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Personality Representation Processable in Fuzzy Logic for Human Behavior Simulation

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"We often fail to realize how little we know about a thing until we attempt to simulate it on a computer"

(Donald Knuth, 1968)

1. Aims

1. to develop a concise and flexible representation of personality knowledge:

    - based on the state-of-the-art of personality theories

    - processable in fuzzy logic and

    - which could be a basis for the specification of software agents with personality

2. to have the ability of represent personality dynamics

Plan

1. Aims
2. Personality knowledge
3. Representations of personality
4. Dynamics of personality
5. Conclusions

- **Personality**

is set of predictable behaviors by which people are recognized and identified.   (Costa & McCrae, 1992)

- **Personality traits**

"dimensions of individual differences in tendencies to show consistent patterns of thoughts, feelings, and actions."   (McCrae & Costa, 1990)

Five factor model of personality

Personality is represented by
30 facets grouped under **5 traits** (factors):

Openness
Conscientiousness
Extraversion
Agreeableness
Negative emotions

This five factor model is also called OCEAN model

History of the five personality factors

- The evidence in support of a five factor view of personality structure has been accumulating for over 50 years.

- The first evidence for the five factor model apparently was published in 1949, by D. W. Fiske.

- The report of his findings sat in relative obscurity until the early 1960s, when Norman [1963], Borgotta [1964], and Smith [1967] approached the same research question with different instruments.

Factor analysis

- Factor analysis is a basic tool for researchers seeking to identify the fundamental traits of personality.

- Factor analysis builds on the correlation coefficients. The correlation coefficient measures the degree of relationship between two variables.

- The correlation coefficient can range from:

  -1.00 (high negative relationship) to

   0.00 (no relationship) to

  +1.00 (high positive relationship).

Factor loadings of IPIP-NEO facets

Facets	O	C	E	A	N
O1: Imagination	**.71**	-.15	.07	-.08	.16
O2: Artistic Interests	**.58**	.10	.27	.31	.10
O3: Emotionality	**.50**	.15	.28	.23	.37
O4: Adventurousness	**.54**	.07	.39	-.08	-.30
O5: Intellect	**.78**	.21	-.05	-.08	-.22
O6: Liberalism	**.60**	-.23	-.07	.06	.01
N1: Anxiety	.00	-.05	-.22	.02	**.87**
N2: Anger	-.03	.09	-.08	-.36	**.75**
N3: Depression	.07	-.31	-.30	-.08	**.73**
N4: Self-Consciousness	-.09	-.32	-.47	.22	**.55**
N5: Immoderation	.10	-.33	.23	-.23	**.50**
N6: Vulnerability	-.10	-.31	-.11	.06	**.83**

Personality knowledge references:

- Costa and McCrae (1992)
- Acton (2001)
- Howard (2000)
- Howard and Howard (2001a, b)
- …

2.1 Personality Trait: Openness   (OCEAN)

"Openness to Experience is tendency to be intellectual, interested in the arts, emotionally aware, and liberal."

(Acton-glossary)

"Openness refers the *number of interests* to which one is attracted and the *depth* to which those interests are pursued.

It is also referred to as culture, originality, or intellect. It is about creativity."

(Howard and Howard, 2001a)

Personality descriptors based on the levels (or values) of the six facets of openness

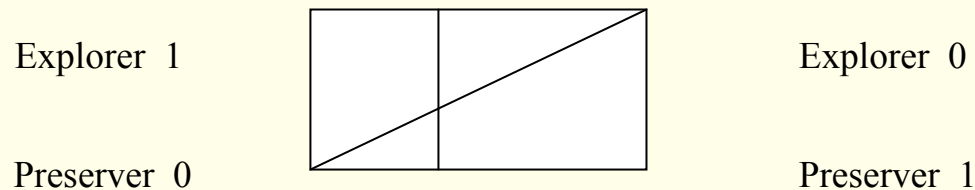| Facets of openness	Levels		
	low	medium	high
Fantasy	focuses on here and now	occasionally imaginative	imaginative, daydreams
Aesthetics	uninterested in art	moderate interest in art	appreciates art and beauty
Feelings	ignores and discounts feelings	accepts feelings	values all emotions
Actions	prefers the familiar	a mixture of preference of the familiar and the new	prefers variety tries new things
Ideas	narrower intellectual focus	moderate curiosity	broad intellectual curiosity
Values	dogmatic conservative	moderate	open to new values open to reexamining values

openness

Personality type	Preserver	Moderate	Explorer
	low	**medium**	**high**

Personality characteristics	- Has narrower interests
	- Is more comfortable with the familiar
	- Is perceived as more
	  -- conventional
	  -- conservative
	- Is perceived not as
	  -- more authoritarian
		- Can explore the novel with interest when necessary
		  (but too much would be tiresome)
		- Can focus on the familiar for extended periods of time
		  (but would develop a hunger for novelty)
			- Has broader interests
			- Has a fascination with novelty and innovation
			- Would generally be perceived as liberal
			- Reports more introspection and reflection

Social roles	Applied scientists Financial managers Performers Project managers		Architects Artists Change agents Entrepreneurs Theoretical scientists (Social and physical)

The continuum of openness - Example

Traits (as well as facets) are not binary valued!

A person may be 0.30 preserver (and 0.70 explorer).

The expression of the linguistic variables in terms of numerical terms is explained by Ghasem-Aghaee and Ören (2003).

Explorer 1   Explorer 0

Preserver 0   Preserver 1

Continuum of openness

2.2 Personality Trait: Conscientiousness

- "Conscientiousness is the tendency to set high goals, to accomplish work successfully, and to behave dutifully and morally"

(Acton-glossary).

- "Conscience is the awareness of a moral or ethical aspect to one's conduct together with the urge to prefer right over wrong." (AHD)

Personality descriptors based on the levels (or values) of the six facets of **conscientiousness**

Facets of conscientiousness	Levels		
	low	medium	high
Competence	often feels unprepared	sometimes feels prepared	feels capable and effective
Order	unorganized unmethodical	half-organized	well-organized neat, tidy
Dutifulness	casual about obligations	covers priorities	governed by conscience reliable
Achievement striving	low need for achievement	serious about success	driven to achieve success
Self-discipline	procrastinates distracted	mix of work and play	focuses on completing tasks
Deliberation	spontaneous hasty decisions	thoughtful	thinks carefully before acting

conscientiousness

	low	medium	high
Personality type	**Flexible**	**Balanced**	**Focused**
Personality characteristics	Easily distracted Less of their total work effort is goal-directed Less focused on goals More hedonistic Weak control over their impulses	Can easily move: - from focus to laxity -from production to research	High self-control Consistent focus on personal and occupational goals In the extreme it results in workaholism. Difficult to distract
Social roles	Consultants Detectives Researchers	Manager	Executive High achievers Leaders

2.3 Personality Trait: Extraversion (OCEAN)

"Extraversion is trait associated with sociability and positive affect."

(Acton-glossary)

"It refers to the number of relationships with which one is comfortable"

(Howard and Howard, 2001a)

Personality descriptors based on the levels (or values) of the six facets of extraversion

Facets of extraversion	Levels		
	low	medium	high
Warmth	reserved, formal	attentive	affectionate, friendly, intimate
Gregariousness	prefers to be alone	alone/with others	gregarious, prefers company
Assertiveness	stays in background	in foreground	assertive, speaks up, leads
Activity	leisurely pace	average pace	vigorous pace
Excitement-seeking	low need for thrills	occasional need for thrills	craves thrills
Positive Emotions	seldom exuberant	moderate exuberance	usually cheerful

extraversion

	low	medium	high
Personality type	**Introvert**	**Ambivert**	**Extravert**

Personality characteristics	Tends to be:
	- independent
	- reserved
	- steady
	- comfortable with
	  being alone
		Able to move:
		- from outgoing social
		  situations
		- to the isolation of working
		  alone
			Tends to:
			- exert leadership
			- be active
			  (physically and verbally)
			- be more friendly and
			  outgoing

Social roles	Production managers Scientists (Physical and natural sciences)	Player-coach	Arts Politics Sales Social sciences

2.4 Personality Trait: **A**greeableness (OCE**A**N)

" **Agreeableness** is tendency to be a nice person"   (Acton-glossary)

" Agreeableness refers to the number of sources from which one takes one's norms for right behavior."

(Howard and Howard, 2001a)

Personality descriptors based on the levels (or values) of the six facets of **agreeableness**

Facets of agreeableness	Levels of agreeableness		
	low	medium	high
Trust	cynical skeptical	cautious	see others as honest & well-intentioned
Straightforward-ness	guarded stretches truth	tactful	straightforward frank
Altruism	reluctant to get involved	sometimes willing to help others	willing to help others
Compliance	aggressive competitive	approachable	yields under conflict defers
Modesty	feels superior to others	equal	self-effacing humble
Tender-mindedness	hardheaded rational	responsive	tender-minded easily moved

agreeableness

	low	medium	high
	Challenger	**Negotiator**	**Adapter**
Personality type			

Personality characteristics	- Egocentrism (independence)
	 - Focused on his or her personal norms and needs rather than on those of the group
	 - Concerned with acquiring and exercising power
	 - Moves against people
	 - Tough-minded
	 - In the extreme becomes:
	   -- narcissistic
	   -- antisocial
	   -- authoritarian
	   -- paranoid personality
		- Situationalism (interdependence)
		 - Is able to move from leadership to followership as the situation demands
			- Altruism (dependence)
			 - Is prone to accept the group's norms rather than insisting on his or her personal norms
			 - Harmony is more important than broadcasting one's personal notion of truth
			 - Moves toward people
			 - Tender-minded
			 - In the extreme becomes dependent
			 - personality who has lost his or her sense of self

Social roles	Advertising Managing Military leadership		Psychology Social work Teaching

2.5 Personality Trait: Negative Emotionality

"Negative Emotionality or neuroticism is the trait associated with emotional instability and negative affect."   (Acton-glossary)

"Negative Emotionality refers to the number and strength of stimuli required to elicit negative emotions in a person."

(Howard and Howard, 2001a)

Personality descriptors based on the levels (or values) of the six facets of **negative emotionality**

Facets of negative emotionality	Levels		
	low	medium	high
Worry (anxiety)	calm relaxed	worried-calm	worried uneasy
Anger	slow to anger composed	some anger	quick to feel anger
Discouragement (depression)	rarely discouraged	occasionally discouraged	easily discouraged
Self-consciousness	seldom embarrassed	sometimes embarrassed	easily embarrassed
Impulsiveness	resists urges easily	sometimes tempted	easily tempted
Vulnerability	handles stress easily	some stress	difficulty coping stress

negative emotionality

	low	medium	high
Personality type	Resilient	Responsive	Reactive
Personality characteristics	rational impervious	not typically able: - to maintain the calmness of a resilient for as long a period of time - to maintain the nervous edge of alertness of a reactive	- susceptibility to negative emotions and discontent with life - at higher intellectual and academic levels, extreme reactivity interferes with performance
Social roles	Air traffic controllers Airline pilots Engineers Finance managers Military snipers	stock trader	Academicians Customer service professionals Social scientists

1. Aims
2. Personality knowledge
→ 3. Representations of personality
4. Dynamics of personality
5. Conclusions

3. Representations of personality

Some of the existing ways to represent personality characteristics are:

- string notation (such as N+E-O=A=C=)

- tabular representation

(Howard and Howard, 2001a) and

- radial representation

(Howard and Howard, 2001b).

3. Representations of personality

1. **Primary** characteristics

      1.1. Personality template

      1.2. Personality vector

      1.3. Personality chart

2. **Compound** characteristics

3.1.1 Personality template – for the OCEAN model

	personality facets	weight	symbolic/ qualitative value	numeric value	descriptors
O1	Fantasy				
O2	Aesthetics				
O3	Feelings				
O4	Actions				
O5	Ideas				
O6	Values				
C1	Competence				
C2	Order				
C3	Dutifulness				
C4	Achievement striving				
C5	Self-discipline				
C6	Deliberation				
…	…				

3.1.2 Personality vector:
Representation of an
  explorer, focused, ambivert, negotiator, and
reactive personality

	Personality traits	symbolic/ qualitative value	numeric value	Personality type
O	Openness	+		explorer
C	Conscientiousness	+		focused
E	Extraversion	=		ambivert
A	Agreeableness	=		negotiator
N	Negative emotion	+		reactive

Transformation of
personality template to personality vector

For each of the 5 traits:

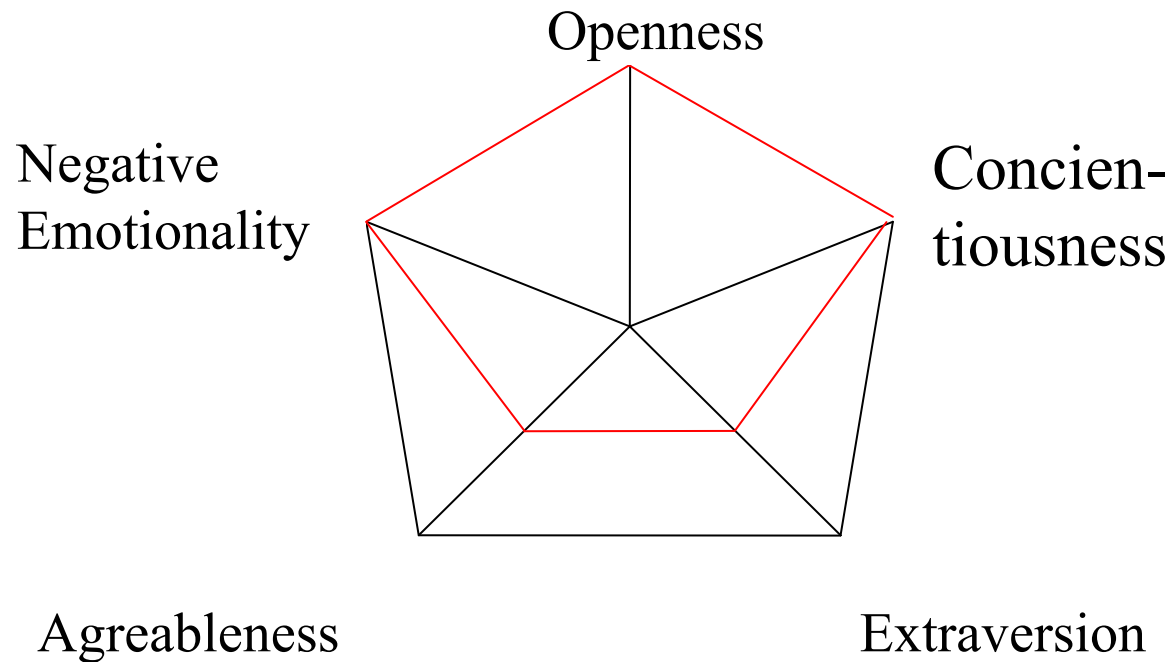   For each of the 6 personality facets:

        - get the weighted numerical value of the facet

         (= weight * numerical value)

        - the dominant value (the highest value)

         determine the value of the trait

3.1.3 Personality Charts

- A personality chart is a Kiviat chart (or a web chart).

- The number of axes is equal to five (which is (the current perception of) the number of personality traits).

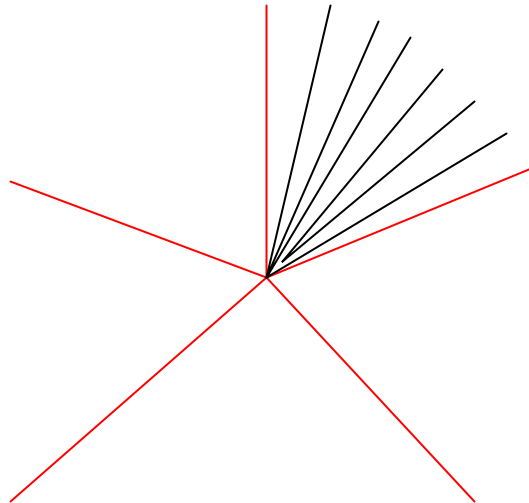# 3.1.3 Personality Charts   (OCEAN)

Openness

Negative
Emotionality

Concien-
tiousness

Agreableness

Extraversion

3.1.3 Personality Charts   (OCEAN)
(A variant chart: **Personality facet chart**)

Between two traits, six facets can be drawn to represent the values of the weighted facets.

(This may be useful for personality management)

3. Representations of personality

1. **Primary** characteristics

      1.1. Personality template

      1.2. Personality vector

      1.3. Personality chart

2. **Compound** characteristics

Vector representation of personalities for different **conflict style**

	SV	negotiator	SV	aggressor	SV	submissive	SV	avoider
O(penness)								
C(oncientiousness)	=	balanced	+	focused	-	flexible	-	flexible
E(xtraversion)	=+	ambivert/ extrovert	+	extrovert	-	introvert	-	introvert
A(greableness)	+	negotiator	-	challenger	+	adaptor		
N(egative emotion)	+	responsive	+	reactive	-	resilient	+	reactive

Text contains examples on:

- leadership styles,

- learning styles, and

- problem solving styles

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4. DYNAMICS OF PERSONALITY

This possibility is very important in management of emotions.

- The values of the personality **facets** may be modified according to the desired personality traits.

  (Howard, 2000, pp. 756-761)

- The personality traits change also by age.

  (Howard, 2000, p. 439)

- After updating the values of the facets
  - one can reassess the personality of an individual then
  - a new personality template and associated personality vector can represent the new personality.

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5. CONCLUSIONS

- The state-of-the-art of the personality theories and applications are reviewed, outlined, and pointers to important sources are given.

- The article by Ghasem-Aghaee and Ören (2003) uses fuzzy logic concepts to process personality knowledge representations used in this article.

- These articles bridges the psychological knowledge about personality and modeling and simulation.

2. Personality knowledge

   (The thirty facets, clustered in five traits (or, factors) to determine the personality types are outlined)

3. Representations of personality

   (Three concise representations of the primary characteristics of human personality are presented: personality template, personality vector, and personality charts)

4. Dynamics of personality