Assessing the Difficulty and Complexity of ELICIT Factoid Sets

Anthony Alston
Lorraine Dodd

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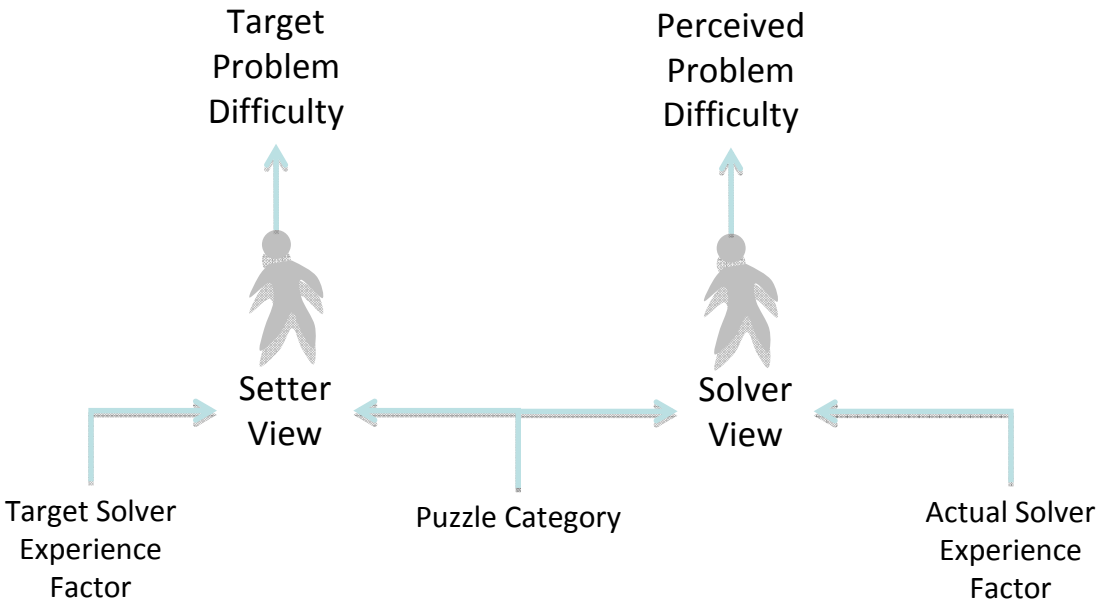
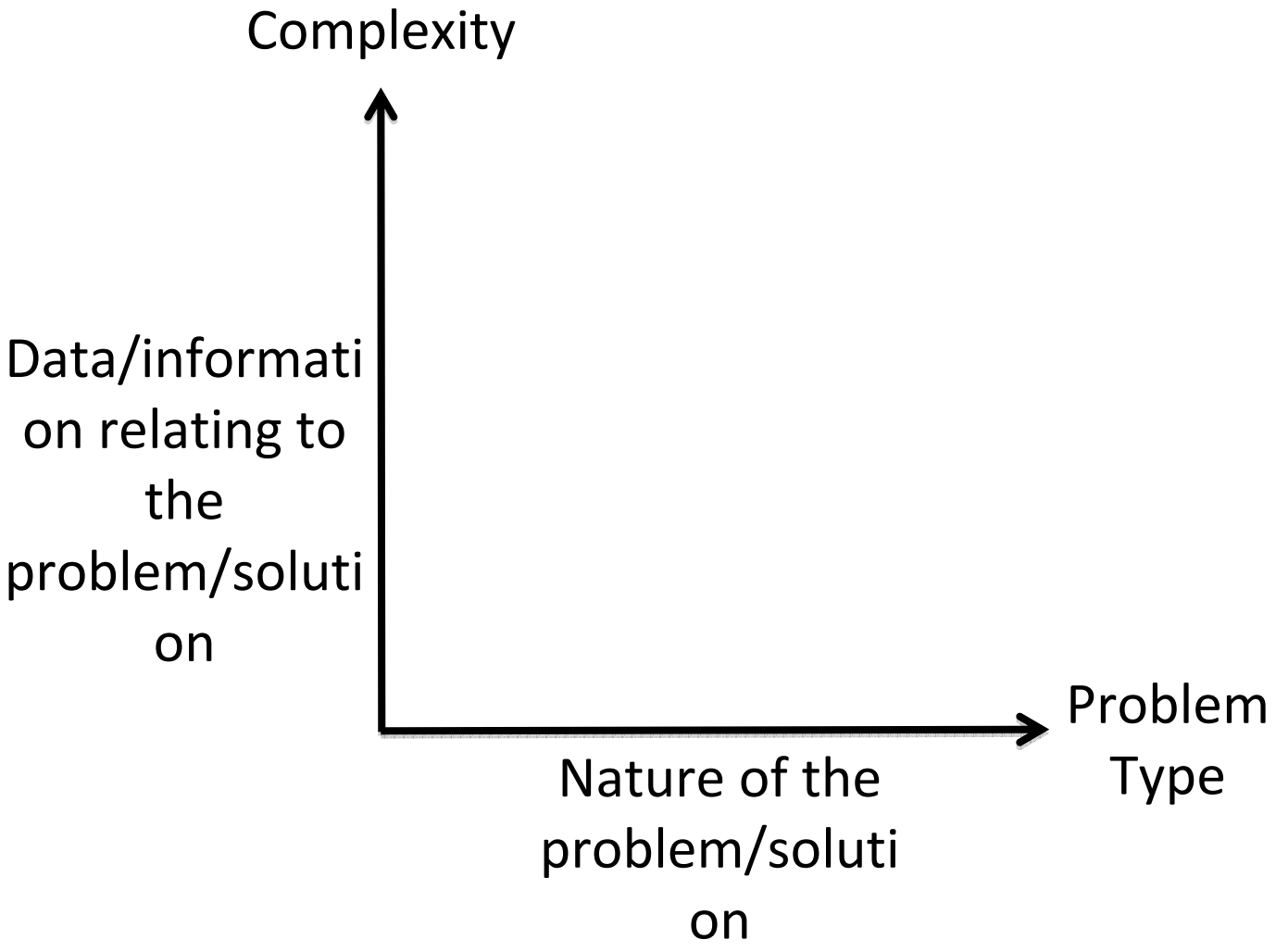
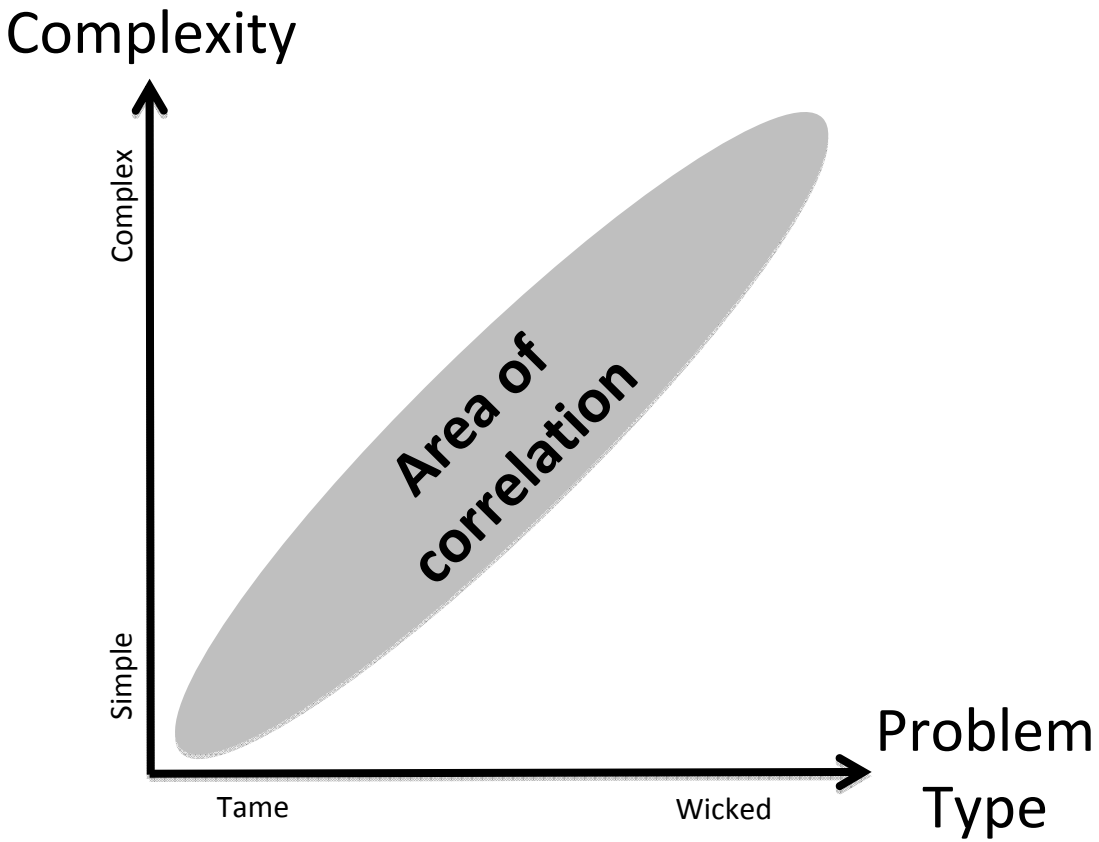
Difficulty due to experience



Factoid complexity and problem type





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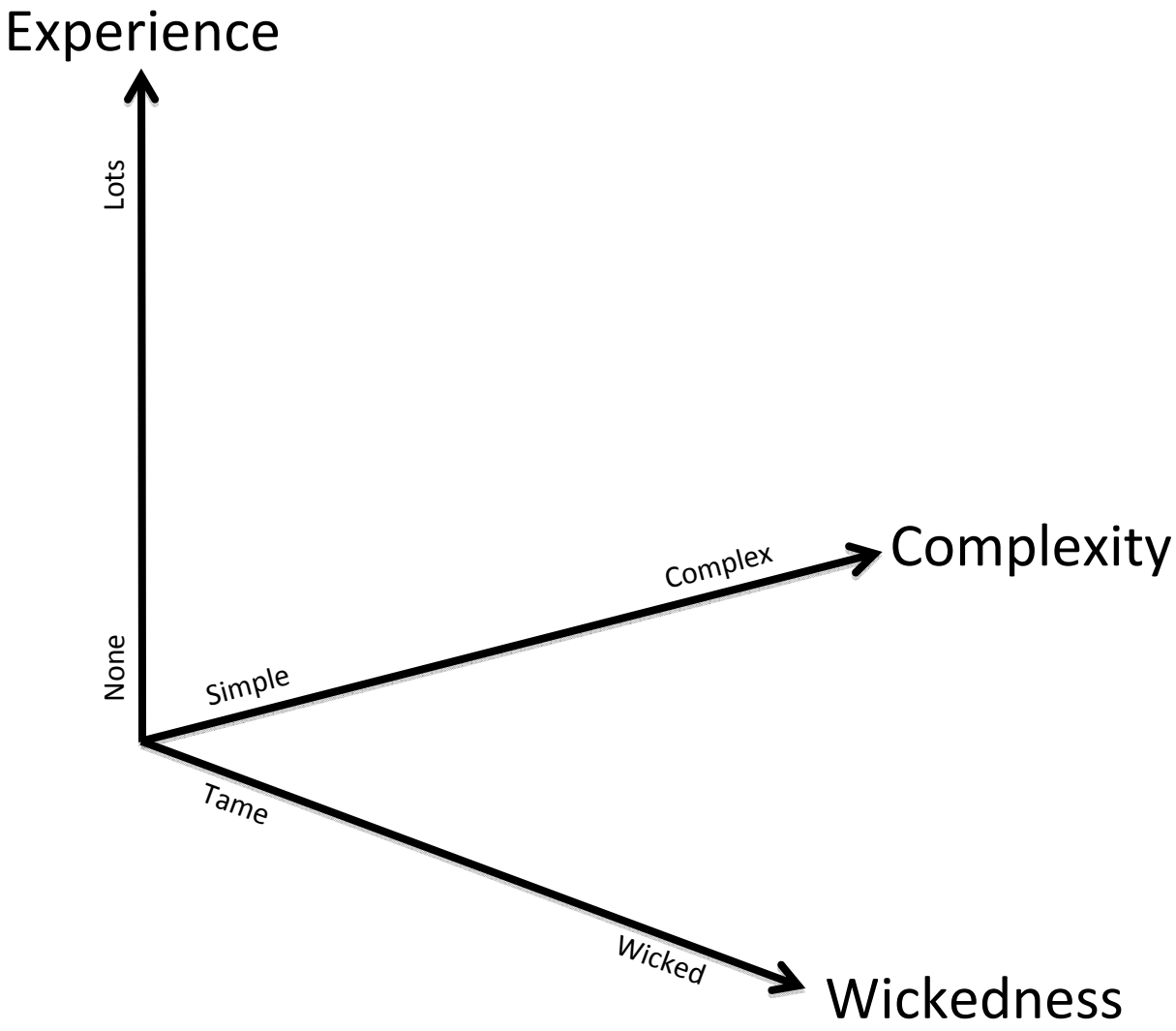
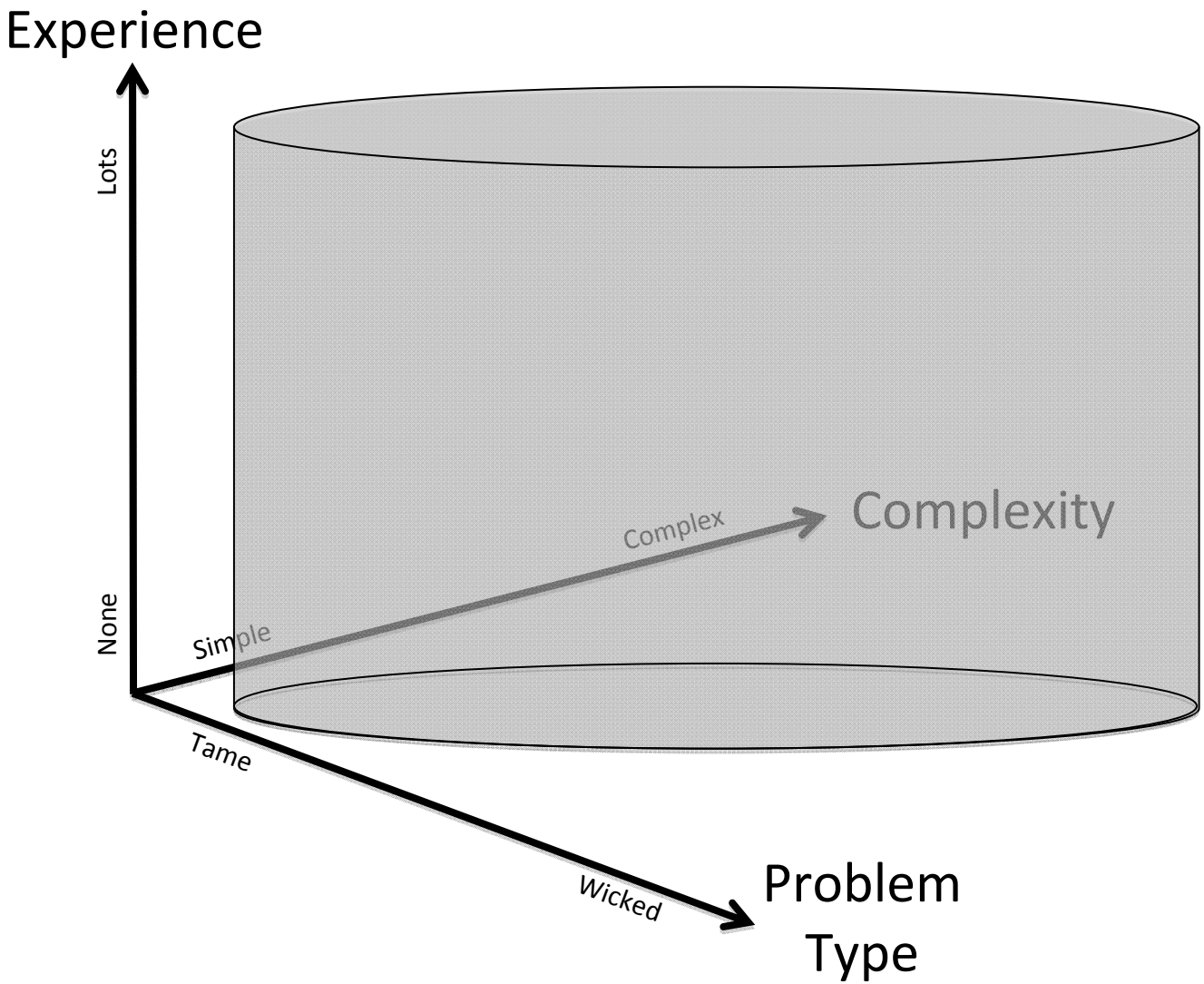

Experience
Lots
None
Complexity
Complex
Simple
Tame
Wicked
Wickedness


Experience
Lots
None
Complex
Complexity
Simple
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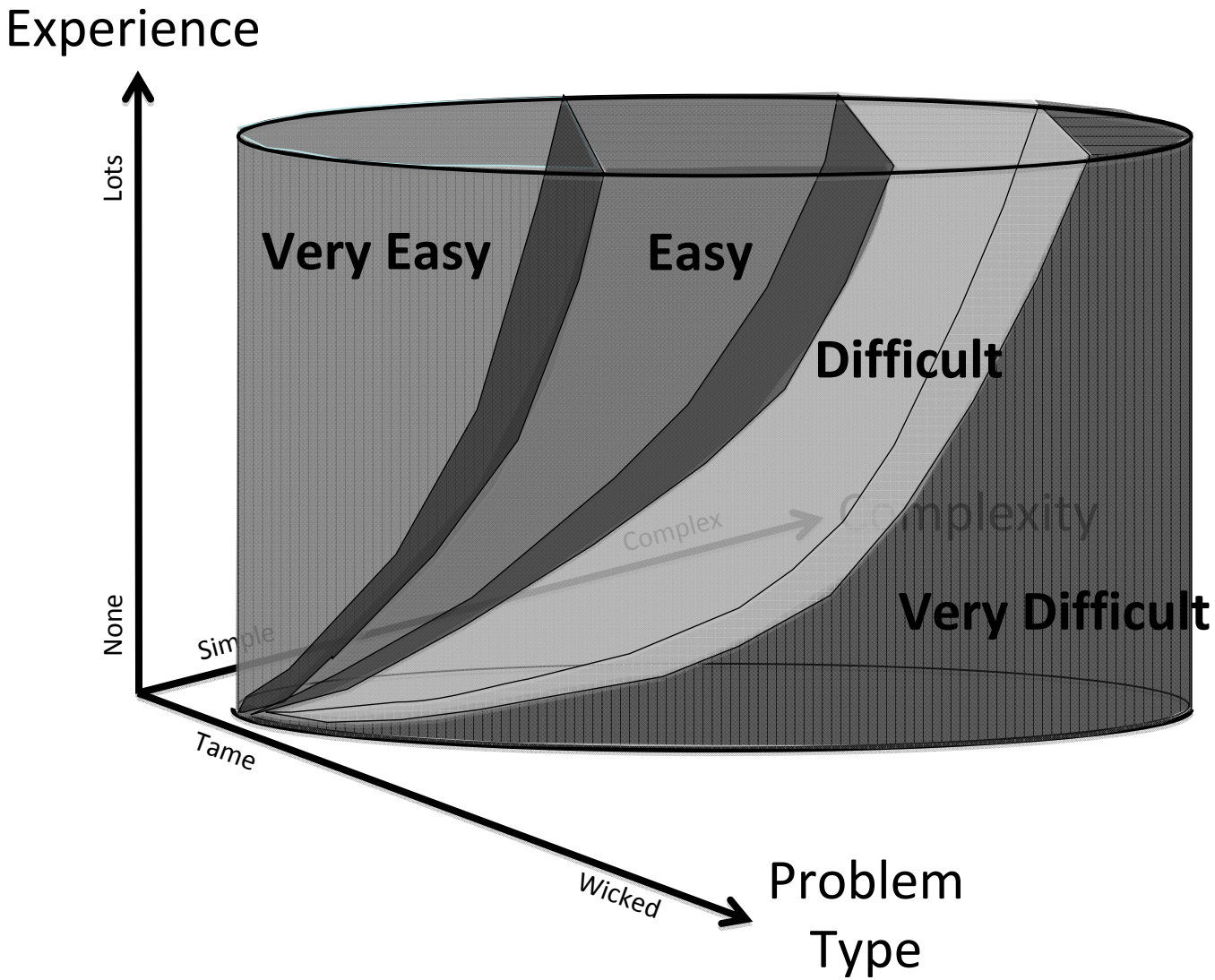
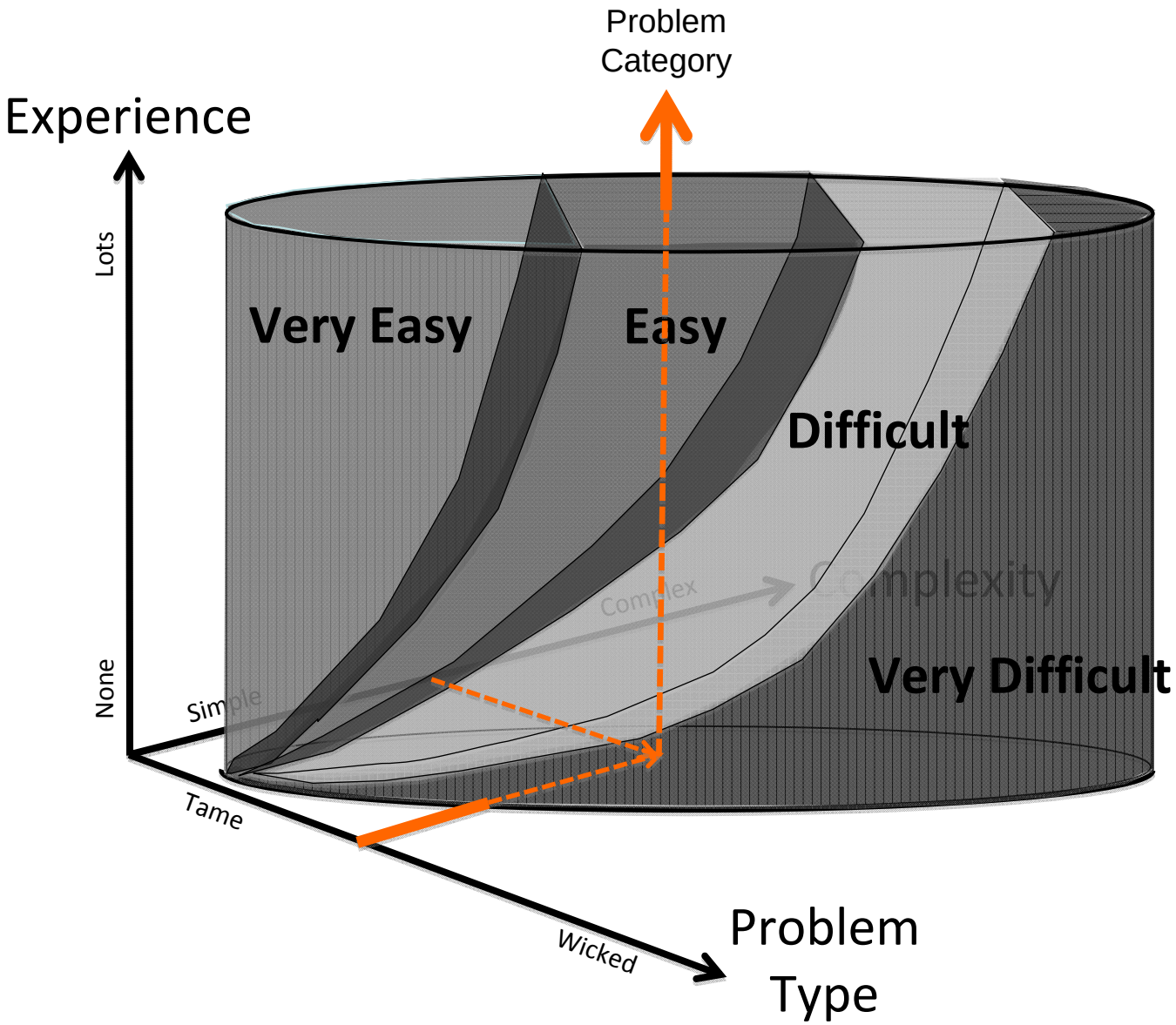
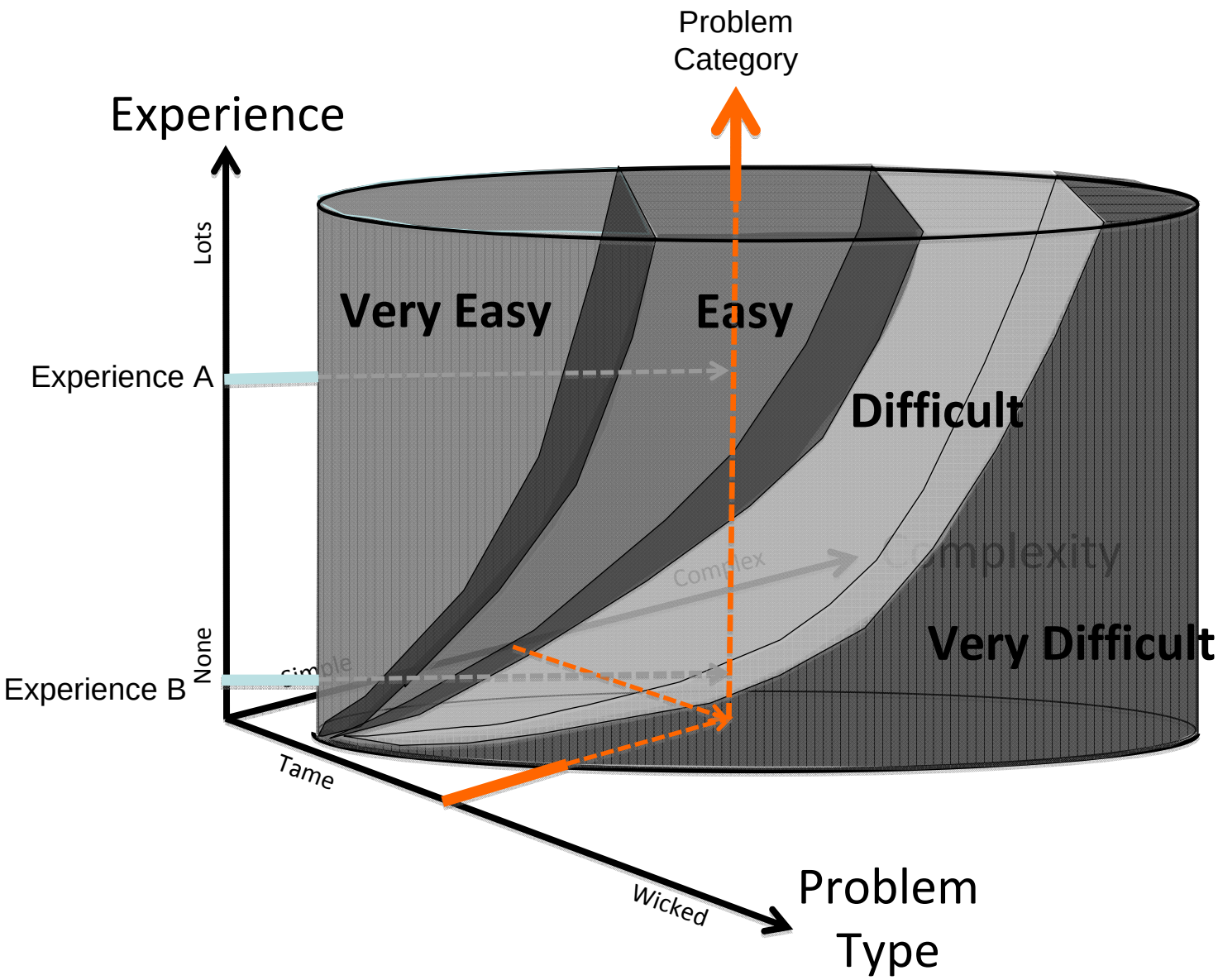
Wicked
Problem
Type


Experience
Lots
None
Very Easy
Easy
Difficult
Very Difficult
Complexity
Complex
Simple
Tame
Wicked
Problem
Type


Problem
Category
Experience
Lots
None
Very Easy
Easy
Difficult
Very Difficult
Complexity
Simple
Complex
Tame
Wicked
Problem
Type


Problem
Category
Experience
Lots
None
Very Easy
Easy
Difficult
Very Difficult
Experience A
Experience B
Tame
Wicked
Problem
Type

ELICIT Factoids

What is ELICIT?

ELICIT provides an experiential education facility for investigating effects of different structures for information-sharing on problem-solving.

U.S. DoD (OASD/NII) Command and Control Research Program (CCRP) sponsored the design and development of the ELICIT platform for exercises focused on information-sharing and problem-solving.

Principal purpose of ELICIT-related Exercises and Analysis is to investigate the impacts of edge versus hierarchical network structures on problem-solving performance.

Attributes

1. Sharing
    1. Just Factoids
    2. Factoids and guesses
    3. Factoids and sub-answers
    4. Factoids guesses and sub-answers
2. Factoid Content
    1. Just facts that are part of a logical argument
    2. Solutions or sub-solutions
    3. Both
3. Factoid Charaterisation
    1. Obvious which sub-solution the Factoid contributes to (including multiple sub-solutions)
    2. Factoid required for non-obvious sub-solution
4. Factoid Distribution
    1. Factoids only distributed to the appropriate sub-solution teams
    2. Factoids distributed to any team
5. Logic
    1. Factoids contain all information required and are unambiguous
    2. Factoids contain all information required and are ambiguous
    3. Factoids do not contain all information required and are unambiguous
    4. Factoids do not contain all information required and are ambiguous
6. Answer
    1. There is a single answer and it is used as the metric.

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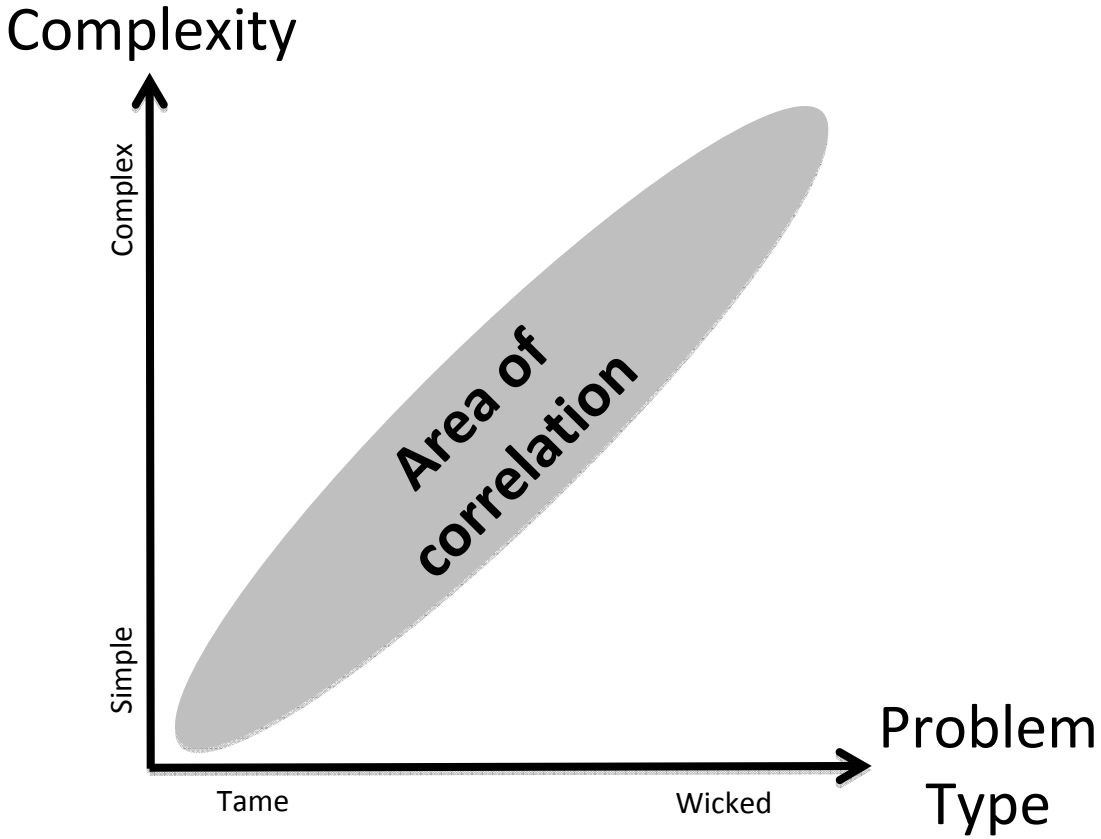
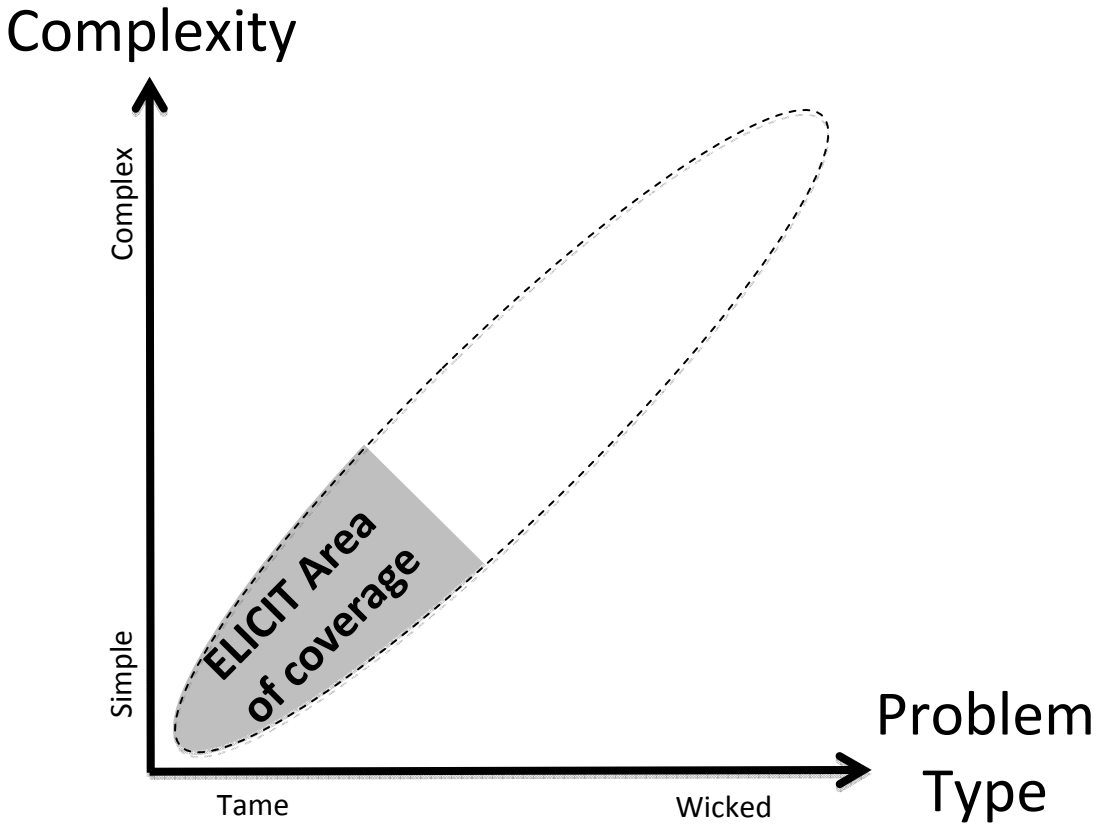

Complexity
Complex
Simple
Area of correlation
Tame
Wicked
Problem Type


Complexity
Complex
Simple
ELICIT Area of coverage
Tame
Wicked
Problem Type

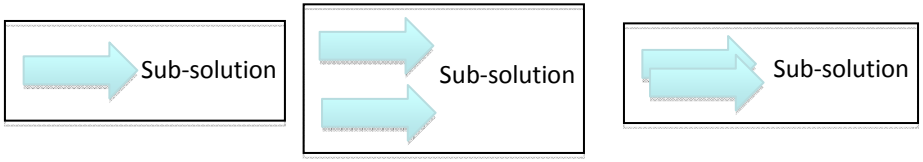
What can we change?

- Cannot changed ‘Problem Type’ without major changes to ELICIT and experimental set-up.
- Can change ‘Complexity’.
- Can say something about ‘Experience’.

Parameters

onceptual level

hat is the puzzle 'big picture'.



Logic level

What logical ructure has been mployed within ach sub-solution.

- Number of Factoids required to deduce sub-solution
- Number of relationships between the Factoids
- Number of candidate sub-solutions

Factoid level

the language used n each Factoid (e.g. ity/vagueness and categorisation).

- Positive or negative language
- Clarity of Factoid - Defines key or support Factoid?
- Single or multiple Factoid Categorisation
- Factoid Categoriation not deducible from the Factoid language
- Sub-solution within Factoid
- Noise Factoids?

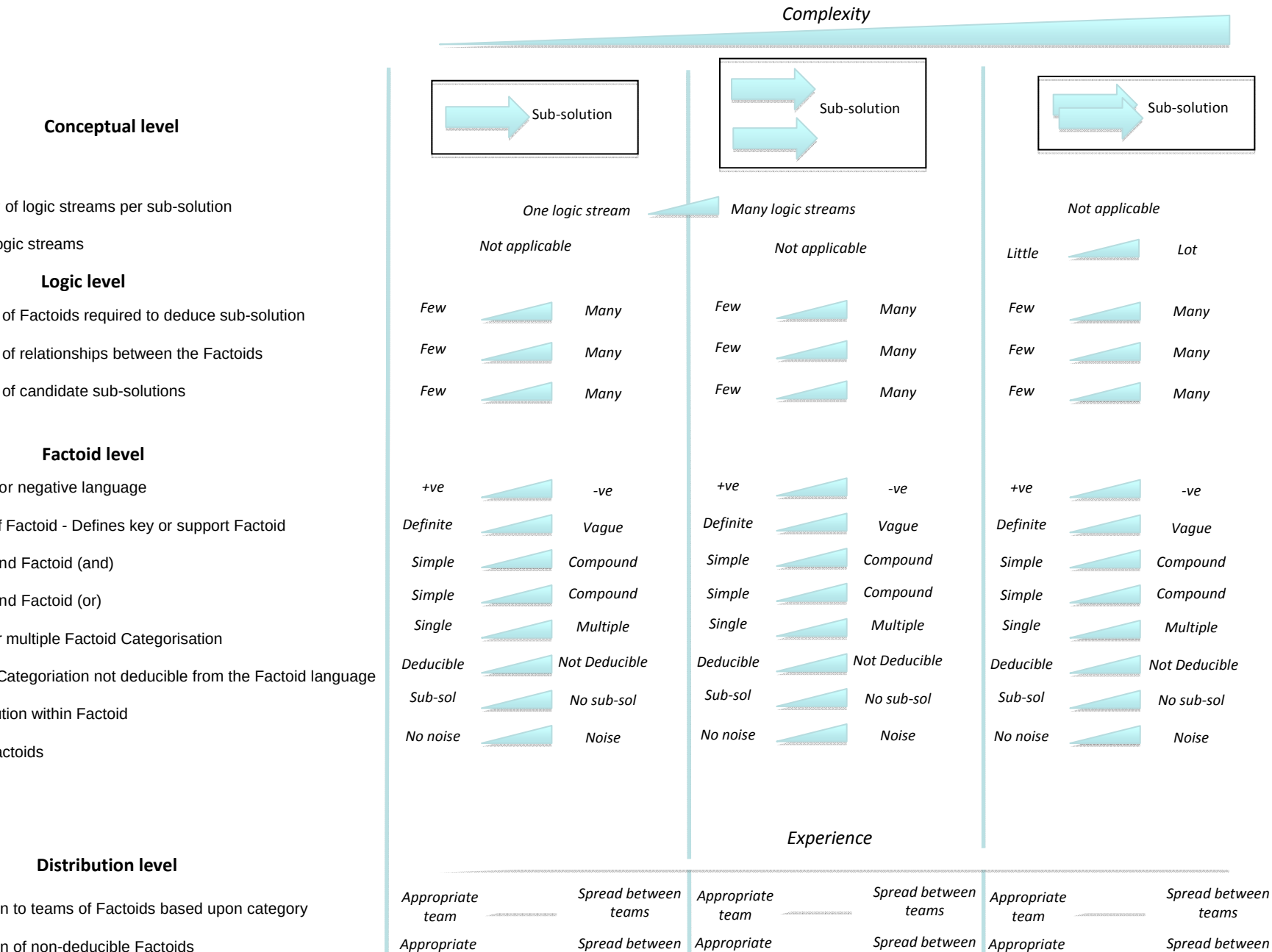
stribution level

v are the Factoids buted between the players.

- Factoids relating to sub-solution sent to appropriate team only
- Factoids relating to sub-solution sent to numerous teams
- Factoids with non-deducible categorisation sent to other sub-solution team
- Key Factoid distribution – but what is a key Factoid?

'Complexity'

'Experience'


Complexity
Sub-solution
Sub-solution
Sub-solution
Conceptual level
of logic streams per sub-solution
One logic stream
Many logic streams
Not applicable
ogic streams
Not applicable
Not applicable
Little
Lot
Logic level
of Factoids required to deduce sub-solution
Few
Many
Few
Many
Few
Many
of relationships between the Factoids
Few
Many
Few
Many
Few
Many
of candidate sub-solutions
Few
Many
Few
Many
Few
Many
Factoid level
or negative language
+ve
-ve
+ve
-ve
+ve
-ve
f Factoid - Defines key or support Factoid
Definite
Vague
Definite
Vague
Definite
Vague
nd Factoid (and)
Simple
Compound
Simple
Compound
Simple
Compound
nd Factoid (or)
Simple
Compound
Simple
Compound
Simple
Compound
r multiple Factoid Categorisation
Single
Multiple
Single
Multiple
Single
Multiple
Categoriation not deducible from the Factoid language
Deducible
Not Deducible
Deducible
Not Deducible
Deducible
Not Deducible
tion within Factoid
Sub-sol
No sub-sol
Sub-sol
No sub-sol
Sub-sol
No sub-sol
actoids
No noise
Noise
No noise
Noise
No noise
Noise
Experience
Distribution level
Appropriate team
Spread between teams
Appropriate team
Spread between teams
Appropriate team
Spread between teams
n to teams of Factoids based upon category
Appropriate
Spread between
Appropriate
Spread between
Appropriate
Spread between
n of non-deducible Factoids

Ordered Parameters

Conceptual level

1. Mixed logic streams
2. Number of logic streams per sub-solution

Logic level

1. Number of Factoids required to deduce sub-solution
2. Number of relationships between the Factoids
3. Number of candidate sub-solutio

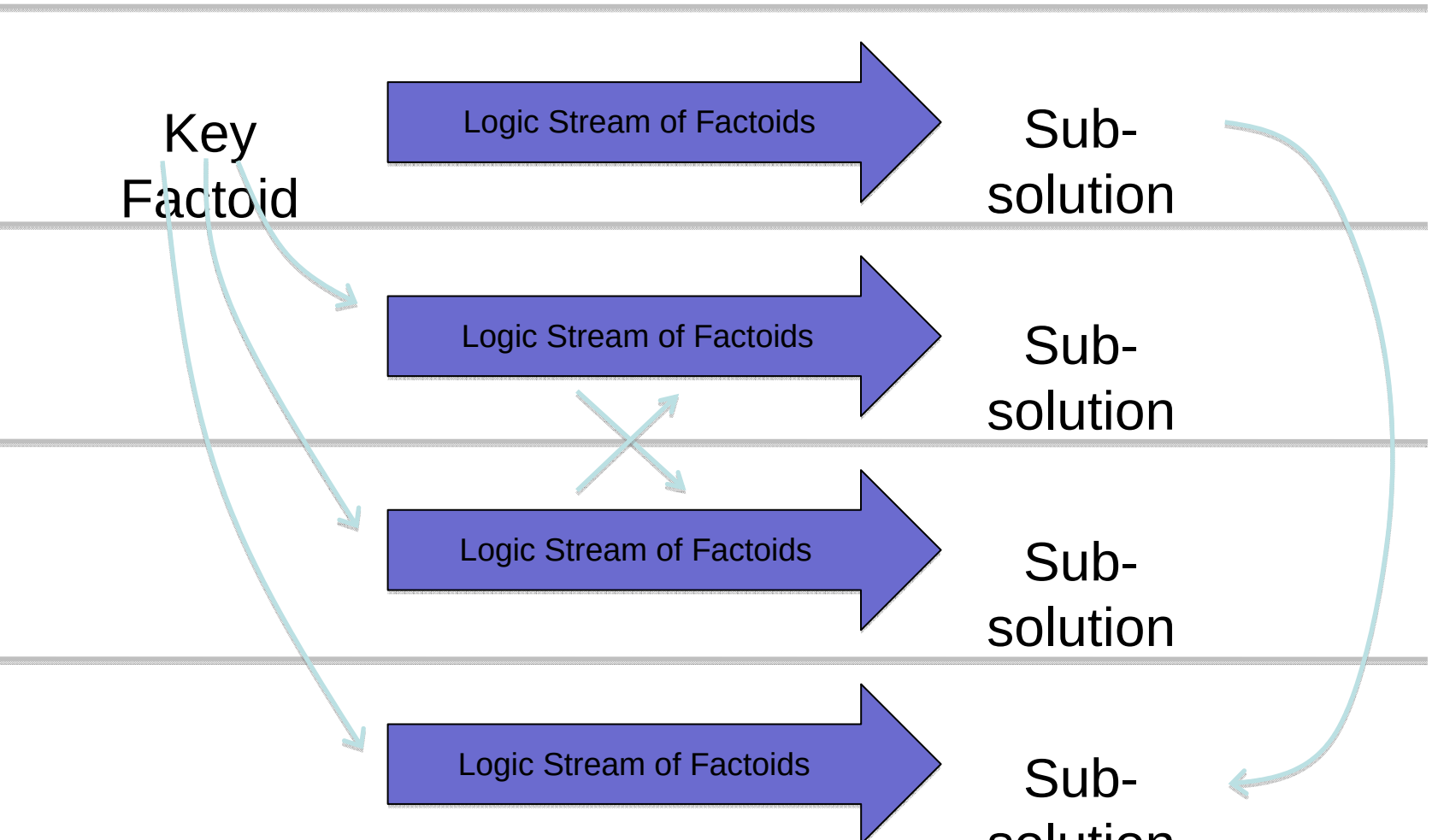
Factoid level

1. Factoid Categoriation not deducible from the Factoid language
2. Compound Factoid (or)
3. Clarity of Factoid - Defines key or support Factoid
4. Positive or negative language
5. Compound Factoid (and)
6. Single or multiple Factoid Categorisation
7. Noise Factoids
8. Sub-solution within Factoid

Distribution level

- Distribution to teams of Factoids based upon category
- Distribution of non-deducible Factoids
- The order in which the Factoids are distributed

General form common to all the Factoid Sets



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8. Sub-solution within Factoid

Comparison

	Factoid Set 1	Factoid Set 2	Factoid Set 3	Factoid Set 4
d Logic Streams:	7	8	9	4
oids per sub-solution:	5,5,5,9 (24)	5,11,8,10 (34)	10,8,14,4 (36)	5,7,6,4 (22)
ber of relationships:	25	25	27	17
ber of Factoids:	15	15	16	12

Comparison

	Factoid Set 1	Factoid Set 2	Factoid Set 3	Factoid Set 4
d Logic Streams:	7	8	9	4
oids per sub-solution:	24	34	36	22
ber of relationships:	25	25	27	17
ber of Factoids:	15	15	16	12
AL	***71***	***82***	***88***	***55***

Comparison

	Factoid Set 1	Factoid Set 2	Factoid Set 3	Factoid Set 4
d Logic Streams:	3	2	1	4
oids per sub-solution:	3	2	1	4
ber of relationships:	2=	2=	1	4
ber of Factoids:	2=	2=	1	4
AL	***10***	***8***	***4***	***16***

‘Experience’

Why is ‘distribution of Factoids’ a parameter of difficulty?

- Degree of difficulty involves the ‘experimental set-up’.
  - The environment you sit in when you do the exam can make it more difficult.
  - Giving them a calculator can make it easier.
- In the ELICIT experiments the ‘information sharing’ regimes act as the environment in which the problem is being solved.
- When organising the distribution of the Factoids, difficulty can be altered using knowledge of the ‘info sharing’ regimes.
- So – Distribution of factoids acts as an ‘experience’ factor and as such it directly affects the degree of difficulty in problem-solving.

Summary

- A measurement method can be developed for factoids.
- It measures the relative difficulty of problems.
- It is sensitive enough to be used to distinguish between the ELICIT Factoids
  - However, ELICIT in its current form can only deal with ‘tame’ problems.
- The experimental set-up is critical to deriving the difficulty of a problem.
  - And could be used to ‘skew’ the outcome.
- ELICIT could be used to examine different problem types, but the experimental set-up would have to be very different.
  - And some cosmetic changes would be required, eg graphic interface.