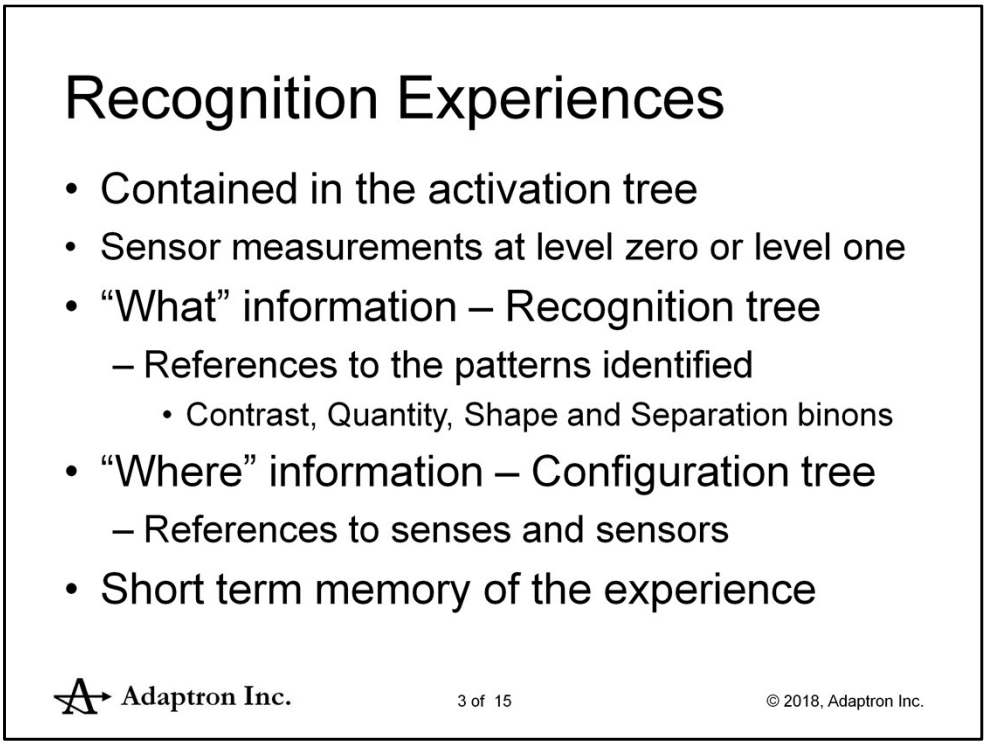
An experience is a short term memory of what, where and when something was perceived, done or thought about.
Remember, this is research and I am often wrong.
Whenever my father made a mistake he would often say: “It’s not often I’m wrong, but I’m wrong again”.

Contents

- Recognition experiences
  - Activation tree
- What – recognized patterns
- Where – configurations of senses & sensors
- Experience examples
  - Dependent and independent sensors

This presentation describes the activation tree that maintains the short term memory of experiences.
The full activation tree maintains a record of the dynamic state of the binons as they are used in recognition and in actions.
It also maintains a record of the configuration of senses, sensors and action devices.
However in this presentation only experiences for spatial recognition are described.
Temporal recognition experiences and the activation tree are covered in the Temporal recognition presentation
And the Action Learning presentation describes the experiences for action control.



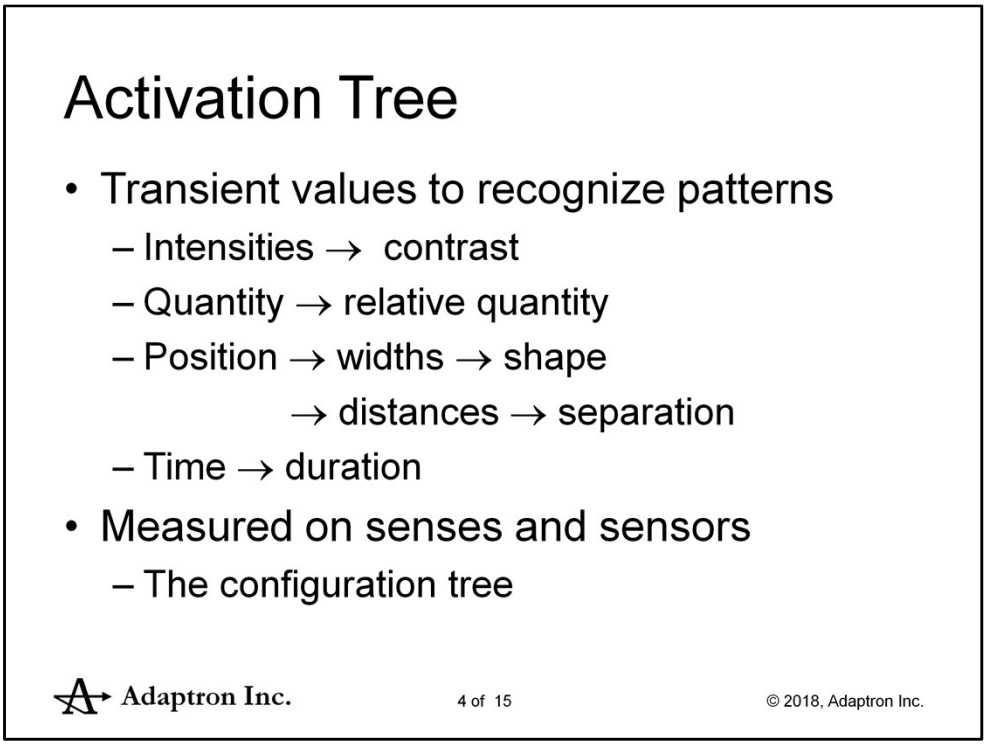
The activation tree keeps three pieces of information; the activation readings, the recognition-action binons and the configuration information.

The activation readings are the absolute values of intensity, quantity and position for determining contrast, quantity ratio, shape and separation patterns.

These also have values at the sensor levels. But quantity re-emerges at all possible levels.

Each entry in the activation tree also contains a reference to the class binon recognized at that point in the tree.

And each entry in the activation tree contains a reference to the sense and sensor configuration for the recognized binon.



The Activation tree contains the experience information.

This is information about what happened and on which sensors (where) it occurred.

The information is always changing.

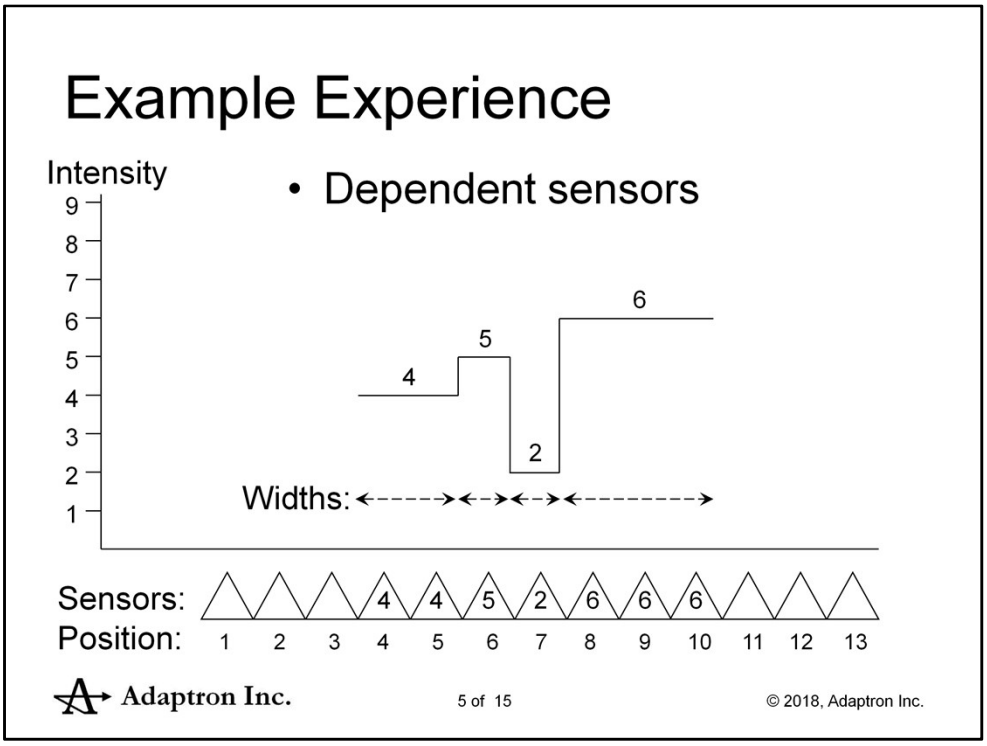
Timing information in the activation tree is addressed in the Temporal recognition presentation.

Many properties are measured and used in recognition.

However it is the relative property values rather than their magnitudes that are used in recognition

The activation tree has to reference the sense and sensor configuration for where the measurements occurred.

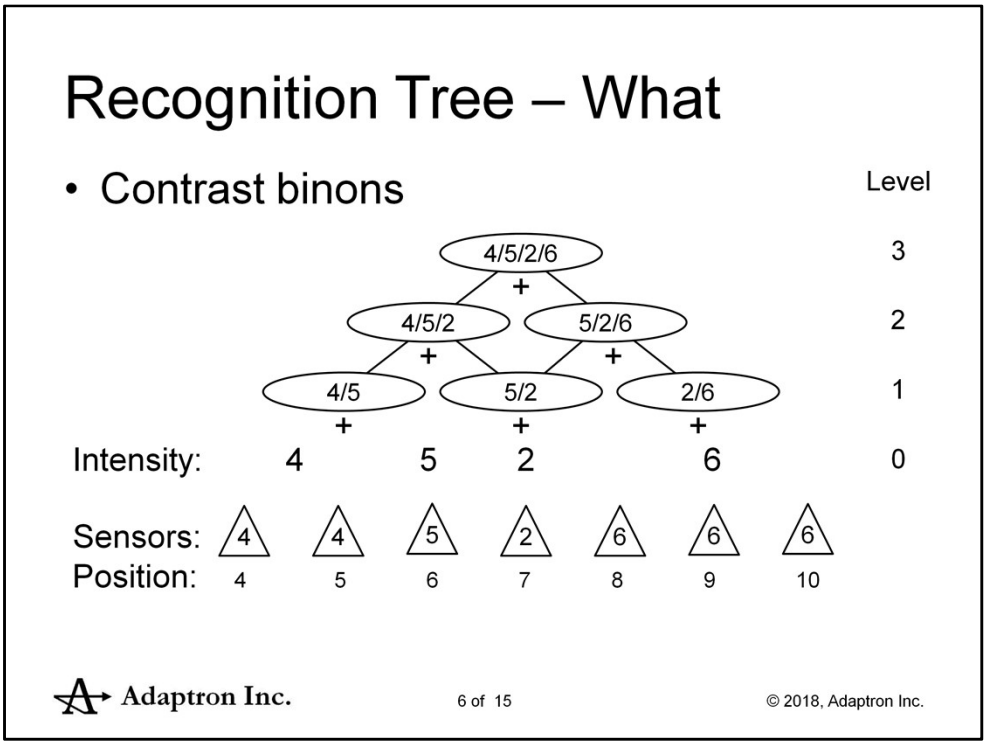
The activation tree also holds the measurements, that is their magnitude values.



As a simple example consider the experience of this spatial pattern.

The intensities are 4, 5, 2 and 6. The widths are 2, 1, 1 and 3. The positions are 4, 6, 7 and 8.

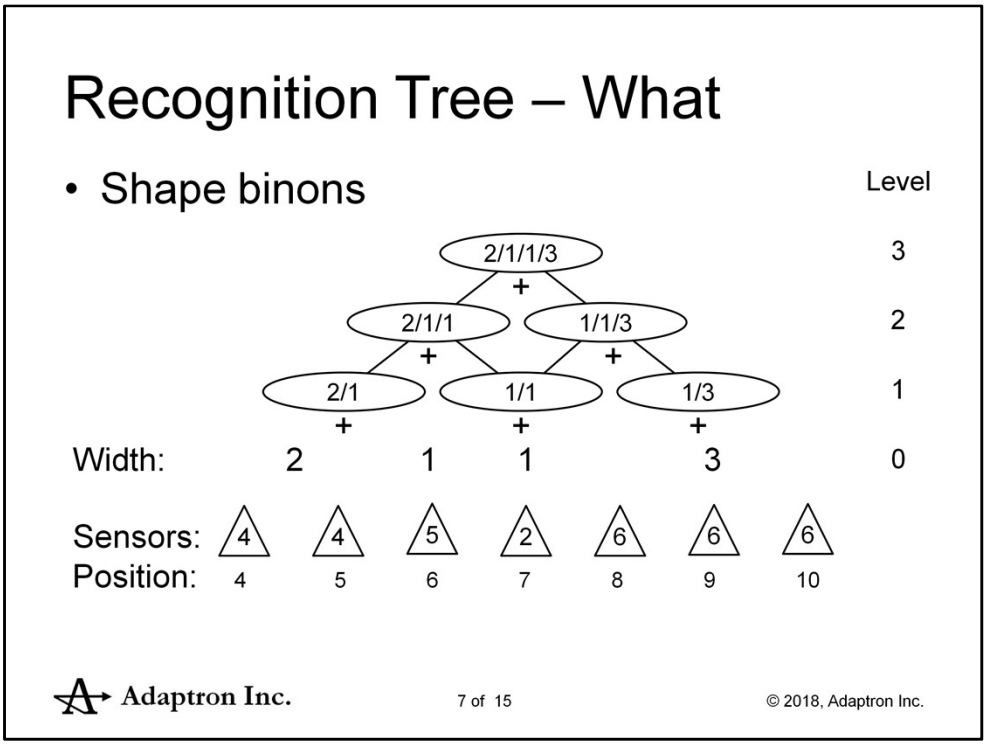
Quantity ratio and Separation patterns are not included to keep it simple.



Here the intensity values are used to produce contrast binons.

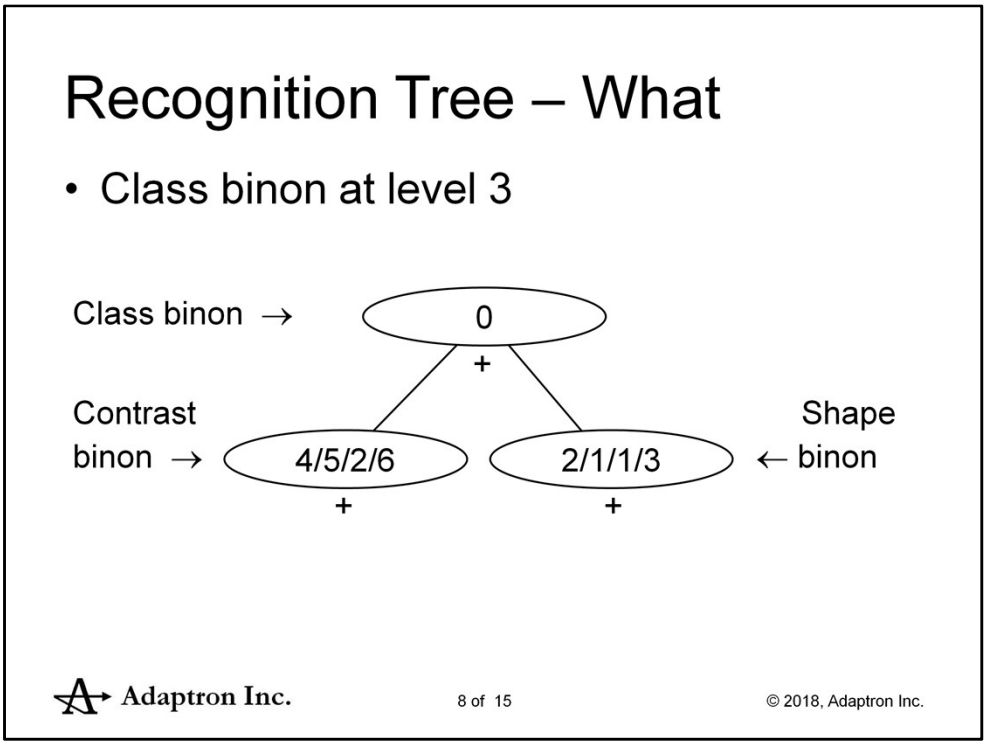
Level 1 binons are edges. This is one aspect of what is being experienced.

[Level 1 binons contain values representing the ratios, higher levels of overlapping binons actually contain zero values representing a 1/1 ratio. The multi-valued ratios on the diagram are for displaying what the binons represent based on their combination of source binons.]



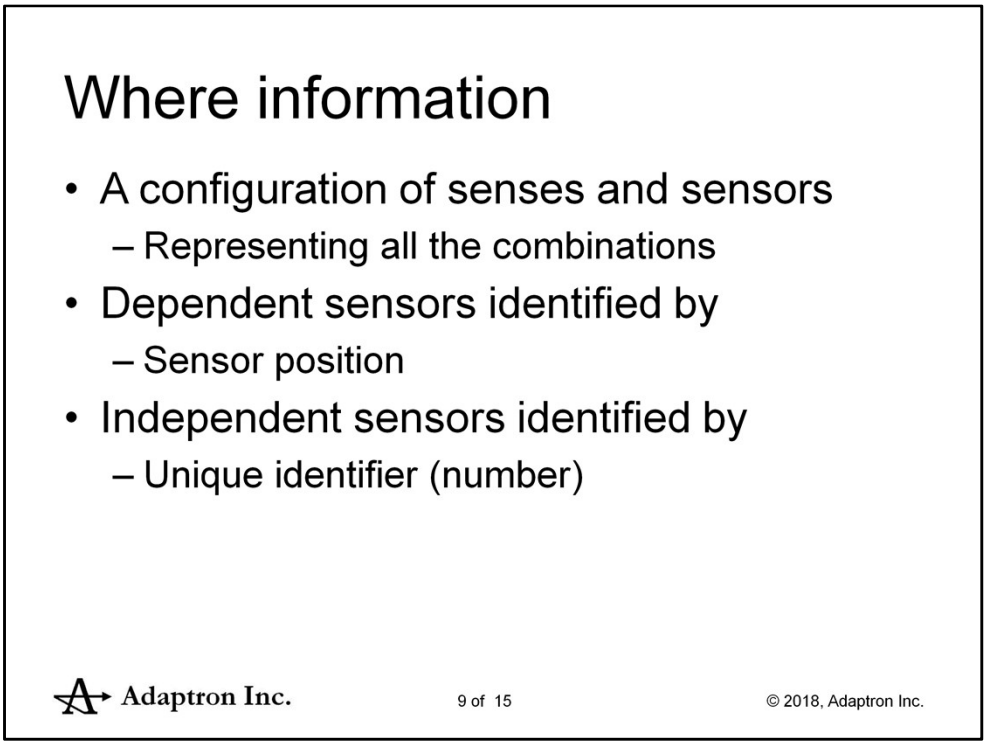
Ratios of widths are used to represent shapes. This is the second aspect of what is being experienced.

[Level 1 binons contain values representing the ratios, higher levels of overlapping binons actually contain zero values representing a 1/1 ratio. The multi-valued ratios on the diagram are for displaying what the binons represent based on their combination of source binons.]



Combine the Contrast and Shape binons to get the Class binon.

[The source binons actually contain zero values representing a 1/1 ratio. The multi-valued ratios on the diagram are for displaying what the binons represent based on their combination of source binons.]



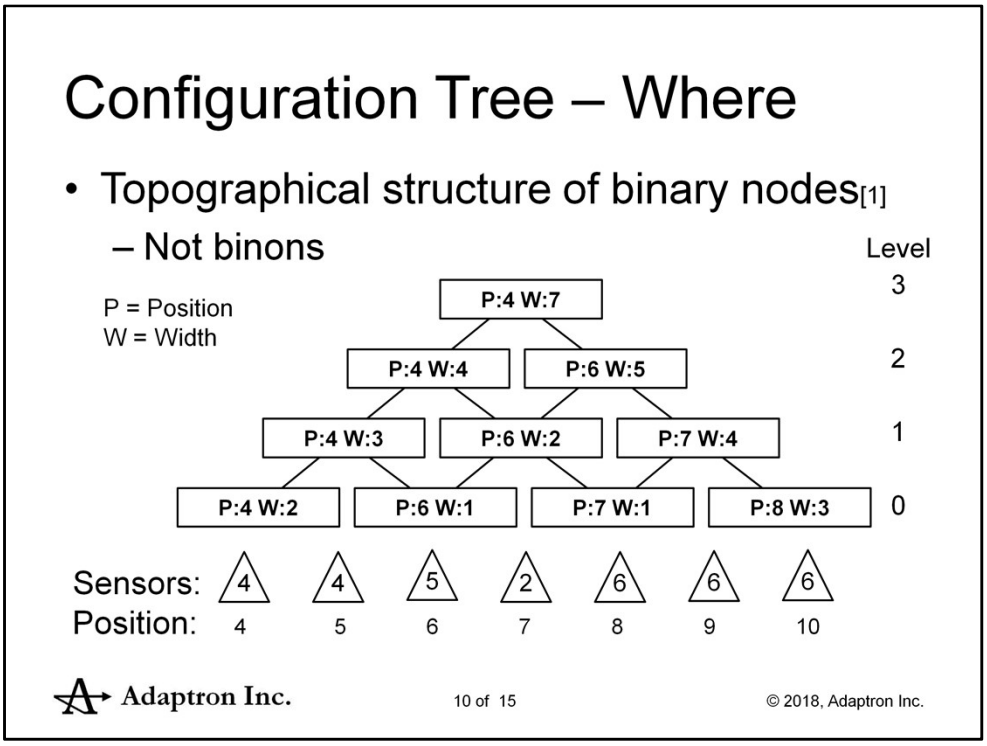
Adding where information to the patterns makes the experience more specific.

Adding patterns from two different senses and you have an even more specific experience.

For example, in the McGurk effect the sound is the same but the visual stimulus helps you decide whether it is “ba”, “ga”, “da” or “fa” that is being said. The same is true for adding information about the sensors involved. In hearing the pitch/frequency of a sound is determined by which hair cells (sensors in the ear) measure the volume. In a tonal language such as Bantu the pitch of a syllable can change the meaning of a word. Thus the where information (pitch) helps make the experience more specific.

For dependent sensors the sensor position is used to identify them. The count of adjacent sensors with the same intensity value provides the width.

For independent sensors each is given a unique identifier (a number) and they are always used, represented and processed in the same order. Their size is always 1.



This is a binary tree structure but the nodes are not binons. They do not contain ratio values.

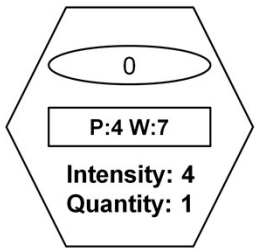
Instead they contain information about the sense(s) and sensor(s) on which an experience was perceived.

The brain represents this information by the position on the cortex, that is topographically represented.

Activation Tree – What & Where

- Same binary tree structure
  - Not binons
- Each node contains:
  - + Class binon
  - + Sensor configuration
  - + Activation readings

Level 3 example



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11 of 15

The nodes in the activation tree are not binons, they do not contain ratio values.

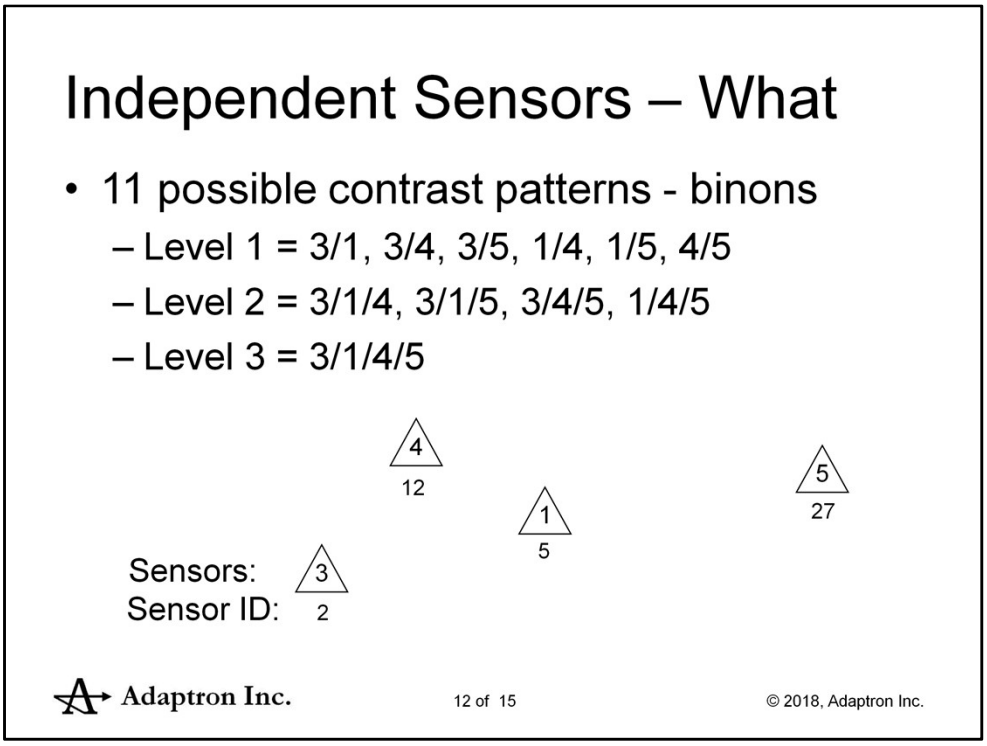
But the structure is a binary tree just like the Configuration tree.

At each entry there are references to the class binon found, the sensory location and the activation measurements.

This is a simplified version.

The class binon should actually be a combination of contrast, quantity ratio, shape and separation binons.

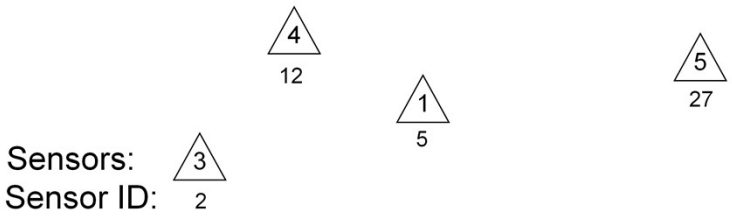
The configuration entry should also contain the sense identifier.



If sensors are independent then possible patterns are 2^N-1 –N. The sensors are independent – therefore they are not ordered and thus the pattern 3/4 is the same as 4/3. The combination 3/4/1 is the same as 3/1/4, 4/1/3, 4/3/1, 1/3/4, and 1/4/3. To obtain the possible combinations one orders the sensors. Then create all pairs maintaining the right to left order as in the first row or ratios. Then for each higher level of complexity combine the lower level ratios that have an overlapping subpart. See the Hierarchies slide show for more details. For example 3/4/1 overlaps with 4/1/7 and that produces 3/4/1/7.

Independent Sensors – Where

- No position dependency – sensor IDs
- 11 possible sensor configurations
  - Level 1 = 2/5, 2/12, 2/27, 5/12, 5/27, 12/27
  - Level 2 = 2/5/12, 2/5/27, 2/12/27, 5/12/27
  - Level 3 = 2/5/12/27



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13 of 15

The configuration structure is the same but based on Sensor identifiers.

Activation Tree – What & Where

- Same binary tree structure
  - Not binons
- Each node contains:
  - + Contrast binon
  - + Sensor configuration
  - + Activation readings

Level 3 example

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[The contrast binon actually contain a zero value representing a 1/1 ratio. The multi-valued ratio on the diagram is for displaying what the binon represents based on its combination of source binons.]

References

[1] Lee I. Newman, Thad A. Polk (2007). The Emergence of Semantic Topography in a Neurally-Inspired Computational Model, 8th International Conference on Cognitive Modeling, 2007. Edited by Richard L. Lewis, Thad A. Polk, and John E. Laird