

**17<sup>th</sup> ICCRTS**  
**“Operationalizing C2 Agility”**

**Understanding What is Meant by ‘Individual Agility’**

**Topic(s)**

Primary: Topic 4 – Collaboration, Shared Awareness and Decision Making

Secondary: Topic 1 – Concepts, Theory and Policy

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## **Abstract**

The United Kingdom (UK) Ministry of Defence (MOD) Development Concepts Doctrine Centre (DCDC) Strategic Trends report Future Character of Conflict (FCOC) [1] set out global and strategic trends for defence and focuses on the concept of agility. The project described in this paper aimed to understand the concept of 'individual agility' by examining current literature to scope the area and then explored the elements of individual agility by conducting a card sort to provide an initial analysis of how the elements of individual agility can be best influenced through recruitment, training and experience. The study team analysed the findings from the card sort by looking for common themes and by conducting a cluster analysis. The conclusions drawn were that individual agility is multi-faceted and can be organised into six distinct clusters: cognitive aspects of individual agility, strength needed for agility, skills needed for agility, the outcome of experienced command, characteristics required to become agile and how to attain agility. Further analysis identified some key knowledge gaps that require further investigation and research.

## **Introduction**

Historically the training and education of soldiers and junior officers in the British Army has focused primarily on tactical tasks, forces and resources. The MOD Development Concepts Doctrine Centre (DCDC) Strategic Trends report Future Character of Conflict (FCOC) published in February 2010 [1] set out global and strategic trends for defence and drew deductions for Defence. This key document focuses on the concept of agility which it states "must be institutionalised at all levels from the organisation to the individual". The FCOC specifies that the "UK must make its people the edge" and that "mental agility will be a fundamental pre-requisite for institutional agility".

The British Army and Force Development and Training (FDT) specifically, have identified that the FCOC requires a need to 'raise the bar' to include more ways and means for training officers and soldiers at both the tactical and operational levels [2] [3]. The FDT Directive "The Basics of 21<sup>st</sup> Century Land Warfare: Redefining and Teaching" [2] recognises that it "must rigorously examine and where necessary change both what we teach and how we teach the basics of land warfare. We are to draw deductions: from the changed and changing characters of conflict; from the changing 'character' of our people; and a hard look at 'what good looks like' in modern training and education".

## **Objective**

The FDT Directive [2] puts the Command on a path to raise the training element of capability, in line with their task to drive change in the Army. The purpose of this study was to identify, from a human factors perspective (i.e. the people element), the issues, risks, and opportunities associated with this change. Specifically, the focus of the study was to 'Understand what is meant by the concept of individual agility'.

## **Methodology**

The following methods were used to explore current thinking about the concept of individual agility:

1. Development of model: Previous work on decision-making by Klein *et al* [4] was used to inform the development of the model of individual agility.
2. Identification of elements: To extract identified elements of individual agility key UK MoD documents were examined [Refs. 5-16]. This high level activity allowed individual concepts to be identified (e.g. responsiveness, adaptability etc).
3. Review: The identified elements of individual agility and the model were reviewed by stakeholders and subject matter experts (SMEs).
4. Card sort: To explore current thinking patterns and trends in individual agility a card sort activity was undertaken using the identified potential elements and the results were variously analysed, including a cluster analysis and a Strengths, Weaknesses,

Opportunities and Threats (SWOT) analysis. This allowed a number of conclusions and recommendations for further research to be generated.

### **Defining Individual Agility**

“Insanity is expecting things to change when we keep doing the same thing” (A. Einstein)

Agility is a seemingly simple concept, like other hypothetical constructs such as workload or situation awareness, but when examined in depth is similarly multi-faceted. Alberts [18] defined agility when he noted that it is about being responsive, that it is the ability to anticipate and or recognize changes that require action and the ability to decide and act in a timely manner. Klein and Pierce [19] describe adaptive teams as agile when, “teams are able to make necessary modifications in order to meet new challenges”.

The authors identified a slightly different version of agility that was:

*“The ability to perceive and adapt to new requirements before failing”*

The key to this definition is three-fold. First, agility, in the authors’ opinion, requires the individual to perceive changes in their environment. Second, they must then do something differently once they have detected the change. Third, the driver for agility is time and outcome bound because they have to successfully achieve this change before the onset of failure. This could be in terms of performance decrement, rather than total failure of the operation.

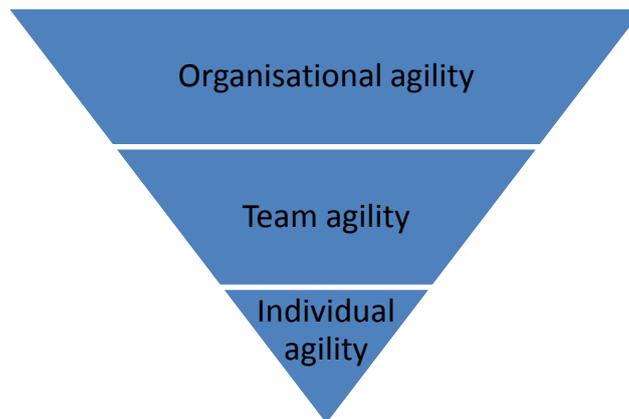
Individual *cognitive* agility then can be thought of as ‘the way decisions are made and the kinds of decisions made’ and the ‘extent to which an individual’s thinking is flexible when data indicate the situation has changed’. This represents an individual’s ability to utilise their existing expertise into considering new frameworks to tackle novel problems before failure. The reverse is ‘cognitive rigidity’ such that an individual is impervious to new data and is dominated by a rigid framework or paradigm that acts to filter out new information that may be relevant, thereby creating blind spots.

### **A conceptual model of agility**

For an agile outcome to occur there are three main areas where interventions could be undertaken: at an organisational level, team level and individual level. The study team adopted the simple model shown in Figure 1 to represent these three levels.

Thus to deploy any individual to theatre and expect them to behave in an agile manner they must be prepared by the organisation and have structures provided by that organisation that allow the team to be supported to be agile.

This team in turn needs to be selected, prepared, deployed, trained, equipped and supported such that each individual can behave in an agile manner. Thus this beguiling simple concept invokes a large range of necessary precursors for the individual soldier to be able to exhibit agile behaviour on operations.

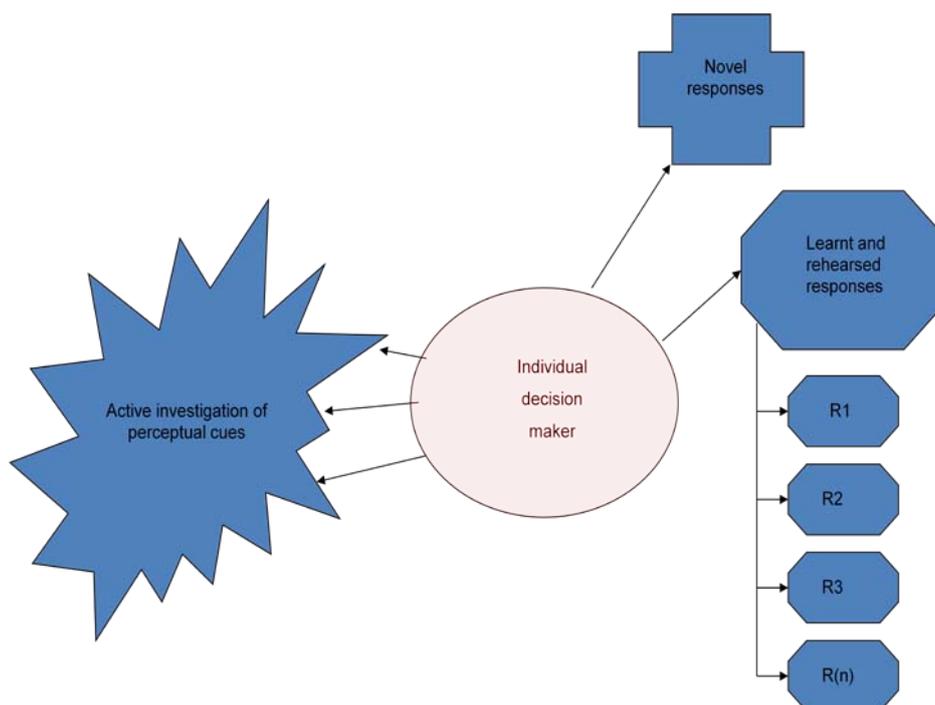


**Figure 1: Conceptual model of agility**

For the purposes of the current study the scope of the task was restricted to just one level of analysis – the individual. However, it is recognised that individual agility will only go so far in terms of providing an agile force.

**A model of agility**

The team were keen to provide a model of individual agility which would allow sensible deductions and practical recommendations to be drawn. A simple ‘off-the-shelf’ model largely based on the Klein Recognition-Primed Decision (Klein *et al*) [3] model of individual cognitive agility was adopted (Figure 2).



**Figure 2: Model of individual agility**

As the model is loosely based on Klein *et al* [3] a number of assumptions can be drawn about the individual approach to decision making, in particular that the individual is most content operating as a “pattern matcher”. Pattern matching is about recognising patterns occurring in the environment that have an agreed, suitable and/or previously successful (“learnt and rehearsed”) response associated with them. Pattern matching is a quick decision approach and appears to be effortless to the onlooker. Thus, the more experience an individual has in an environment, the more patterns they have seen, and the more subtle patterns they are able to differentiate between. Pattern matching is not, however, a passive

serial process, but a parallel active process where the individual may actively seek to gain a better understanding of the environment to ease pattern matching.

As well as being a pattern matcher, the individual is assumed to be a “satisficer”. This means he/she is not trying to optimise the outcome but is trying to select a response from his/her repertoire that is “good enough”. Thus, it is entirely possible that an experienced decision maker is willing to select a response from their repertoire of responses that he/she suspects might not be the best approach, but is likely to work in the time and with the resources available, and has less risk associated with it than a more complicated, less well rehearsed or entirely “novel” response which might be considered optimal (see Figure 2).

The number of responses that an individual has in their repertoire is a function of the amount and quality of experience and training they have had. Experienced decision makers will be able to judge how much time they have to make a decision, and may be constrained by the equipment/resources at their disposal.

In some circumstances an emerging pattern might require the decision maker to make a very quick response to avoid a potentially difficult situation; in other circumstances it is possible to “wait and see” as the pattern emerges and thus hold off selecting any one particular response until later. The ability to assess the amount of time available to consider the decision is highly dependent upon experience.

This simple model of decision making allows one to make a number of deductions regarding the development of individual agile behaviour. These deductions are as follows:

1. The more agile individuals will have a greater skill at identifying patterns in their particular environment. For example, a section commander on operations at the end of his tour in Afghanistan will be able to distinguish the intent of a local national carrying a weapon much more accurately than when he first started his tour. Problem detection is paramount for agility and Klein *et al* [20] describes this as when faced with a very difficult problem, successful problem detection is characterised by individuals who are looking for problems before they have become serious problems.
2. With practice individuals will be able to quickly differentiate between a number of different patterns. Thus providing them with more time to respond.
3. Some seasoned decisions makers become so tuned to their environment that they can anticipate certain patterns in particular circumstances and thus are able to change or adapt their course of action very nimbly. For example, the authors have observed pilots anticipate the release of their clearance to a new flight level and have already keyed in the new flight level into their flight management system and just need to activate the command upon the receipt of the clearance.
4. Individuals with a larger repertoire of possible responses will be more likely to exhibit agile behaviour than those with a smaller repertoire. In this instance, if an individual has had little experience of the possible options, they will not have the options to choose from in order to be agile. The idiom of, “all problems look like nails, if the only tool you have is a hammer” comes to the fore here. The authors have witnessed surgeons undertake the planned surgical procedure even though the patient’s anatomy is less suited to the planned procedure than another procedure.

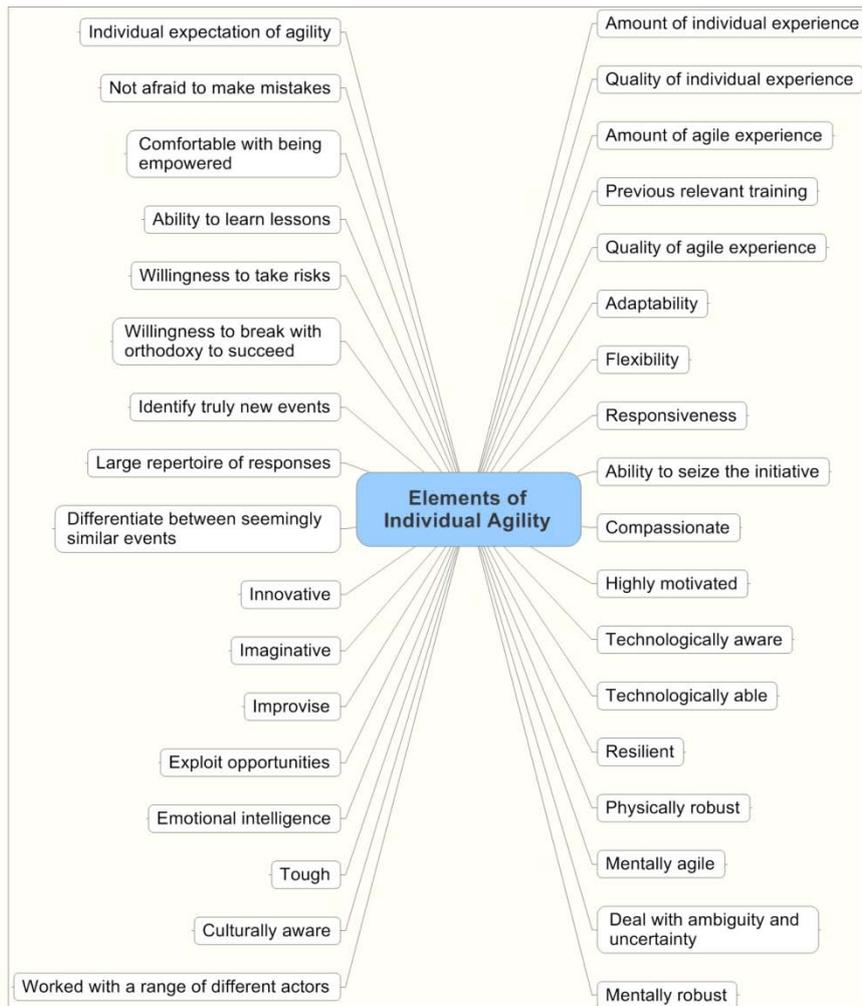
5. In some situations, decisions makers will realise that they are in a truly new situation and that none of their repertoire of responses are suitable. In these situations the individual must seek to generate a novel response. This type of problem solving, according to Rasmussen [21], is considered slow, serial, effortful and error prone. Described as Knowledge Based Behaviour by Reason [22], this type of decision making will eventually provide a novel response. However, identifying the response is only part of the task; the individual will then have to execute a new response which they will generally find effortful and error prone. Klein and Pierce [19] describe a case where a fire fighting commander identified that he and his troop were in a new situation and only a novel response would save their lives. He did not have time to share his new course of action with this troop and two of them subsequently died due to not being able to participate in the new plan.
6. In the truly new situations, the decision maker will have to weigh up a number of competing factors in a time limited situation. In these cases Baddeley [23] says that a decision maker with a more effective working memory will be both quicker and more successful. This situation is more like the classical decision making optimising task. In this case brute logic and individual intelligence is required.
7. Individual agile behaviour can be exhibited once a pattern has been matched and a suitable response selected. In this case the decision maker is monitoring the outcome and determines that something has changed and the response is not generating the required outcome. Agile individuals are skilled in these circumstances to know what measures or indicators they need to monitor in order to identify whether the current course of action is working and they know either how to modify their current response or switch responses completely. Klein and Pierce [19] describe this as the “mindset” of the individual. Those individuals who have a mindset that the course of action may well need to change are more flexible than those who have sunk psychological capital in the single plan and are surprised when they realise the plan will not work/is not working.

### **Identifying elements of individual agility**

To explore current UK MoD thinking on the concept of agility a number of documents were examined (Refs. 4-17) and high-level topics relating to agility extracted. These topics were combined with the above deductions in relation to individual decision-making to generate a number of elements (Figure 3) which might provide suitable to identify and enhance thinking about individual agility.

These elements of individual agility and the model were reviewed by stakeholders and subject matter experts (SMEs) to ensure suitability.

The elements can be thought of as being some of the conceptual building blocks to describe individual agility. The identified elements were subsequently used in a card sorting procedure reported below.



**Figure 3: Elements of individual agility**

These elements are deemed to be important to agility but it was unclear as to how to instil these qualities in the individual, nor how important they were. For this reason a card sorting activity was undertaken to elicit subject matter expert (SME) advice. The options provided to the respondents were 1) train in these qualities, 2) allow individuals to accumulate them by providing the breadth and depth of experience and finally 3) recruit individuals who have the preponderance to exhibit these characteristics.

This potentially provides an interesting gap with the Klein type Naturalistic Decision Making (NDM) approach to individual agility which is focused on the role of experience and expertise and rarely explores issues of selection. Klein's research paradigm generally relies upon knowledge elicitation with expert practitioners. It generally does not explore the idea that individuals might be able to be recruited to exhibit these particular characteristics. The NDM perspective typically explores situations where these skills are acquired via experience and training.

However, Pulakos *et al* [24] undertook a wide ranging study into the taxonomy of individual adaptability in the workplace. They produced a taxonomy of adaptive performance from both interviews and factor analysis which they believe can be used to select individuals to exhibit adaptable behaviour in workplace settings. They call this the Job Adaptability Inventory. The dimensions identified are:

1. Handling emergencies or crisis situations
2. Handling work stress

3. Solving problems creatively
4. Dealing with uncertain and unpredictable work situations
5. Learning work tasks technologies and procedures
6. Demonstrating interpersonal adaptability
7. Demonstrating cultural adaptability
8. Demonstrating physically orientated adaptability

In addition, tools such as 'Cognitive Agility Profiler' developed by DiBello [25] to help people locate themselves as decision makers may provide useful examples of how to identify and measure agility (e.g. similar to comparing a novice chess player with a grand master). This tool profiles the framework or heuristic, that an individual or team uses to approach problems in a given context, as well as the degree of agility present in the individual or team. It was built around understanding how world-class experts approach and solve complex business problems in contrast to less experienced individuals. An individual's answers are rated and compared to those of the ideal expert.

### **Data collection and analysis**

Twelve people participated in the card sort activity including military personnel, and subject matter experts.

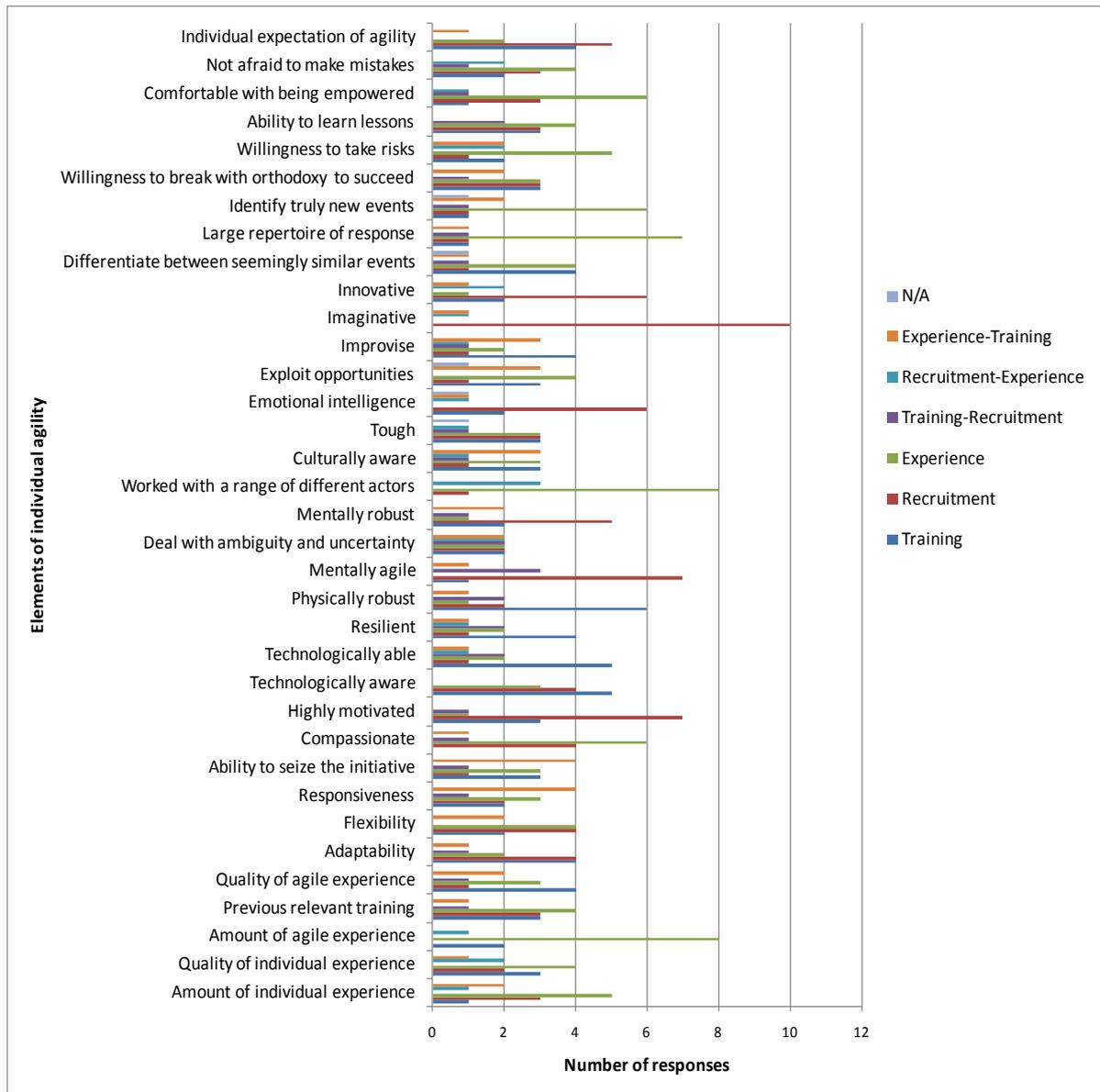
Participants organised each of the thirty five elements of individual agility into three piles relating to where they believed each could be influenced most effectively – training, recruitment and experience (or in between if they felt that more than one category was relevant). Participants then selected their top five elements and provided a rationale for their selection.

These card sort data should be viewed with a degree of caution due to the relatively small sample size who participated in the activity. However, the data does illustrate some common themes across participants from a range of backgrounds with respect to the Training, Experience and Recruitment categories. Although, these data are from a small sample size and should be viewed with a degree of caution the key points to note from those selected by at least half the participants are:

- The elements felt to be most influenced by recruitment were imaginative, emotional intelligence, mentally agile and highly motivated.
- The elements felt to be most influenced by experience were comfortable with being empowered, identify truly new events, large repertoire of responses, worked with a range of different actors, compassionate and amount of agile experience.
- The element felt to be most influenced by training was physically robust.

Table 1 shows how participants categorised the thirty five elements.

**Table 1: Analysis of element by category**

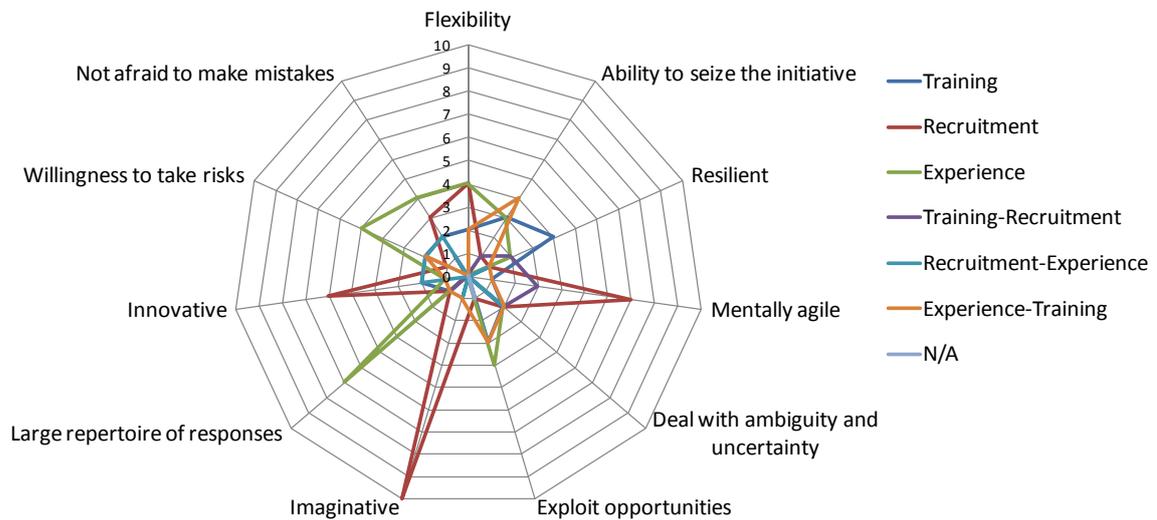


The potential ways to effectively influence the elements of individual agility were identified by the participants placing them into categories of recruitment, training and experience. Figure 4 shows the most frequently selected category type for each element.

The 'radar' diagram in Figure 4 further expands on these findings by illustrating the categories thought to be most influential on the most commonly selected elements of individual agility. The scale shows the number of times each element was placed in each category (a maximum of 10). Although, these data are from a small sample size and should be viewed with a degree of caution the key points to note are:

- The elements of imaginative, innovative, flexibility and mentally agile are thought to be most effectively influenced at the point of recruitment.

- The elements of flexibility, willingness to take risks, large repertoire of responses and ability to seize the initiative are thought to be most effectively influenced by experience.
- The element ‘deal with ambiguity and uncertainty’ was selected the most frequently but there was no agreement on how it could be best influenced.



**Figure 4: Most selected ‘top 5’ elements by category of influence**

### Cluster analysis

The statistical method of cluster analysis was applied to the card sort data to help identify the underlying data structures in the participants’ responses. This analysis required a simple similarity matrix to be calculated by counting on how many occasions each card was placed in the same group as every other card. This 35x35 distance matrix was analysed using Ward’s method to identify, in Euclidian space, the cluster structure. This structure is not related to name of the group that cards were placed in but where they were placed in relation to each other. For the purposes of the analysis the 35 elements were given abbreviated titles (Table 2).

**Table 2: Cluster analysis abbreviations**

1	Innovation	INNOVIAT
2	Imagination	IMAGINT
3	Emotional intelligence	EM-INTEL
4	Mental Agility	MNT_AGIL
5	Tough	TOUGH
6	Mentally robust	MNT_ROBU
7	Physically robust	PHY_ROBU
8	Highly motivated	HI_MOTIV
9	Culturally aware	CULT_AWR
10	Technologically aware	TCH_AWRE
11	Individual expectation of agility	EXPT_AGL
12	Resilient	RESLANT
13	Deal with ambiguity and uncertainty	D_AMBIGY

14	Technologically able	TCH_ABLE
15	Compassionate	CMPASSANT
16	Previous relevant training	PRV_TRN
17	Willingness to take risks	TK_RISKS
18	Differentiate between seemingly similar events	DIF_EVNT
19	Willingness to break with orthodoxy to succeed	BRK_ORTH
20	Identify truly new events	ID_NEW
21	Exploit opportunities	EXPLT_OP
22	Ability to seize the initiative	SZ_INITI
23	Improvise	IMPROVIS
24	Responsiveness	REPSON
25	Ability to learn lessons	AB_LRN_L
26	Flexibility	FLEX
27	Adaptability	ADAPT
28	Amount of agile experience	AM_A_EXP
29	Worked with a range of different actors	WK_ACTRS
30	Quality of individual experience	QL_EXP
31	Not afraid to make mistakes	NT_MSTKE
32	Comfortable with being empowered	CMF_EMPW
33	Large repertoire of responses	LG_RSPNS
34	Quality of agile experience	QL_A_EXP
35	Amount of individual experience	AM_EXP

The results of the cluster analysis are shown in Figure 5. The linkage distance between two items that are closest indicates that they were most likely to be in the same group. For example, starting at the left hand side of the graph, the card 'innovation' (INNOVIAT) was often sorted to be in the same set as 'imaginative' (IMAGINT). Likewise 'emotional intelligence' (EM\_INTEL) and 'mental agility' (MNT\_AGIL) were closely linked and these two clusters are highly related. However, these items are very distant from items on the far right, 'Amount of experience and quality of agility experience' (AM\_EXP).

Thus from this graph it is a relatively easy to identify a sensible number of clusters of conceptual issues. These titles are entirely arbitrary but are an attempt to understand the underlying data structure. The clusters are thus summarised as:

**Cluster 1: “Cognitive aspects of individual agility”**

- Innovation; Imagination; Emotional intelligence; and Mental agility.

**Cluster 2: “Strength needed for agility”**

- Tough; Mentally robust; Physically robust; Highly motivated.

**Cluster 3: “Skills needed for agility”**

- Culturally aware; technically aware; Expectation of agility; Resilient; Ability to deal with ambiguity; Technically capable; Compassionate and Previous relevant training.

**Cluster 4: “The outcome of experienced command”**

- Take risks; Differentiate between seemingly similar events; Willingness to break with orthodoxy to succeed; Identify truly new events; Exploit opportunities and Seize the initiative.

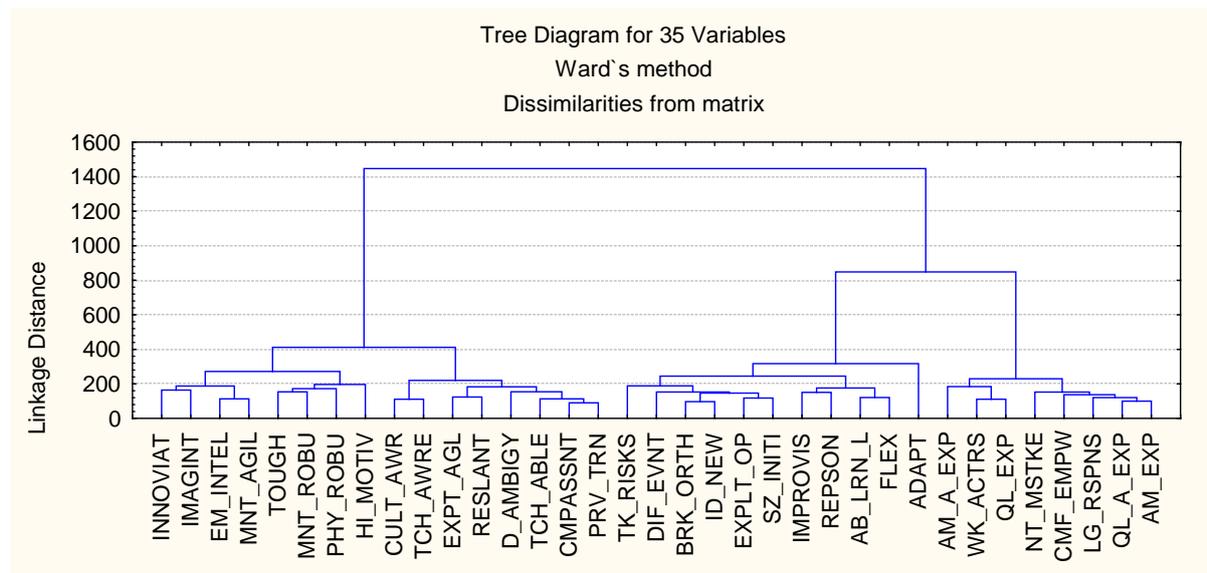
**Cluster 5: “Characteristics required to become agile”**

- Improve; Responsiveness; Ability to learn lessons; Flexibility and Adaptability

**Cluster 6: “How to attain agility”**

- Amount of agility experience; Worked with large range of actors; Quality of experience; Not afraid to make mistakes; Comfortable with being empowered; Large repertoire of responses; Quality of agile experience and Amount of experience.

This short, exploratory data analysis would suggest that collectively this small number of respondents were considering the agility items in a structured manner. These groupings could be used to help construct development plan for agility which is meaningful to military practitioners.



**Figure 5: Tree diagram showing Ward’s method clusters for card sort data**

**SWOT Analysis**

An initial Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis has been compiled based on the authors’ view of the concepts being discussed in the current literature (see bibliography) and the findings from this study’s initial examination of the concept of individual agility (Table 3). The SWOT aims to pull together some of the key gaps identified throughout the course of the project that are likely to require further exploration by future studies. This should be viewed as ‘work in progress’ and should be further developed as the concept becomes better understood.

**Table 3: SWOT Analysis on Individual Agility**

Strengths	Weaknesses
<p>Identified and agreed elements of individual agility – an initial step towards creating a model of agility.</p> <p>Difficult concept to pin down/not prescriptive and no one size fits all – but has common themes.</p>	<p>Elements are poorly defined and understood.</p> <p>Measurements do not exist for individual agility.</p> <p>Team agility is not well understood and has further compounding elements within the concept.</p>
Opportunities	Threats
<p>Create measures of individual agility that can be integrated into recruitment/selection and training and built into individual and team experiences.</p> <p>Start to understand how to recruit people who are cognitively agile and how to develop and enhance these skills during training and through individual and team experiences.</p> <p>Develop a feedback system to identify agile behaviour in operations, training etc.</p> <p>Build a core competency around agility.</p> <p>Create selection, testing and recruitment criteria that identify cognitively agile individuals.</p> <p>Assist leaders to communicate agility.</p> <p>Encourage intelligent risk taking.</p>	<p>Lack of organisational enablers – i.e. mindset/culture, preparation, flexibility, adaptability and empowerment. The organisational set up needs to be in place to allow an agile person to act in an agile way: otherwise people who are implicitly agile may be prevented by structures from exercising this agility (e.g. job descriptions, processes, compensation, rewards, policies need to align with the new behaviours).</p> <p>Agility comes from the complex interaction of many individual, team and organisational factors.</p>

**Conclusions**

Individual agility is a seemingly simple concept, like other hypothetical constructs such as workload or situation awareness, but when examined in depth is multi-faceted. The definition adopted for the purposes of this study is that agility is the ability to perceive and adapt to new requirements before failing.

While the card sort data should be viewed with a degree of caution due to the relatively small sample size, the main conclusions of this study are:

1. Individual agility can be broken down into numerous components or elements. A total of thirty five elements were identified. During a card sort activity with 12 participants, the most frequently selected elements were: Deal with ambiguity and uncertainty, Mentally agile, Exploit opportunities, Imaginative, Willingness to take risks, Large repertoire of responses, Not afraid to make mistakes, Flexibility, Ability to seize the initiative, Resilient and Innovative.
2. The most frequently selected individual agility element in the card sort activity was ‘deal with ambiguity and uncertainty’. This is an important

element, but currently there is no clear route to influence selection or enhancement of this skill across recruitment, training or experience.

3. The elements of imaginative, innovative, flexibility and mentally agile were thought by participants to be most effectively influenced at the point of recruitment.
4. The elements of flexibility, willingness to take risks, large repertoire of responses and ability to seize the initiative were thought by participants to be most effectively influenced by experience.
5. A cluster analysis suggested that collectively respondents were considering the agility items in a structured manner. The six groupings identified could be used to help construct development plan for agility that is meaningful to military practitioners.

Cluster 1. Cognitive aspects of individual agility

Cluster 2. Strength needed for agility

Cluster 3. Skills needed for agility

Cluster 4. The outcome of experienced command

Cluster 5. Characteristics required to become agile

Cluster 6. How to attain agility

6. The initial SWOT analysis based around the concept of individual agility identified some key gaps that require further work, in particular the threat of a lack of organisational enablers (e.g. culture, empowerment, policies, job descriptions etc).

## **Recommendations**

The following recommendations are made to assist other researchers to gain a deeper level of understanding about the concept of agility through further, more focused, research.

1. Conduct a similar activity with a large number of participants to explore the reliability of the conclusions drawn from this small scale study.
2. Gather military case studies of individual, team and organisational agility in practice (both good and bad – e.g. times when X was agile and it worked; times when X was agile and it didn't work; times when X was not agile/was rigid and it didn't work; times when X was rigid and it worked) and also for non-military organisations, such as the police, for comparison.
3. Research team agility in terms of relevance of the identified elements and the measurements that can be used to identify and assess behaviours. What does team agility look like? What are the enablers? What are the barriers?

4. Explore and understand the organisational characteristics that encourage and impede individual agility. What does team agility look like? What are the enablers? What are the barriers?
5. Explore non-military creative and innovative thinking training and apply to military training context.
6. Identify reliable measures of individual and team agility. This could involve:
  - Exploring non-military cognitive agility recruitment methods, measurements and taxonomies and apply to the military context (e.g. Cognitive Agility Profiler developed by DiBello *et al*, [25], Job Adaptability Inventory developed by Pulakos *et al* [24]).
  - Seeking evidence of team agility during training processes.
  - Developing behavioural markers of what agility looks like which can be used for assessment during recruitment, training and experiences.
  - Nurturing agile talent (i.e. do not train out agility). What are the innate attributes that support agile thinking and behaviour?
  - Rewarding agility through assessment process.
  - Incorporating agility as part of the career development process.
  - Enhancing individual and team agility through education and experience.
  - Providing opportunity to exercise an individual's agile talents.
7. Explore the cognitive underpinnings of the skill set for key military tasks. Locate individuals with regard to these models (e.g. like chess players evaluated against the notion of a grand master).
8. Adopt a holistic approach to the concept of agility by adopting a systems thinking approach to consider individual, team and organisational agility (e.g. create a culture in which people feel encouraged and are supported in being agile).

The following recommendations from the card sort analysis are proposed to facilitate the development of individual agility:

9. Being able to 'deal with ambiguity and uncertainty' was the most frequently selected 'top 5' element of agility. Participants were all unsure about whether this can be influenced during recruitment, training or through experience and felt that there was currently no clear way to measure this element. Therefore, how to identify and enhance this potentially important element of individual agility should be explored further.
10. Develop measures to identify the key characteristics in individuals at the point of recruitment.
11. Enhance individual agility. This could involve:
  - Developing training to develop and enhance resilient individuals.

- Building in opportunities for flexible behaviour and thinking during and after experiences.
- Developing opportunities to enhance the ability to seize the initiative through training and experience.
- Exploring the types of experience that can increase a soldier's repertoire of responses (e.g. Enable individuals to work with a different range of actors such they can develop much wider repertoire of responses or repertoire generation training). Or exploring alternative Courses of Action (COAs) in a what-if exercise in an After Action Review (AAR) (e.g. what if we had done X instead of Y).
- Building in opportunities to enhance the ability to exploit opportunities through training and experience.
- Provide individuals with suitable learning environment where they are allowed to take intelligent risks and potentially fail without harming their career. The organisation must support this type of behaviour.
- Building in opportunities for soldiers to learn from their mistakes through experience.

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### References

1. Ministry of Defence (2010) Strategic Trends Programme: The Future Character of Conflict (FCOC). *Development Concepts Doctrine Centre (DCDC)*.
2. Army (2010) The New Core Basics for Every Soldier and Every Officer for 21<sup>st</sup> Century Warfare. *Ministry of Defence* FDT CIG INJECT 001/10.
3. Army (2010) *The Basics of 21<sup>st</sup> Century Warfare: Re-defining and Teaching*. FDT/3/4, Directive 001, 01 October.
4. Klein, G., Orasanu, J., Calderwood, R., and Zsombok, C.E. (1993) Decision Making in Action: Models and Methods. *Ablex Publishing Co., Norwood, NJ*.
5. Cornish, P. and Grouille, O. (2011). Land Forces Fit for the 21st Century. *Chatham House International Security Programme*, ISP PP 2011/02.
6. Mackley, T., Barker, S. and John, P. Concepts of Agility in Network Enabled Capability. [http://www.nectise.co.uk/pdfs/9\\_Tim%20Mackley.pdf](http://www.nectise.co.uk/pdfs/9_Tim%20Mackley.pdf) [accessed 21st November 2011].
7. Ministry of Defence (2011) Agile Warrior 11: Summary of insights.
8. Ministry of Defence (2011). Agile Warrior. *Centre for Defence Enterprise, Cardiff University*.

9. Ministry of Defence (2010). What is meant by the term 'Transformation' in the military context? *FDT CIG INJECT 002/10*.
10. Ministry of Defence (Winter 2010/11). Get it right first time. *British Army Review Number 150*.
11. Ministry of Defence (March 2011). Exercise Agile Warrior and the future development of UK Land Forces. *Royal United Services Institute: Occasional Paper*.
12. Ministry of Defence (Spring 2011). What must a future Officer Corps be and what should it feel like? *British Army Review Number 151*.
13. Ministry of Defence (2011). People as our strategic edge. *LF/DAPS/PROJ/SE. 24 February*.
14. Ministry of Defence (2011). 'Agility' – a blue print for the flexible force. *An Agile Warrior experiment paper (Work Package 6) for DGLW*.
15. Parton, N. (2006). Air Power: The Agile Air Force. *CAS Air Power Conference. RAF Ministry of Defence*. ISBN 0-9522189-1-8.
16. Alberts, D.S. (2011). The Agility Advantage: A survival guide for complex enterprise and endeavours.  
[http://www.dodccrp.org/html4/research\\_agility.html](http://www.dodccrp.org/html4/research_agility.html).
17. Klein, G. and Pierce, L. (2001) Adaptive Teams. *6th ICCRTS conference*.
18. Klein, G., Pliske, R. M., Crandall, B., & Woods, D. (1999). Features of problem detection. *Proceedings of the Human Factors and Ergonomics Society 43rd Annual Meeting*, 1, 133-137.
19. Rasmussen, J. (1983) Skills, rules, and knowledge; Signals, signs, and symbols, and Other Distinctions in Human Performance Models. *IEE Transactions on systems, man and cybernetics*, Vol.13, No.3, May.
20. Reason, J. (1990) Human Error. *Cambridge University Press*.
21. Baddeley, A. (1992) Working Memory. *Science, New Series*, Vol. 255, No. 5044. (Jan. 31, 1992), pp. 556-559.
22. Pulakos, Arad, Donovan and Plamondon (2000) Adaptability in the workplace: Development of a taxonomy of adaptive performance. *Journal of Applied Psychology*, 85(4), 612-624.
23. DiBello, L., Lehmann, D. & Missildine, W. (2011) How do you find an expert? Identifying blind spots and complex mental models among key organizational decision makers using a unique profiling tool. In *Informed by knowledge: expert performance in complex situations*. Edited by K. Mosier and U. Fischer.