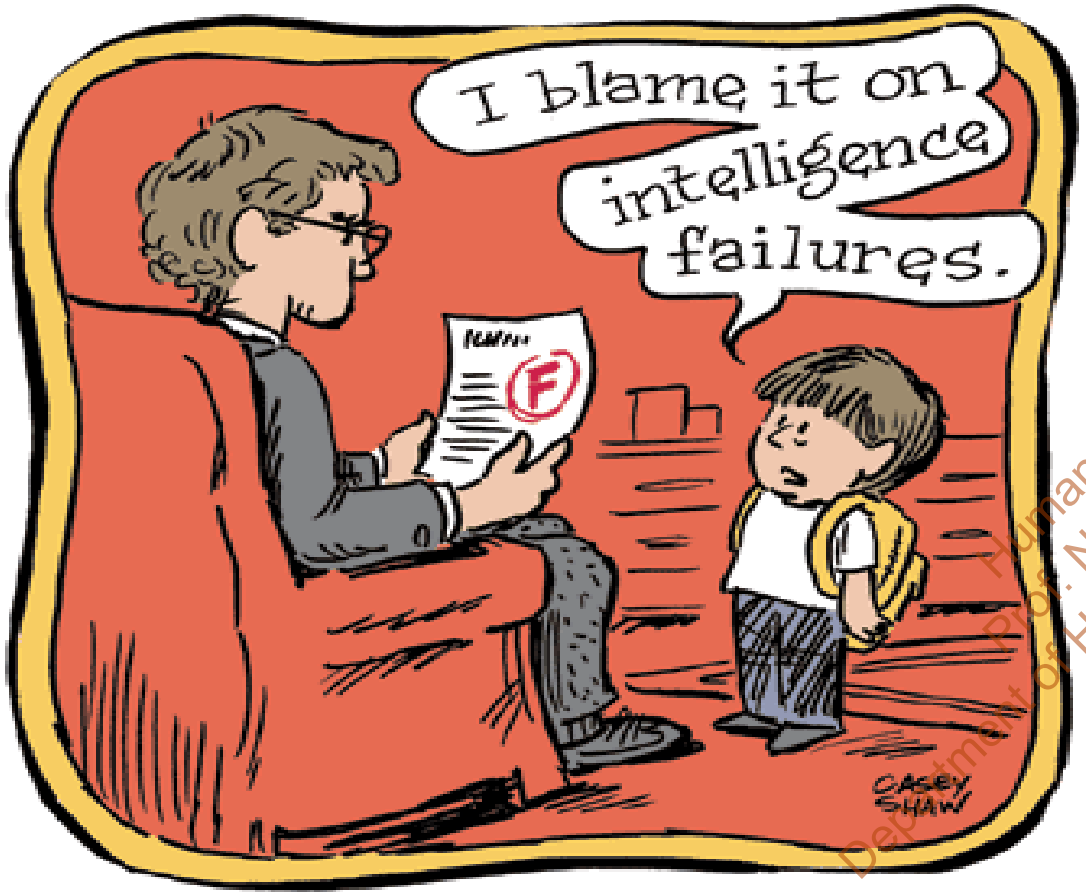
Intelligence

Prof. Human Behaviour
Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Naveen Kashyap, PhD
Indian Institute of Technology Guwahati
Email: naveen.kashyap@iitg.ac.in

Intelligence





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Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

"The man of knowledge must be able not only to love his enemies but also to hate his friends." — Friedrich Nietzsche

Nature of Intelligence

Intelligence, like love, is one of those concepts that are easier to recognize than to define. Some reasons why intelligence cannot be defined with certainty are

- Defining intelligence is difficult as there are many different definitions

- Some see intelligence as a label for what intelligence tests measure

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- Some take a broader view – that intelligence involves the ability to learn from experience, think in abstract terms & deal effectively with one's environment

However for the purpose of clarity the definition of intelligence should be held as *the term intelligence refers to* ***individuals ability to understand complex ideas, to adapt efficiently to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by careful thought***

-------Neisser et.al., 1996

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Prof. Navaneetham Kasthuri
Indian Institute of Technology Guwahati
Humanities and Social Sciences

Whether intelligence is unitary or multifaceted?

- Intelligence is a unitary characteristic or dimension along which people vary

- Spearman (1927) believed that performance on any cognitive task depended on a primary ***general* factor (g)** and more or more ***specific* factors (s)** relating to a particular task.

- Spearman's finding stem from the fact that most intelligence tests although measure different items, they have high correlation among themselves. This suggests the presence of a single primary factor

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- Intelligence is composed of separate abilities that operate more or less independently.

- According to the ***multifaceted*** view, can be high on some components of intelligence but low on others.

- Thurston (1938) suggests that intelligence is composed of seven distinct primary mental abilities like *verbal meaning, number and space.*

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Theories of Intelligence

- **Gardner's theory of multiple intelligences**
  - Mental processes underlie intelligent behaviour
  - Seven distinct types of intelligence that are independent & each operate separate module in brain

1. linguistic intelligence,
2. musical intelligence,
3. logical-mathematical intelligence,
4. spatial intelligence,
5. bodily-kinesthetic intelligence,
6. Intrapersonal intelligence
7. Interpersonal intelligence

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Table 12.3

Gardner's Seven Intelligences *(Adapted from Gardner, Kornhaber, & Wake, 1996)*

Type of Intelligence	*Description*
1. **Linguistic intelligence**	The capacity for speech, along with mechanisms dedicated to phonology (speech sounds), syntax (grammar), semantics (meaning), and pragmatics (implications and uses of language in various settings).
2. **Musical intelligence**	The ability to create, communicate, and understand meanings made of sound, along with mechanisms dedicated to pitch, rhythm, and timbre (sound quality).
3. **Logical-mathematical intelligence**	The ability to use and appreciate relationships in the absence of action or objects—that is, to engage in abstract thought.
4. **Spatial intelligence**	The ability to perceive visual or spatial information, modify it, and re-create visual images without reference to the original stimulus. Includes the capacity to construct images in three dimensions and to move and rotate those images.
5. **Bodily-kinesthetic intelligence**	The ability to use all or part of the body to solve problems or fashion products; includes control over fine and gross motor actions and the ability to manipulate external objects.
6. **Intrapersonal intelligence**	The ability to distinguish among one's own feelings, intentions, and motivations.
7. **Interpersonal intelligence**	The ability to recognize and make distinctions among other people's feelings, beliefs, and intentions.

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Theories of Intelligence

- **Anderson's theory of intelligence & cognitive development**
  - Differences in intelligence result from differences in the ***"basic processing mechanism"*** that implements thinking, which in turn yields knowledge
    - Two different ***"routes" to knowledge*** – ***first involving basic processing mechanism***, which operates through specific processers, to acquire knowledge. ***Second route involves use of modules to acquire knowledge*** which comes automatically if module has matured enough

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Theories of Intelligence

- **Sternberg's triarchic theory**
  - –Theory has ***three sub-theories***
    - ***Componential sub-theory*** – involves the abilities to think critically and analytically
    - ***Experiential sub-theory*** – emphasizes insight and the ability to formulate new ideas (Einstein / Newton)

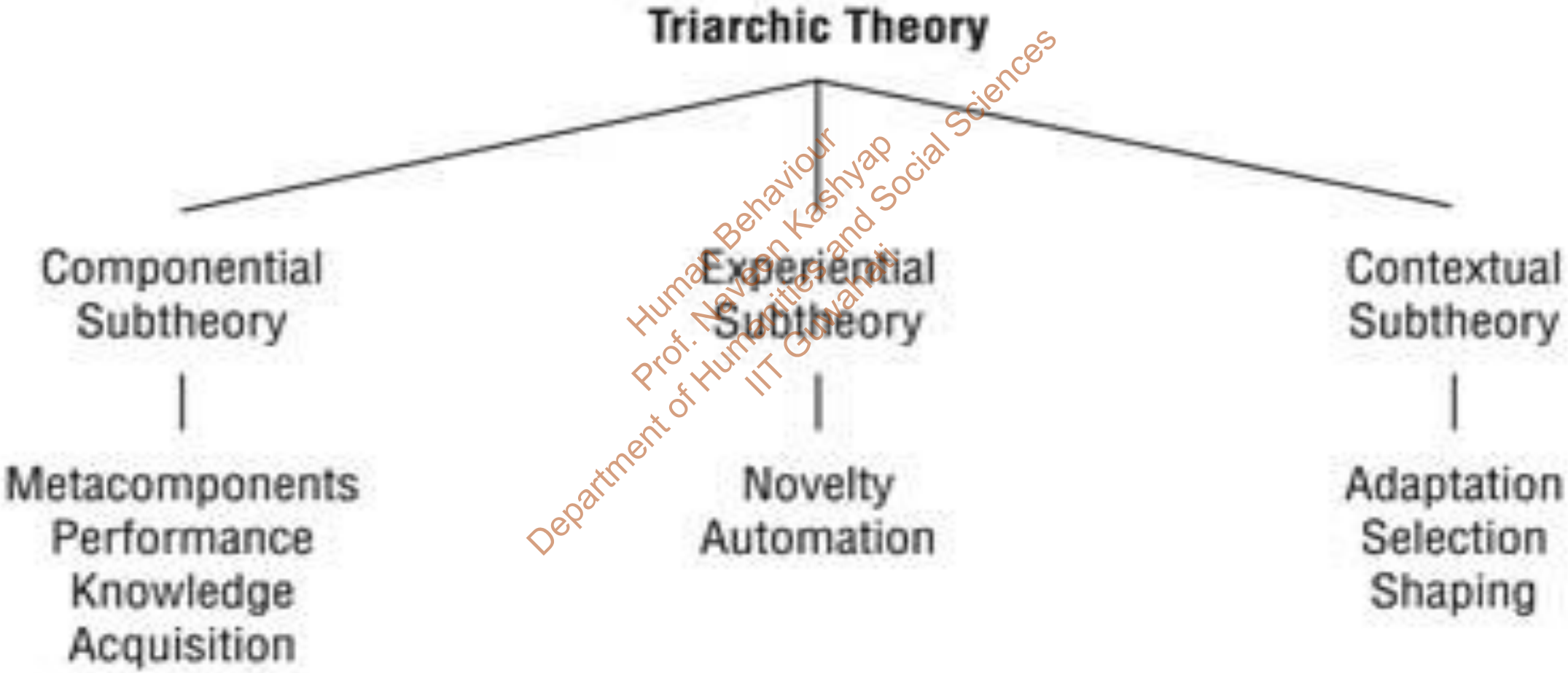
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Contextual sub-theory – people high on this dimension are intelligent in a practical, adaptive sense – they have what many would call *"street smart"* and adapt to solve everyday problems

Most highly developed is componential sub-theory which includes meta-components, performance components & knowledge-acquisition components

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Components of the Triarchic Theory



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Theories of Intelligence

Cattell's Theory of Fluid and Crystallized Intelligence

- This theory is based on the statistical technique of ***factor analysis.***
- Cattell (1963) concluded that *two major clusters* of mental abilities exist *fluid & crystallized intelligence*
- Fluid intelligence – refers to our *largely inherited abilities to think and reason* – in a sense the hardware of our brains that *determines the limits of our information processing capabilities*

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- ***Crystallized intelligence*** – refers to accumulated knowledge – information we store over a life time of experience, plus the application of skills and knowledge to solving specific problems

- *The speed with which one can analyze information is an example of fluid and the breadth of one's vocabulary, of crystallized intelligence*

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Theories of Intelligence

- ***Ceci's bioecological theory***
  - Everyday intellectual performance cannot only be explained by IQ or biological notions of general intelligence
  - Rather, intellectual performance depends on interaction between multiple cognitive potentials with a rich, well-organized knowledge base
  - This highlights impact of environment on IQ – more environmental risks child exposed to – lower the IQ

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Prof. Naveen Kashyap
Department of Humanities and Social Sciences
IIT Guwahati

Assessment of Intellectual Abilities

- ***Intelligent tests***
  - Key that they measure what they intend to measure

- ***Reliability***
  - A test with good reliability will yield reproducible & consistent results

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- Assessed by ***correlating two sets of scores***
- Test-retest reliability – ***person takes test twice – scores correlate***
- Alternative form reliability – ***two forms of same test correlate highly***
- Internal consistency – ***test items correlate highly with each other***
- Interjudge reliability – ***ratings of judges correlate highly***

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Assessment of Intellectual Abilities

- ***Validity***
  - A test with good validity is one that measures what it's meant to measure
    - ***Criterion/empirical validity*** – correlating test score with some external criterion can assess validity
    - ***Criterion problem in assessment*** – where there is no "truth" against which to validate the test
    - ***Construct validity*** – where test scores correlate with the predicted outcomes of the theory underlying the research

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0	24 H in a D	24 HOURS IN A DAY
1	26 L of the A	
2	7 D of the W	
3	7 W of the W	
4	12 S of the Z	
5	66 B of the B	
6	52 C in a P (W J)	
7	13 S in the U S F	
8	18 H on a G C	
9	39 B of the O T	
10	5 T on a F	
11	90 D in a R A	
12	3 B M (S H T R)	
13	32 is the T in D F at which W F	
14	15 P in a R T	
15	3 W on a T	
16	100 C in a D	
17	11 P in a F (S) T	
18	12 M in a Y	
19	13 is U F S	
20	8 T on an O	
21	29 D in F in a L Y	

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Measuring Intelligence

The first attempt to measure intelligence was made by Alfred Binet & Theodore Simon on request by the Paris School Board.

Binet & Simon decided to use items of two basic types –

- ***so unusual*** that none of the children have prior exposure to them
- ***so familiar*** that almost all youngsters would have encountered them

IQ: its meaning then and now

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IQ stand for *intelligence quotient* and a *quotient* is precisely the scores

IQ = Mental Age / Chronological Age * 100

There is one problem with the IQ score – at some point mental growth levels off or stops, while chronological age continues to grow. As a result the IQ scores begin to decline after age 13!!!

Today IQ simply reflect an individual's performance relative to that of persons of the same age who have taken the test.

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Table 12.1

Items from the Stanford-Binet Intelligence Scale *Typical examples of items from the 1986 Stanford-Binet Intelligence Scale for a 6- to 8-year-old.*

Test	*Description*
Verbal reasoning	
Vocabulary	Defines words, such as 'dollar' and 'envelope'.
Comprehension	Answers questions, such as 'Where do people buy food?' and 'Why do people comb their hair?'
Absurdities	Identifies the 'funny' aspect of a picture, such as a girl riding a bicycle on a lake or a bald man combing his hair.
Verbal relations	Tells how the first three items in a sequence are alike and how they differ from the fourth: scarf, tie, muffler, shirt.
Quantitative reasoning	
Quantitative	Performs simple arithmetic tasks, such as selecting a die with six spots because the number of spots equals the combination of a two-spot die and a four-spot die.
Number series	Gives the next two numbers in a series, such as 20 16 12 8 ___ ___.
Equation building	Builds an equation from the following array: 2 3 5 + =. One correct response would be 2 + 3 = 5.
Abstract/visual reasoning	
Pattern analysis	Copies a simple design with blocks.
Copying	Copies a geometrical drawing demonstrated by the examiner, such as a rectangle intersected by two diagonals.
Short-term memory	
Bead Memory	Shown a picture of different-shaped beads stacked on a stick. Reproduces the sequence from memory by placing real beads on a stick.
Memory for sentences	Repeats after the examiner sentences such as 'It is time to go to sleep' and 'Ken painted a picture for his mother's birthday'.
Memory for digits	Repeats after examiner a series of digits, such as 5–7–8–3, forward and backward.
Memory for objects	Shown pictures of individual objects, such as a clock and an elephant, one at a time. Identifies the objects in the correct order of their appearance in a picture that also includes extraneous objects; for example, a bus, a clown, an elephant, eggs, and a clock.

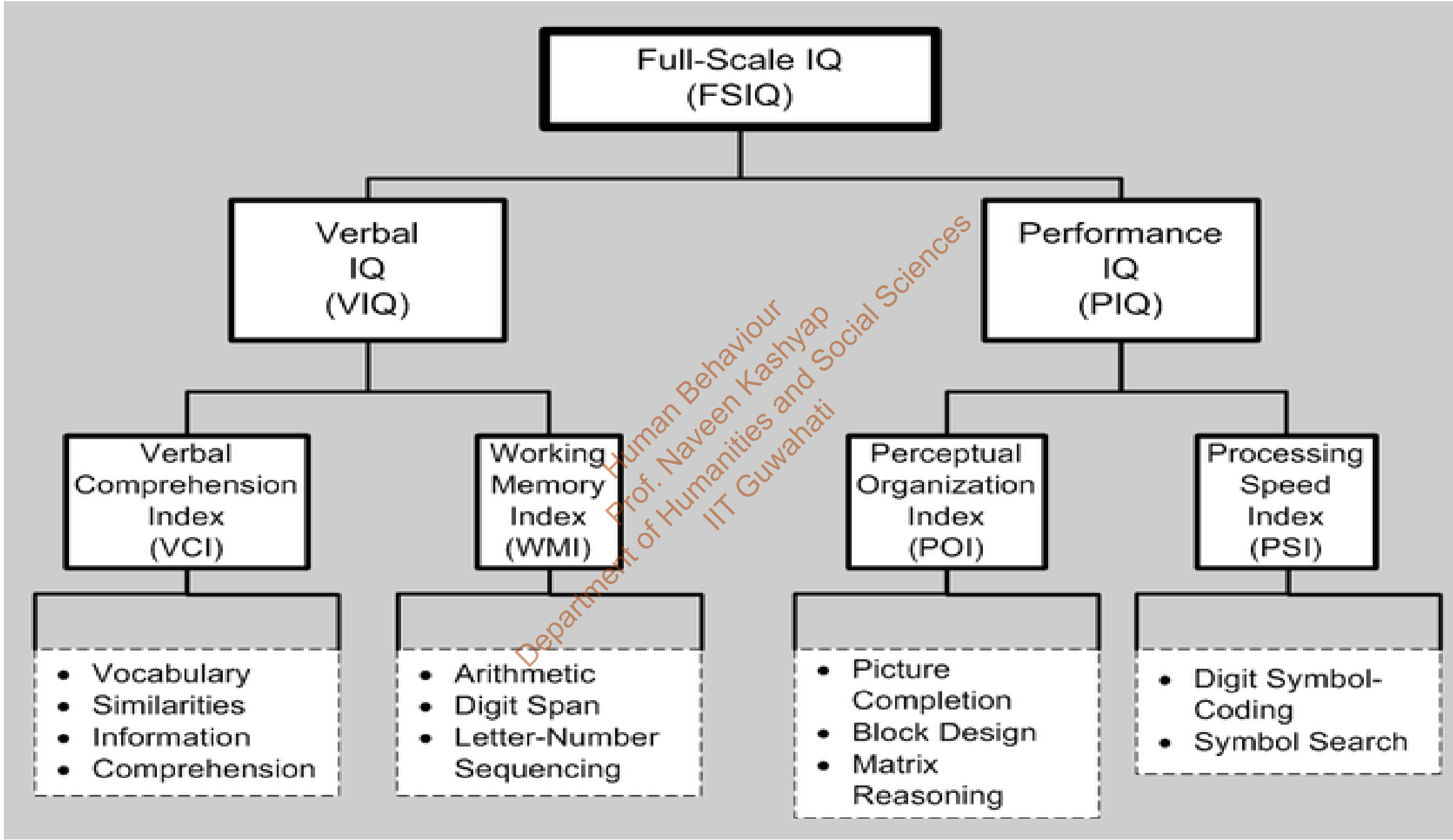
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Measuring Intelligence

Binet and Simon's intelligence test has one major drawback:

All contents of the test was verbal. To overcome this problem David Weschsler devised a set of tests for both children and adults that include ***nonverbal, or performance***, items as well as verbal ones, and that yield separate scores for these two components on intelligence.

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The Cognitive Basis of Intelligence: Processing Speed

This viewpoint suggests that being intelligent involves being able to process information quickly. This has led to two major developments

- ***new tests*** based on findings of cognitive psychology emerged

- ***speed of processing*** simple perceptual & cognitive tasks correlate with scores on intelligence tests

- ***inspection time*** – minimum amount of time a particular stimulus must be exposed to acquire a judgment that meets some pre-established criterion of accuracy, is the new measure of intelligence

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The Neural Basis of Intelligence: Intelligence and Neural Efficiency

This viewpoint suggest that

- ***nerve conduction velocity*** - the speed with which nerve impulses are conducted in the visual system – correlates significantly with the measures of intelligence.

- ***metabolic activity in the brain*** – is a direct measure of intelligence

- ***brain structures*** are also linked to intelligence

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Human Intelligence: Role of Heredity and Environment

Human intelligence is the result of the complex interplay between genetic factors and a wide range of environmental conditions

Evidence for the influence of heredity

- Findings with respect to family relationship and measured IQ (It has been confirmed in experiments that the more closely two persons are related the more similar theirs IQ's)

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- Findings involved adopted children (IQ’ s of adopted children resemble more closely to they biological parents then the adopted parents)

- Findings from studies that focus on the task of identifying the specific *genes* that influence intelligence (the view argues that many *genes* each exerting relatively small effects, probably play a role in general intelligence – i.e., in what many aspects of mental abilities [verbal, spatial etc.] have in common)

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Human Intelligence: Role of Heredity and Environment

- Findings involving research on identical twins separated as infants, who were then raised in different homes (IQ's of twins reared apart correlated highly and was similar to those twins reared together)

On the basis of these results it is estimated that the *hereditability* of intelligence

- the proportion of the variance in intelligence within a given population that is attributable to genetic factors – ranges from about 35% in childhood to as much as 75% in adulthood and maybe about 50% overall.

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Evidence for the influence of environmental factors

- Performance on IQ tests has risen substantially around the world at all age levels in the recent decade. This phenomenon is called the ***Flynn effect***

A large number of factors are, responsible for such an effect – better nutrition increased urbanization, the advent of television, more and better education, more cognitively demanding jobs and exposure to computer games!!

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Human Intelligence: Role of Heredity and Environment

- Another evidence for the role of environmental factors in intelligence is provided by the findings of studies of *environmental deprivation and environmental enrichment*.

(with respect to deprivation it was found that intelligence can be reduced by the absence of key forms of environmental stimulation early in life; as proof for enrichment, removing children from sterile restricted environments and placing them in favorable ones can increase their intelligence)

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Department of Humanities and Social Sciences
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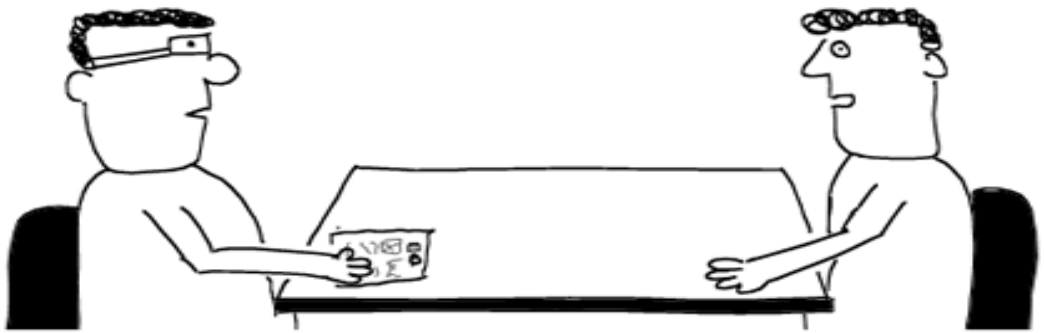
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Department of Humanities and Social Sciences
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"Why do I get the feeling that he's not willing to leave our disagreement at the office?"

I am sorry to say but you have failed in your test because you didn't even make a sad face when a sad story was being narrated to you.



* How E.Q. tests are conducted.

Emotional Intelligence

Daniel Goleman (1995, 1988) defines emotional intelligence as *a cluster of traits or abilities relating to the emotional side of life.* He further states that this kind of intelligence is more important for a happy, productive life than IQ.

Major components of Emotional Intelligence

-Knowing our own emotions

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to the extent individuals are not aware of their own feelings they cannot make intelligent choices

-Since people are not aware of their own emotions, they are often low in *expressiveness*

-*Managing our own emotions* (managing our emotions is to regulate their nature, intensity and expression

-*Motivating ourselves (*remaining optimistic, enthusiastic and delaying gratification till the final goal)

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- *Recognizing and influencing others emotions* (the ability to read others emotions and to recognize the mood)

- *Handling Relationships (this can be termed as interpersonal intelligence)*

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Evidence on the existence and effects of Emotional Intelligence

- With respect to first of these issues evidence is mixed. All other issues have found no stable foundations

- Researchers have indicated that only one component of Goleman's theory: *emotion perception – ability to read accurately others emotions* have strong evidence of intelligence like effects

- Is the theory useless? Research offers the view that we don't have adequate methods for measuring all aspects of emotional intelligence

- Further these components may be independent of each other.

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Creativity: Generating the Extraordinary

Creativity is the ability to produce work that is novel (original, unpredicted)
and appropriate (it works – it is useful or meets task requirements).

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The reason creativity was never studied extensively is that

- No appropriate method exists that captures all aspects of creativity in real life situation
- Concept of creativity was associated in many people's minds with forces outside the realm of science – for instance with vague notions of the "creative spirit"

Contrasting views of creativity

What factors produce creativity?

- Cognitive psychologists focus on the basic process that underlie creative thought like retrieval of information from memory, association, synthesis, transformation and categorical reduction

- Studying creativity involves distinguishing between mundane & exceptional creativity

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Creativity: Generating the Extraordinary

- Social psychologists have focused on the personality traits and environmental conditions that encourage creative thinking.

Confluence approach of creativity – the approach suggests that in order to creativity to occur multiple components must converge

- Intellectual abilities: the way to see problems in new ways

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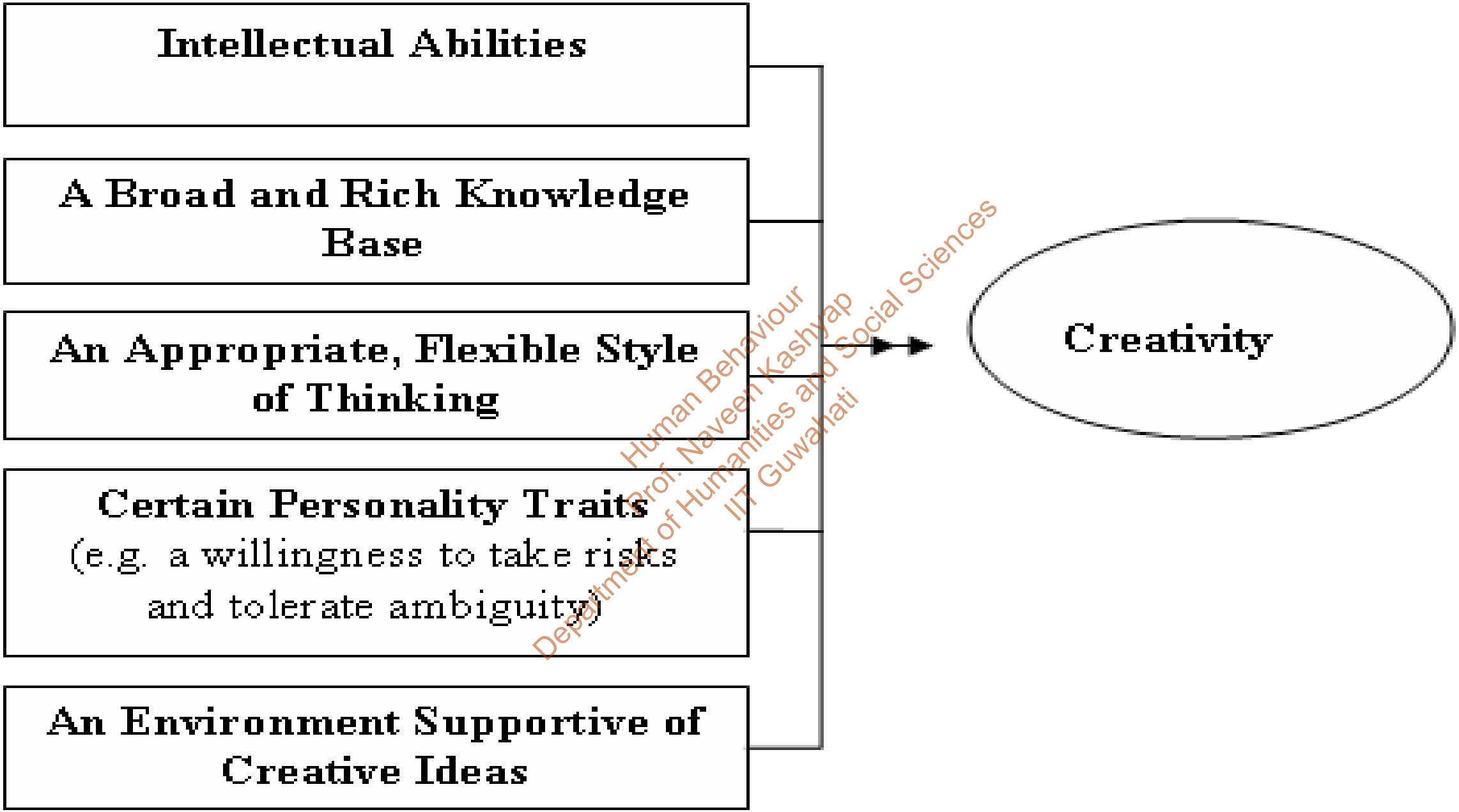
- Knowledge: enough knowledge about the field

- Certain styles of thinking: a preference for thinking in novel ways

- Personality attributes: traits as willingness to take risks and tolerate ambiguity

- Environment that supports creativity.

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