Attempt to Generalize AI – Part 8: Forgetting as Part of the Exploratory Relevance Process*. [Online] paul-almond.com. <http://www.paul-almond.com/AI08.pdf> or <http://www.paul-almond.com/AI08.doc>.

<sup>9</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 9: Improving the Exploratory Relevance Process*. [Online] paul-almond.com. <http://www.paul-almond.com/AI09.pdf> or <http://www.paul-almond.com/AI09.doc>.

<sup>10</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 1: The Modeling System*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>.

## 2 A Note on Pattern Instances and Probability Values

This article will tend to discuss pattern instances as if each pattern instance in the conceptual hierarchy has one of two possible values, 0 or 1, as this is the most obvious form for the hierarchy, and the easiest one to describe. With such a hierarchy, any pattern instance in the actual hierarchy in the AI system can be described by a single probability value indicating the probability that the corresponding pattern instance in the conceptual hierarchy has a value of 1.

The purpose of the actual hierarchy is to minimize the uncertainty in specific pattern instances. For a pattern instance described by a single probability value, this means getting its probability as far away from 0.5, and as close to 0 or 1, as possible.

In principle, the conceptual hierarchy could take other forms. It could take a form in which each pattern instance has more than two possible values. In such a hierarchy, more than one probability value would be needed to describe a pattern instance. The general approach discussed in this article would still apply, however: It would just involve propagation with multiple probability values for pattern instances, and minimizing the uncertainty associated with a pattern instance would simply mean minimizing it for its multiple probabilities.

I suggest that readers ignore this, and just assume we are dealing with a hierarchy of 0/1 pattern instances, each described in the actual hierarchy by a single probability value indicating our state of knowledge about it.

A description of the existing way in which the hierarchy is made, with the relationship between patterns and pattern instances, will now be given. Readers already familiar with this may prefer to go straight to Section 4: The Possibility of Different Construction Methods, on page 11.

## 3 How the Existing System Works

### 3.1 The General Idea

The way in which the hierarchy is put together was previously described in *An Attempt to Generalize AI - Part 1: The Modeling System*.<sup>11</sup> The specific approach described so far is part of a general approach which is as follows.

#### 3.1.1 Pattern Instances

The system is a hierarchy of *pattern instances*. Each pattern instance is a basic, computational unit that accepts labeled *pattern inputs* and applies some internal logic to their values to generate a *pattern output*.

The labeled pattern inputs of a pattern instance are connected to the pattern outputs of other pattern instances.

Bottom-level pattern instances are a special case. A bottom-level pattern instance has no pattern inputs. Instead, its value is the value of a particular, external input or output *occurring at a particular time*. The fact that the external input or output is occurring at a particular time is important. A bottom-level pattern instance does not repeatedly change its value as the value of some external input or output changes. It does not correspond to an input or output over a period of time, but only to the input or output at some instant and is assigned an actual value only once, when the relevant input/output occurs. Multiple pattern instances would be required to represent input/output values over a period of time.

#### 3.1.2 The Role of Pattern Instances

The purpose of the hierarchy is to predict future inputs/outputs and this involves using the known values of the bottom-level pattern instances corresponding to inputs/outputs that have already occurred to make probabilistic predictions of the values of pattern instances corresponding to future inputs/outputs. Probabilistic information is propagated through the hierarchy. In the upwards direction, this requires the ability to assign a probability value to a pattern instance, based on probabilities already assigned to its pattern inputs, and the ability to propagate information downwards is also required.

The most basic process used for this is *logic application*, which involves assigning probabilities to a pattern instance based on what is known about its pattern inputs

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<sup>11</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 1: The Modeling System*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>. pp.6-14.

(which will itself be probabilistic) and the pattern instance's internal logic. There is a similar, downwards version of this.

Another process used for this is *statistics application*. Statistics application relies on putting pattern instances into well-defined groups, the idea being that the pattern instances in the group about which we know a lot – those mainly dependent on inputs/outputs that have already occurred – will tell us about pattern instances in the same group which depend more on future inputs/outputs and about which we know less. Statistics application, in the upwards direction, assigns a probability to a pattern instance, based on what is known about its pattern inputs *and what is known about other pattern instances in a group to which this pattern instance belongs*. This group is a *pattern*. The process can also be applied downwards.

### 3.1.3 Patterns

A pattern is a group, or set, of pattern instances. Patterns should be well-defined, and the system needs to allow them to be defined as generally as possible: Ideally, any formally definable set of pattern instances could be expressed as a pattern. A pattern defines the requirements that a pattern instance must have to be a member of it, and this definition can be made with regard to the way a pattern instance is connected into the rest of the hierarchy and the structure of the hierarchy around it. A pattern should therefore be able to examine the hierarchy “around” a pattern instance.

### 3.1.4 Conceptual and Actual Hierarchies

The system can be understood in terms of a *conceptual hierarchy* and an *actual hierarchy*.

The **conceptual hierarchy** is an idealized hierarchy consisting of every pattern instance that could possibly exist, with every pattern that could possibly relate these pattern instances in use.

The conceptual hierarchy is atemporal. Pattern instances do not change over time. Instead, each bottom-level pattern instance corresponds to an input/output occurring at some instant in time, and other pattern instances are dependent, directly or indirectly on these. Each pattern instance therefore has a single value.

Whether an observer knows the value of a given pattern instance depends on when the observer is viewing the hierarchy and how much of it he/she can “see”. If an observer views the hierarchy before the input/output corresponding to a bottom-level pattern instance has occurred, or before the inputs/outputs corresponding to the bottom-level pattern instances on which some higher-level pattern instance depends have occurred, then he/she will not know the value of the pattern instance, though he/she may be able to make a probabilistic prediction about it by looking at what is known about the

pattern instance and taking into account what is known about other pattern instances in the same pattern.

The **actual hierarchy** is the representation of the conceptual hierarchy that actually exists in a computer. It consists of a limited number of pattern instances from the conceptual hierarchy, related by a limited number of patterns. Ideally, it contains those parts of the conceptual hierarchy which are most useful. Bottom-level pattern instances corresponding to inputs/outputs that have already occurred are known about with certainty, and probabilistic values are assigned to other pattern instances, by propagating probabilistic information through the hierarchy as previously described, in 3.1.2.

### 3.1.5 Other Features of the System

Other features of the system will receive only a brief mention here, because they are not that relevant to the issue of how to relate pattern instances and patterns. The system's actions are produced using the *action selection process*, previously described in *An Attempt to Generalize AI - Part 2: Planning and Actions*.<sup>12</sup> In this process, evaluation function score (EFS) values are continually computed and provided to the system as inputs. When an output is to be made, the different possible values are tried, the hierarchy being updated experimentally each time, with probabilistic information propagating through it and a prediction for a future input of the EFS being obtained. This is not the real planning process, though, but is merely to drive the system in a particular direction. The *real* planning process occurs in the hierarchy, where the system models its own behavior along with other features of the world.

The action selection process defines the pattern instances that are of interest when making predictions: those corresponding to future EFS inputs. An exploratory relevance process (ERP) is used to grow the hierarchy and prune it as appropriate so that uncertainty in the predictions for these pattern instances is minimized, as discussed in *An Attempt to Generalize AI – Part 6: Measuring Relevance*, *An Attempt to Generalize AI – Part 7: A Basic, Exploratory Relevance Process* and *An Attempt to Generalize AI – Part 9: Improving the Exploratory Relevance Process*.<sup>13</sup> Forgetting has also been made part of

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<sup>12</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 2: Planning and Actions*. [Online] paul-almond.com. <http://www.paul-almond.com/AI02.pdf> or <http://www.paul-almond.com/AI02.doc>. pp.9-16.

<sup>13</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 6: Measuring Relevance*. [Online] paul-almond.com. <http://www.paul-almond.com/AI06.pdf> or <http://www.paul-almond.com/AI06.doc>. Almond, P., 2010. *An Attempt to Generalize AI - Part 7: A Basic, Exploratory Relevance Process*. [Online] paul-almond.com. <http://www.paul-almond.com/AI07.pdf> or <http://www.paul-almond.com/AI07.doc>.

Almond, P., 2010. *An Attempt to Generalize AI - Part 9: Improving the Exploratory Relevance Process*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>.

this process, as described in *An Attempt to Generalize AI – Part 8: Forgetting as Part of the Exploratory Relevance Process*.<sup>14</sup>

## 3.2 The Specifics

A specific way of providing the functionality just discussed, in 3.1, was proposed in *An Attempt to Generalize AI - Part 1: The Modeling System*.<sup>15</sup> This is as follows.

The approach involves patterns constructing pattern instances. That is to say, each pattern acts as a machine, examining different parts of the hierarchy and connecting new pattern instances of that pattern into it.

A pattern consists of a *pattern specification* and a set of pattern instances. The pattern specification consists of a *construction specification* and a *logic specification*.

The logic specification describes how each pattern instance generates a pattern output from its labeled pattern inputs. The logic specification is the same for every pattern instance in the pattern.

The construction specification controls the connection of new pattern instances for this pattern into the hierarchy. It is able to examine the hierarchy and follow connections between pattern instances. For example, it could examine a pattern instance and determine the pattern to which it belonged, the pattern instances it was using as pattern inputs and so on. I have not specified exactly how the construction specification will work, but a placeholder idea, for now, is that it is a computer program capable of “reading” the hierarchy’s structure and directing the “wiring” of new pattern instances into it.

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<sup>14</sup> Almond, P., 2010. *An Attempt to Generalize AI – Part 8: Forgetting as Part of the Exploratory Relevance Process*. [Online] paul-almond.com. <http://www.paul-almond.com/AI08.pdf> or <http://www.paul-almond.com/AI08.doc>.

<sup>15</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 1: The Modeling System*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>. pp.6-14.

## 4 The Possibility of Different Construction Methods

Inclusion of pattern instances in a pattern is determined by the pattern's construction specification. In the first article of this series, *An Attempt to Generalize AI - Part 1: The Modeling System*, I described the construction specification as actually making new pattern instances that are going to belong to the pattern, by examining the hierarchy and defining new pattern instances to be connected into it.<sup>16</sup>

This is only one way of constructing patterns, however. The most important features of a pattern are that the pattern instances that belong to a pattern are determined by the construction specification and that the construction specification can examine the "wiring" in the hierarchy. In the third article, *An Attempt to Generalize AI - Part 3: Forgetting*, I suggested that the construction specification might work differently.<sup>17</sup> Patterns could be wired into the hierarchy randomly, and the construction specifications of patterns, instead of *making* the pattern instances, could *select* existing pattern instances for inclusion in the pattern, but still by the same general method of examining the hierarchy. With such a process, a pattern instance might belong to multiple patterns, and membership of patterns might also be made "fuzzy", so that pattern instances could have varying degrees of membership of patterns.

Different approaches for "construction" of pattern instances will now be discussed.

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<sup>16</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 1: The Modeling System*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>. pp.11-14, p.25.

<sup>17</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 3: Forgetting*. [Online] paul-almond.com. <http://www.paul-almond.com/AI03.pdf> or <http://www.paul-almond.com/AI03.doc>. p.10.

## 5 Different Ways in Which the Construction Specification Could Work

### 5.1 Pattern instances are *made* by patterns.

This is the approach described in the first article, *An Attempt to Generalize AI - Part 1: The Modeling System*.<sup>18</sup> A pattern has a *construction specification*. The pattern adds new pattern instances to the hierarchy, the construction specification controlling how their labeled pattern inputs connect to it, and they belong to the pattern that added them. When the construction specification is adding pattern instances, it is able to examine the structure of the hierarchy; for example, it can read the type of pattern to which a pattern instance belongs, or examine its pattern inputs.

### 5.2 Pattern instances are made *randomly* and *selected* by patterns.

This is the approach previously described in *An Attempt to Generalize AI - Part 3: Forgetting*.<sup>19</sup> When pattern instances are added to the hierarchy, they are connected randomly to it, with the possible limitation of some limit on the logic distance between pattern instances. The pattern's specification examines the pattern instance's internal logic – how it relates its labeled pattern inputs to its pattern output – and its “local situation” – how it is connected to the hierarchy and the structure of the hierarchy around it, giving it some degree of membership of the pattern. The greater a pattern instance's degree of membership of some pattern, the greater the effect it would have on the pattern's statistics in statistics generation and the greater the effect those statistics would have on the probabilistic information for the pattern instance in statistics application. A pattern instance could belong to multiple patterns: In fact, it could have some degree of membership of *all* patterns.

### 5.3 Pattern instances are made by some *exploratory process* and *selected* by patterns.

This is similar to the approach just described, in 5.2, except that a pattern instance is not made *completely* randomly. Instead it changes, and as it changes its degree of membership of different patterns changes. The pattern instance would change to seek relevance. This would mean altering the BERP, or any ERP derived from it, a bit: The

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<sup>18</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 1: The Modeling System*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>. pp.11-14, p.25.

<sup>19</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 3: Forgetting*. [Online] paul-almond.com. <http://www.paul-almond.com/AI03.pdf> or <http://www.paul-almond.com/AI03.doc>. p.10.

removal of pattern instances would now become pattern instances being required to change. The general idea of the BERP would remain however: Changing a pattern instance into another one is nothing more than a *gradual* removal of it, and the gradual replacement of it with another pattern instance.

## **5.4 The connection of pattern instances is *influenced* by patterns.**

This has some similarity with the approach of allowing a pattern to construct pattern instances, in 5.1, except that a pattern instance's behavior and connection to the hierarchy is not controlled by a single pattern. Instead a pattern instance is influenced by different patterns over a period of time, each having some ability to change its behavior and the way it is connected to the hierarchy.

Other approaches might combine features of these.

## 6 The general idea is the same.

A number of ways of relating patterns to pattern instances have just been described. The exact approach used does not affect the basic principles on which the system works. If we select a particular approach, it would have some affect on the *details* of how the various processes in the system work, but not on the general principles. For example, if a pattern instance could have varying degrees of membership of multiple patterns, then with statistics generation/application this would just mean that account would need taking of the degree of membership of some pattern, and therefore the extent to which a pattern instance affects the statistics or the statistics affect that pattern, or others, when generating or applying statistics. With some approaches to connecting pattern instances to the hierarchy, what is currently described as the “removal” of pattern instances from the hierarchy in the BERP may instead involve *changing* pattern instances.

For now, I will not make a final decision on this issue. The “constructive” approach described in the first article,<sup>20</sup> and the description of the ERP for such a system,<sup>21</sup> are adequate for now.

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<sup>20</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 1: The Modeling System*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>. pp.11-14, p.25.

<sup>21</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 6: Measuring Relevance*. [Online] paul-almond.com. <http://www.paul-almond.com/AI06.pdf> or <http://www.paul-almond.com/AI06.doc>. Almond, P., 2010. *An Attempt to Generalize AI - Part 7: A Basic, Exploratory Relevance Process*. [Online] paul-almond.com. <http://www.paul-almond.com/AI07.pdf> or <http://www.paul-almond.com/AI07.doc>.

Almond, P., 2010. *An Attempt to Generalize AI – Part 8: Forgetting as Part of the Exploratory Relevance Process*. [Online] paul-almond.com. <http://www.paul-almond.com/AI08.pdf> or <http://www.paul-almond.com/AI08.doc>.

Almond, P., 2010. *An Attempt to Generalize AI - Part 9: Improving the Exploratory Relevance Process*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>.

## 7 Conclusion

The way in which the hierarchy is put together was previously described in *An Attempt to Generalize AI - Part 1: The Modeling System*.<sup>22</sup> The specific approach described so far is part of a general approach which is as follows.

The existing way in which patterns relate to pattern instances is a constructive one. Each pattern is a machine that “builds” its pattern instances, its construction specification directing the connection of each new pattern instance into the hierarchy. The construction specification can be considered as a computer program, in a Turing equivalent language, able to read the structure of the hierarchy.

It is not essential for such an approach to be used, however. The only requirements are that pattern instances belong to patterns and that the relationship between a pattern and its pattern instances can be expressed very generally. This article has discussed possible alternatives for the relationship between patterns and pattern instances.

One approach involves pattern instances being made *randomly* and *selected* by patterns. This means that the pattern’s construction specification, rather than directing the connection of new pattern instances that satisfy its requirements, would find existing pattern instances that satisfy its requirements. Pattern instances might satisfy the requirements of a pattern in varying degrees, so membership of a pattern could be a matter of degree.

Another approach involves pattern instances being made by some *exploratory process* and selected by patterns. This is similar to making pattern instances randomly, except that a pattern instance is not made *completely* randomly. Instead, some exploratory, possibly Darwinian, process changes it to seek high relevance, and as it changes, its degree of membership of different patterns changes.

A further approach involves the connection of pattern instances being *influenced* by patterns. A pattern instance is influenced by different patterns over a period of time, each having some ability to change its behavior and the way it is connected to the hierarchy.

For now, I will not make a final decision on this issue. The “constructive” approach described in the first article,<sup>23</sup> and the description of the exploratory relevance process

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<sup>22</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 1: The Modeling System*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>. pp.6-14.

<sup>23</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 1: The Modeling System*. [Online] paul-almond.com. <http://www.paul-almond.com/AI01.pdf> or <http://www.paul-almond.com/AI01.doc>. pp.11-14, p.25.

(ERP) for such a system,<sup>24</sup> are adequate for now, but I may return to this issue later. If any change is made later, it may need to be reflected in the ERP, but the main features of the ERP would remain the same.

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<sup>24</sup> Almond, P., 2010. *An Attempt to Generalize AI - Part 6: Measuring Relevance*. [Online] paul-almond.com. <http://www.paul-almond.com/AI06.pdf> or <http://www.paul-almond.com/AI06.doc>.  
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Almond, P., 2010. *An Attempt to Generalize AI – Part 8: Forgetting as Part of the Exploratory Relevance Process*. [Online] paul-almond.com. <http://www.paul-almond.com/AI08.pdf> or <http://www.paul-almond.com/AI08.doc>.  
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