

# The Systems Thinking Tool Box

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*“.. bump, bump, bump, on the back of his head. It is, as far as he knows the only way of coming downstairs, but sometimes he feels that there really is another way, if only he could stop bumping for a moment and think of it.”*

Winnie the Pooh - A. A. Milne

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## Affinity Diagram (AD)

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### What is it and what does it do?

Affinity Diagramming is a simple tool that allows a team to:

- Generate ideas about a situation or problem.
- Organize a large number of ideas, opinions and issues into meaningful groups.
- Communicate their ideas in a simple and powerful representation.

### Why do it?

When attempting to understand a situation or solve a problem, the task is to find amongst all the possibilities those critical aspects or solution respectively. Borne out of a reductionist mind-set, we often attempt to do this in one-step by “jumping” to the “answer” since we obtain an outcome quickly. This obsession with speed typically results in the wrong understanding or solution, thus requiring a return to and reconsideration of the situation or problem at a later date typically at great expense in terms of cost and time.

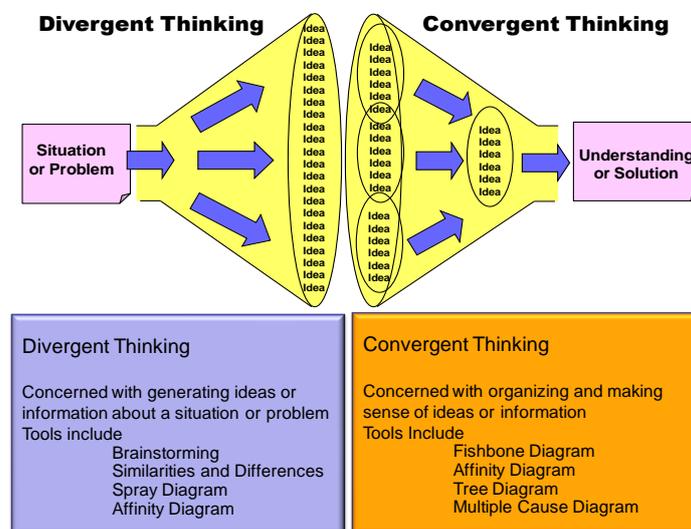
Systems Thinking, however, asserts that we need to be more holistic and consider the whole of the situation or problem. Achieving this logically comprises two activities:

1. Generating information
2. Organizing information.

These two activities require different mental skills and are often referred to as Divergent Thinking and Convergent Thinking respectively:

- **Divergent Thinking:** concerned with generating information and ideas about a problem or situation. Associated with “right-brain<sup>1</sup>” creative thinking it requires the use of both logical and lateral thinking and the suspension of the human mind’s tendency to self-censor.
- **Convergent Thinking:** concerned with organizing, categorizing and making sense of information and ideas. Very much logical “left-brain” thinking. It is often a destructive activity with the removal and consolidation of ideas and information.

The concept of Divergent and convergent thinking is shown pictorially in Figure 1.



**Figure 1: Affinity Diagramming fully supports Divergent and Convergent Thinking**

To aid the two types of thinking a number of tools are available and Affinity Diagramming is particularly powerful because it integrates both the Divergent and Convergent thinking activities providing a single approach.

### Where and when to use it?

The Affinity Diagram is an alternative to brainstorming that is particularly useful when:

- The situation or problem is too large or too complex to be handled by a simple brainstorming session.
- There is a need to get agreement between a number of individuals.
- There is a need to communicate the outcomes to other people.

<sup>1</sup> Right and left brain thinking stems from research that shows that the hemispheres of the human brain are optimised for different types of thinking. Typically the left hand hemisphere is associated with logical thought while the right with creative imaginative thinking.

- There are likely to be issues around group dynamics where it is not possible or desirable to have a non-hierarchical group.

## Who does it?

Affinity Diagrams can be created by an individual or, more powerfully, by a team. This is primarily because it is a creative thinking tool whose purpose is to generate information about the problem or situation. It is therefore important that a team comprises members who have knowledge about the situation or problem. There is, however, no reason why this core team cannot be supplemented with additional members who have limited experience of the situation or problem. This can help ensure that “obvious” or “basic” information is not excluded; experts often mentally “self-censor” ideas non-experts do not.

There is great benefit in terms of quality of output and time efficiency if the sessions are facilitated by people, who are familiar with the tool and its use.

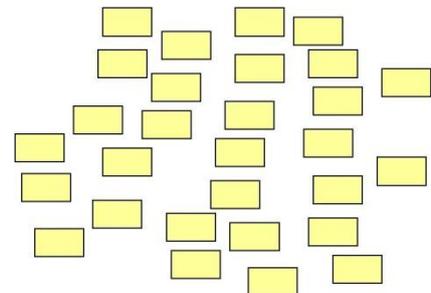
## How to do it?

There are two basic approaches to generating an Affinity Diagram: the *classic* approach, which can be accomplished with or without a facilitator, and the *facilitated* approach (which must be done with a facilitator).

### The Classic Affinity Diagram Approach

#### Divergent Thinking Stage

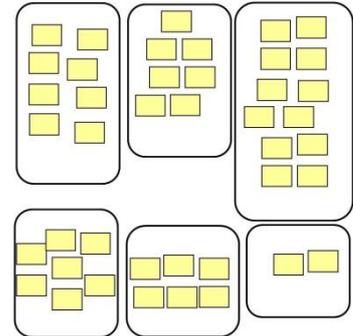
- The team uses sticky notes or cards to record the individual views/ideas about the problem or situation. It is typical to allocate a certain time period for this (15 minutes is often suitable).
- Each team member writes their ideas on a sticky note or card with one per sticky note or card.
- The sticky notes are then stuck on a wall or card stuck on a pin board.



Allowing each team member to individually think of and capture their own ideas avoids issues that surround a hierarchical group or a group containing either a dominant and/or shy individual. It allows each team member to make a more balanced contribution, but it does result in duplications.

## Convergent Thinking Stage

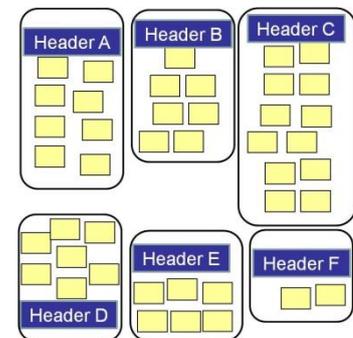
- In silence, the team organize the sticky notes or cards into related groups that are thematically linked; that have an affinity. The intent is to let the natural groups emerge consensually. Silence is used to restrict individuals from forcing non- consensual structure on the outcome.



- Everyone is allowed to move the sticky notes or cards in order to place them with others with which they consider they have affinities.
- Existing groups can be broken and new groups should be allowed to emerge.

- Once the groups have reached a stable state, the team should now discuss the groups to:

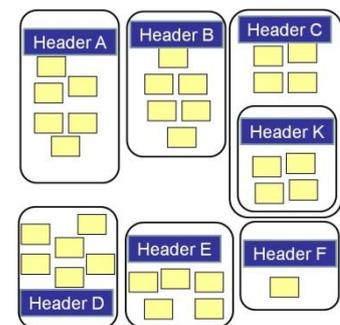
- Give each group a header. This may be an existing sticky note or card.
- Larger groups should be sub-divided into smaller groups. A useful rule of thumb is to aim for group sizes of five to seven of different sticky notes or cards (if there are potential duplications – see next step – the group size can be larger. If sub-groups are formed, they too should be given a header.



- The last step is to review the Affinity Diagram to:

- Reconcile duplications. There are two possibilities here:

- Exactly the same words on two or more sticky notes or cards. These should be discussed to determine whether they are capturing the same information or ideas. If they are then the duplications should be removed. If the words capture different ideas or information the sticky note should be rewritten.
- The words are similar or appear to be recording the same information. These should be discussed to determine whether they are capturing the same information or ideas. If they are then a suitable set of words should be agreed. If the words capture different ideas or information then consideration should be given to rewriting the sticky notes or cards to make the difference clear.



- One of the advantages of grouping the sticky notes or cards is that it makes it much easy to review the diagram to identify missing ideas or information. Each group on the Affinity Diagram should be examined to determine, and record, additional ideas or information that is pertinent.

- Consider different groupings. The whole Affinity Diagram should be examined for other groupings and structures.

### **The Facilitated Affinity Diagram Approach**

The use of an experienced facilitator to create an Affinity Diagram can often improve the overall quality of the output and reduce the generation time. There can be some loss of ownership if the facilitator does not allow time for debate and discussion.

#### **Divergent Thinking Stage**

- The Facilitator should start by defining the problem or situation under consideration before directing the team to generate ideas or information. As information or ideas are verbalised, the Facilitator captures the individual views/ideas on sticky notes or cards. A good Facilitator will manage the idea/information generation to avoid any individual dominating. They should also probe the information or ideas to aid in generating further views. It is typical to allocate a certain time period for this (20-30 minutes is often suitable).
- As the information is captured on the sticky notes or cards these are stuck on a wall or pin board as appropriate.

#### **Convergent Thinking Stage**

- The convergent thinking stage is typically carried out as per the classic approach described above.

### **What Goes Wrong: The limitations of Affinity Diagramming**

Affinity Diagramming is a very simple but powerful tool for generating, capturing and organizing ideas and information about a problem or situation. It does however have limitations and can be awkward to use. Some of the issues with its use are given below with advice on avoiding, and recovering from, the problem:

- Individuals dominating the grouping. If the group is hierarchical consider using a facilitator or limit the number people involved in the grouping.
- Difficulties in finding agreed affinities. Ensure that the initial grouping activity is performed in silence. Consider limiting the number of individual involved in the group (a minimum of three is recommended). If affinity groups have not stabilised after 10 to 15 minutes allow the team to discuss potential options for grouping. Consider the possibility of two Affinity Diagrams.
- Do not spend the time:
  - checking out duplications.
  - seeking additional elements.

Explain time allocation at the beginning of the session and allocate sufficient time for resolving duplications and considering addition elements. A typical breakdown is:

- Divergent Stage            15 minutes
- Convergent Stage
  - Affinity grouping        15 minutes
  - Duplications            10 minutes
  - Additional                10 minutes
- Output format not intuitive to novice reader. Completed Affinity Diagrams are not immediately intuitive to a person who has not seen one before. The diagram should be explained if included another document. Alternatively it can be readily converted into a Tree Diagram. An example of this is shown in the following illustrative examples.

### Illustrative Examples

The following example demonstrates the use of an Affinity Diagram to elicit, capture and organize a set of customer/user requirements for a domestic washing machine. It is a typical situation where Affinity Diagramming can be applied. A similar outcome could be achieved by brainstorming but Affinity Diagramming offers several advantages that include:

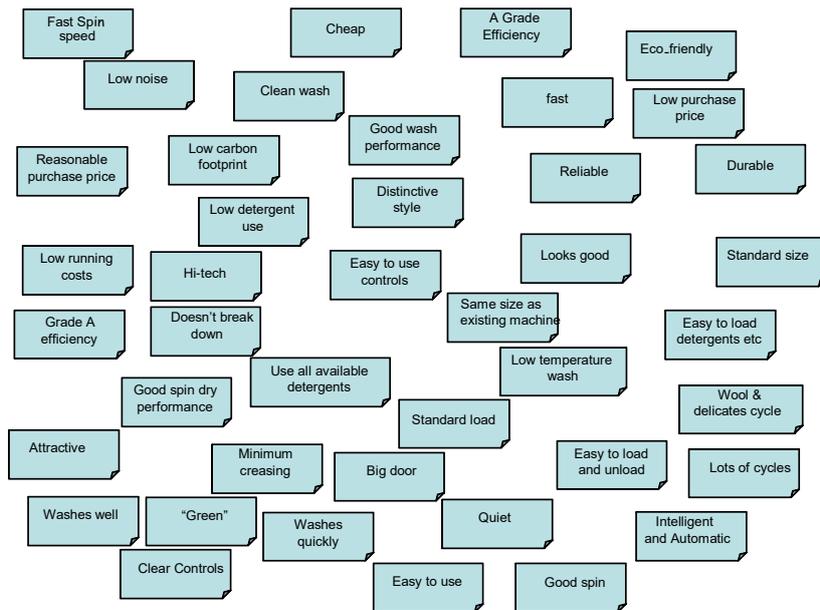
- Organized and structured output.
- Balanced individual input.
- Easily reviewable output.
- Through duplications a qualitative measure of importance.

The team comprised a small number of potential customers for the machine who were set the question:

What are your requirements for your next washing machine?

The question was deliberately posed to extract current needs and expectations. It is important when undertaking an Affinity Diagramming session to be clear on the starting question. Individuals were supplied with a pack of sticky notes. A trivial, but important, point is to provide plenty to encourage the individual to maximise their output. They were instructed to write one requirement per sticky note and stick them on a wall. Emphasis was placed on quantity rather than quality.

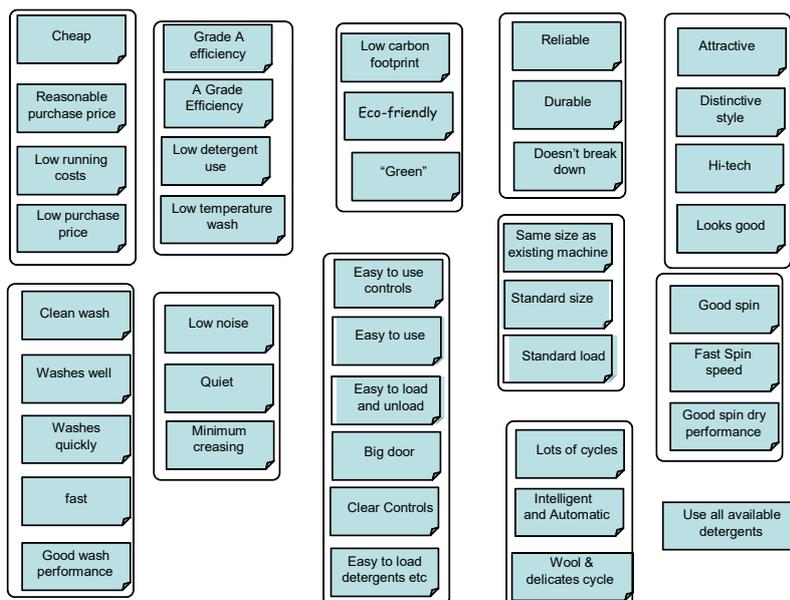
The outcome of this first step is shown in **Error! Reference source not found.** from which it is clear that there are what appear to be several duplications of requirements. This is expected and should be maintained until the appropriate step. Early removal of duplications without discussion can reduce the overall effectiveness of the tool.



**Figure 2: Output of the first step in constructing an Affinity Diagram for a set of user requirements for a washing machine**

Experience shows that this first step will typically take 10 – 20 minutes and it is important to encourage the team members to seek as many ideas as possible. The step should not be brought to a halt if individuals are still writing sticky notes.

The second step is concerned with arranging the sticky notes into themed groups of sticky notes that have an affinity. All the team members should perform this in silence to allow natural or obvious groups to emerge. Many groups find this uncomfortable and quickly begin discussing potential groupings. This is natural and should be only mildly resisted. Figure 3 shows such a grouping.



**Figure 3: Initial affinity groups**

Once the affinity groups are stable, each should be considered in turn to determine a suitable header. This is actually an important step and care and time are necessary to get a good header. A suitable header might be one of the sticky notes or something new that reflects the contents of the group. At this point the creation of suitable headers may lead to some reorganization of the groups. This is perfectly acceptable.

Figure 4 shows the Washing Machine requirements problem.

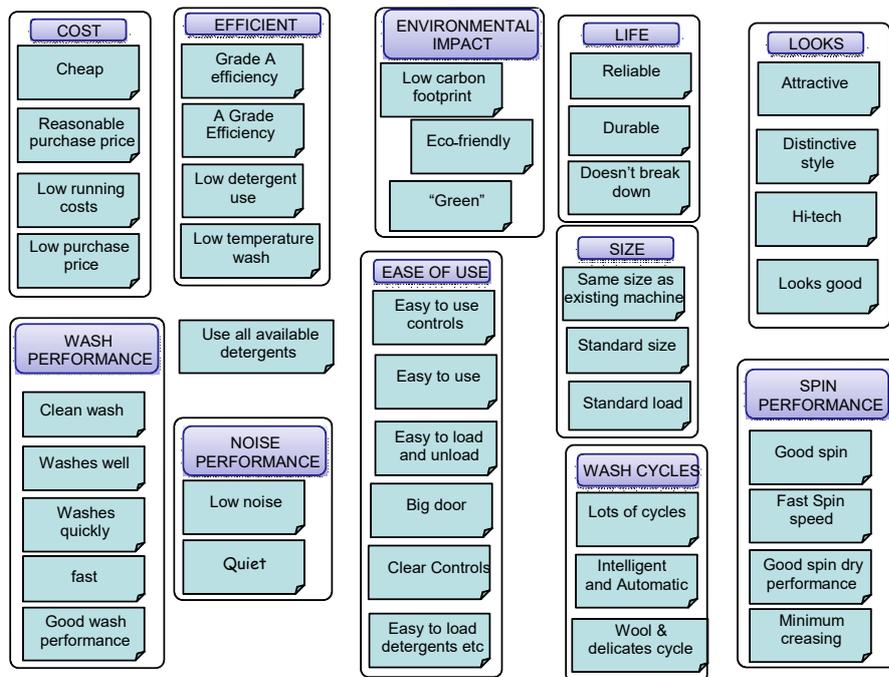
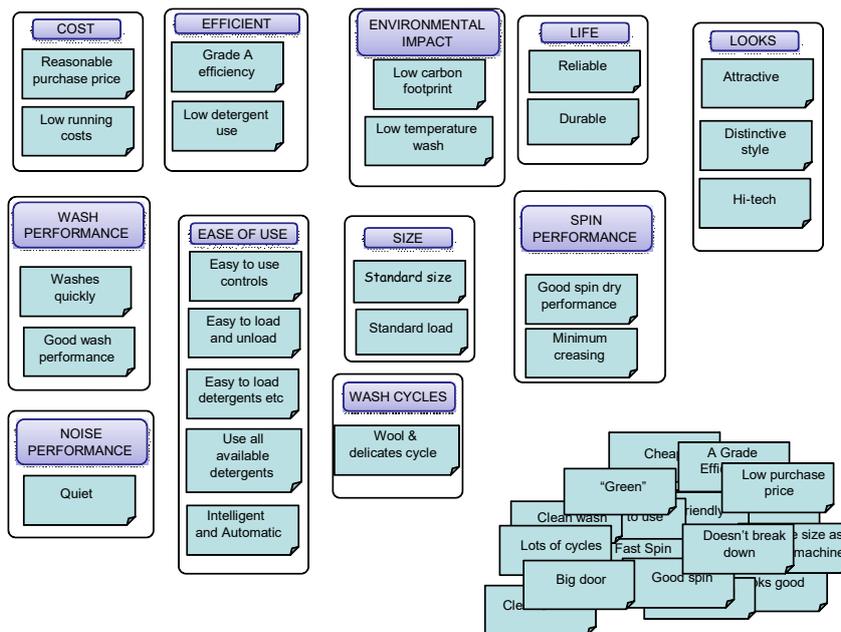


Figure 4: Headed Affinity Groups

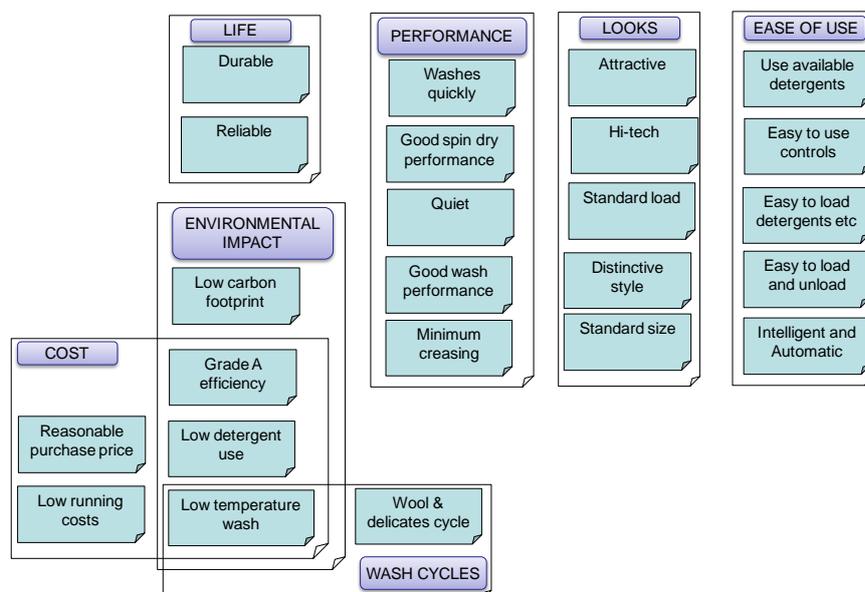
Note that Figure 3 contained a requirement "Minimum creasing" that was associated with "Low noise" and "Quiet". It was clear in attempting to determine a header for this group that "minimum creasing" did not fit and it was moved to the group SPIN PERFORMANCE.

The penultimate step of creating an Affinity Diagram is to review and reconcile duplications. Care again needs to be exercised since duplication not only covers those sticky notes that are identical but those that are similar in intent. For example, Figure 4 contains a group headed COST and in that group are two sticky notes "Cheap" and "Reasonable purchase price". Consultation with the originators of those requirements quickly determined that they were talking about the same requirement of purchase price. Further debate led to the agreement that "Reasonable Purchase Price" was the better description. Accordingly, the "Cheap" sticky note was removed. Figure 5 shows the revised Affinity Diagram following the removal of duplications.



**Figure 5: Revised Affinity Diagram with duplications reconciled**

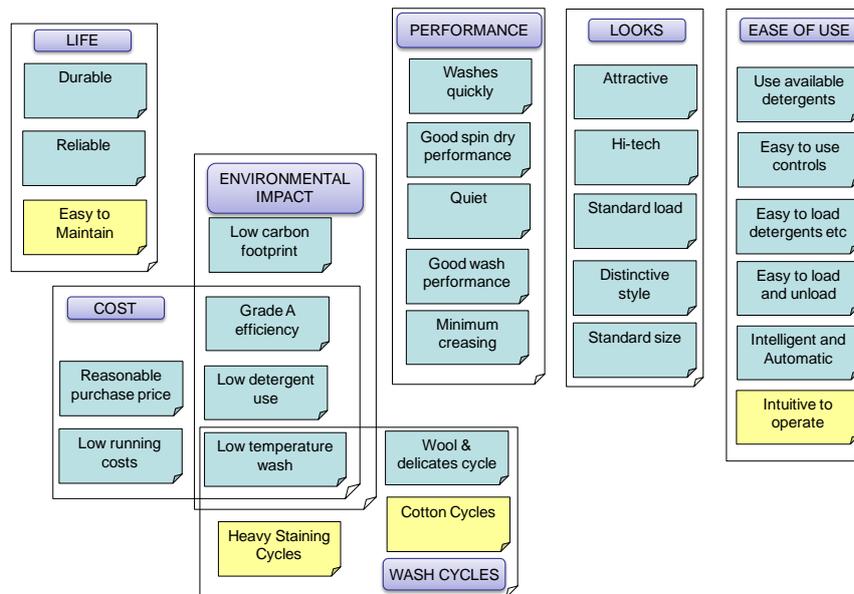
The Affinity Diagram shown in Figure 5 has separate groups. It is quite commonplace when arriving at this grouping for there to be extensive debate because individual ideas (sticky notes) can reside in several groups. This source of potential conflict can be overcome by allowing the various groups to overlap much like a Venn diagram. Not only will this resolve any tension it is also a powerful representation of the inherent complexity of particular situation. This approach is shown in Figure 6 where three of the groups overlap to show that some requirements are members of several groups.



**Figure 6: Nested Affinity Diagram**

The last step in constructing an Affinity Diagram is the review of the groups to identify further ideas. The affinity groups effectively provide a simple mechanism for “divide and rule” such that the individual groups can be reviewed in isolation as a manageable element. Quite simply the question asked is “what is missing from this group?”

shows some additions to the washing machine example and presents the final Affinity Diagram.

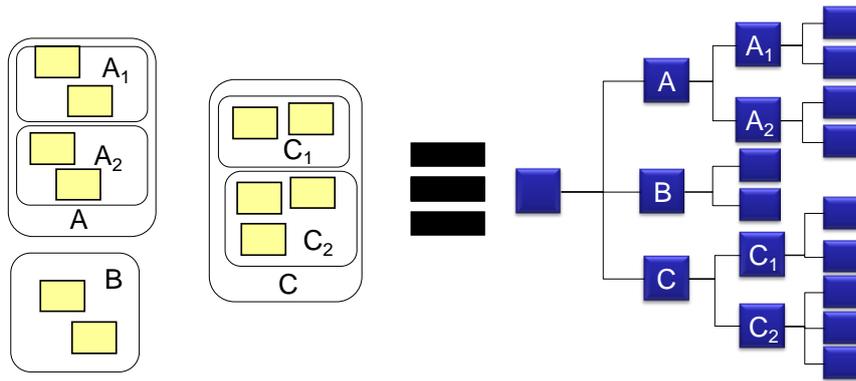


**Figure 7: Final Affinity Diagram for a set of washing machine requirements**

Affinity Diagrams are a very powerful representational tool that allows complex relationships between items to be simply portrayed. They are, however, not intuitive to read when first encountered. Novices often misinterpret the diagrams or ignore them since their message is not apparent. This can be a critical failing of the diagramming method since one of its prime purposes is to communicate the ideas of a team or individual. Indeed, it is critical to good Systems Thinking and Engineering that ideas and thoughts are clearly communicated for review in order to test for completeness and correctness.

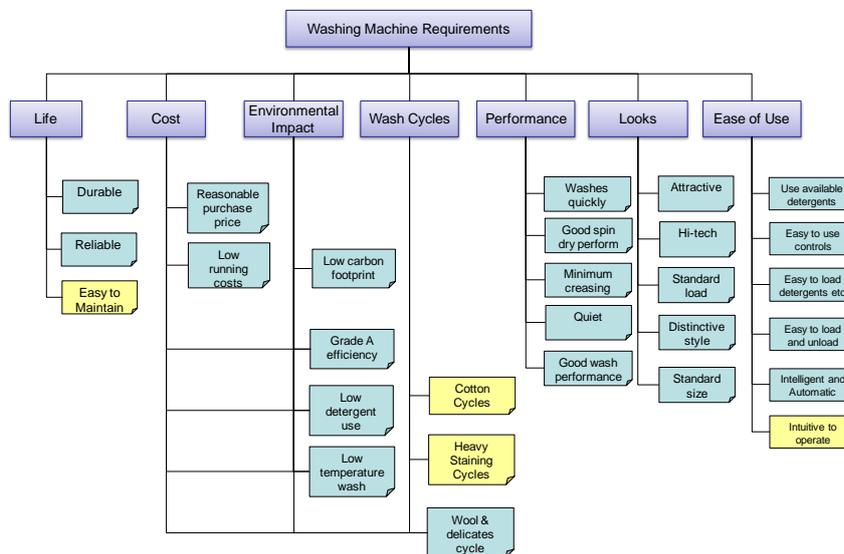
If the reviewing audience is not familiar with the Affinity Diagram representation then the ability to test completeness and correctness is reduced. However, Affinity Diagrams have a simple relationship with the very intuitive representation by means of a simple hierarchy. In other words, it is quite straightforward to convert an Affinity Diagram into a Tree Diagram (hierarchy diagram) as shown in

The main group headings become the first level of the hierarchy. Sub-group headings become the next level and so on until the lowest level captures the individual sticky notes.



**Figure 8 The structural equivalence between Affinity Diagrams and Tree Diagrams**

To complete the washing machine requirements example, Figure 9 shows the Tree Diagram equivalent to the Affinity Diagram shown in Figure 7. Note how the overlapping groups of the Affinity Diagram are captured in the Tree Diagram through multiple connections.



**Figure 9: Tree Diagram representation of the washing machine requirements**

Tree Diagrams, like that shown in Figure 9, are intuitively understood by almost all humans and require little explanation. Thus, it is commonplace to translate an Affinity Diagram into its equivalent Tree Diagram.

## **Bibliography**

Descriptions of Affinity Diagram appear in many texts, particularly those on quality improvement, but unfortunately most are glib and ephemeral. The following are recommended:

Straker David "A Toolbook for Quality Improvement and Problem Solving" 1995, Prentice Hall, ISBN 0-13-746892

Mizuno Sigeru "Management for Quality Improvement: The New 7 Quality Control" 1988, Productivity Press, ISBN-13: 978-0915299294