MSA: Maximum Satisfaction Architecture
A Basis for Designing Intelligent Autonomous Agents on WEB 2.0

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Introduction

With the advance of the Internet, mankind will become more networked and will have to live together with a number of intelligent autonomous agents. WEB 2.0 is the symbolic term to refer to this trend. The agents would have a variety of purposes, but their ultimate goal would be to ensure a better life for humans. However, useful models for designing such agents have not been provided in the research disciplines, such as Cognitive Sciences and Information Technology. This is mainly because traditional *linear* and *reductionistic* approaches would not be appropriate for modeling human beings, or brains, which exhibit a multi-layered structure with *nonlinear* interconnections (Prigogine, 1997).

Nonlinearity means two important things that affect development of individual brain–society system:
1) **Dissipative system:** a fluctuation of the system caused by an environmental change would trigger creation of a new order or catastrophe, and
2) **Sensitive Dependence on Initial Condition (SEDIC):** a small variation in the initial condition, during one's infant period, would develop exponentially as one grows up.

MSA: Maximum Satisfaction Architecture

This paper proposes Maximum Satisfaction Architecture (MSA), which consists of three parts: happiness goals, *i.e.*, basic living purposes of human beings, human brain, and society, with the aim of providing a basis for designing intelligent autonomous agents that contribute to realizing better living.

Happiness goals

MSA assumes that the human brain pursues one of the seventeen happiness goals defined by Morris(2006) at every moment, and switches when appropriate by evaluating the current circumstances.
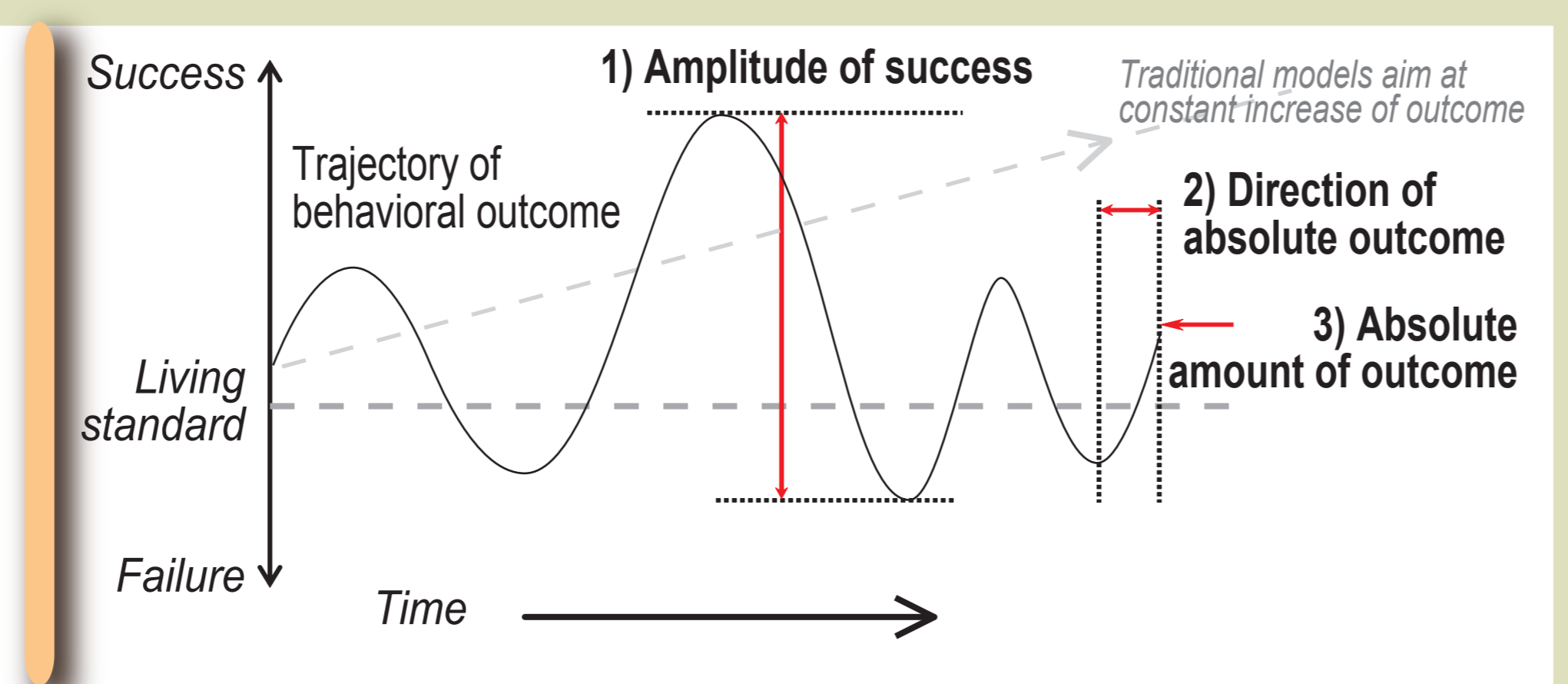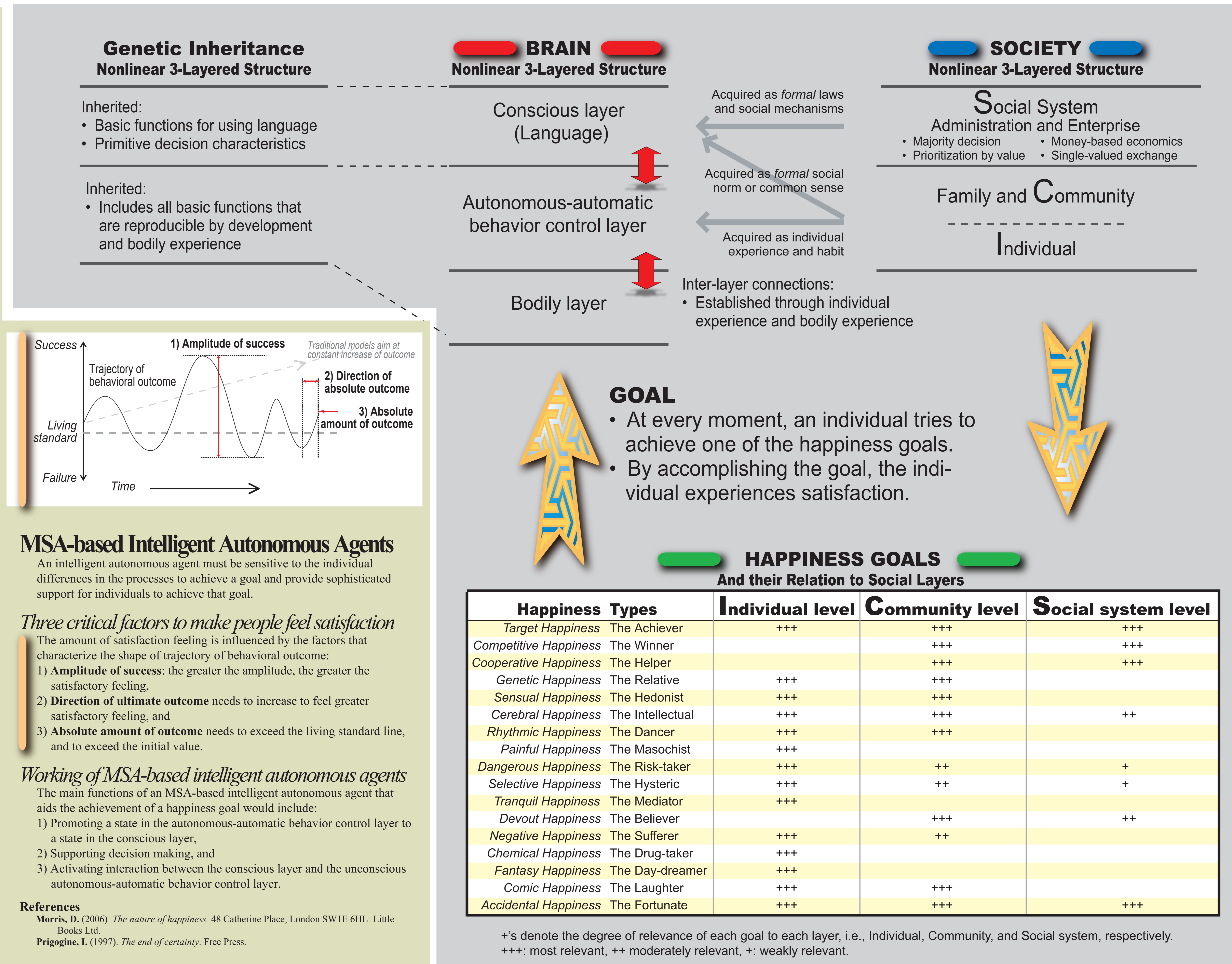
Society layers

Each of the happiness goals is associated with one or multiple layers of Society: *Individual*, *Family and Community*, and *Administration and Enterprise*. These layers have evolved from the history of human beings. Each layer is associated with its own value reflecting historical development, and thus different sets of happiness goals are relevant.

Brain layers

The knowledge necessary to achieve the happiness goals is partly acquired and partly inherited. At the level of Conscious layer, knowledge such as formal laws and social mechanisms necessary to deal with administration and enterprise, and formal social norms and common sense to deal with "family and community" and "individual" is acquired. In contrast, knowledge such as basic functions for using language and primitive decision characteristics is inherited. Similarly, at the level of Autonomous-automatic behavior control layer, knowledge such as individual experience and habit is acquired to deal with "family and community" and "individual." However, as opposed to the inherited knowledge at the Conscious layer, all basic functions that are reproducible by development and bodily experience are inherited in the Autonomous-automatic behavior control layer.

Working of the brain–society system

The pieces of knowledge at each layer in the brain are nonlinearly interconnected through individual experience. This implies that individuals that pursue the same goal might have different patterns of activated networks because of SEDIC, and thus the processes to achieve the goal might be different.

Genetic Inheritance
Nonlinear 3-Layered Structure

Inherited:
• Basic functions for using language
• Primitive decision characteristics

Inherited:
• Includes all basic functions that are reproducible by development and bodily experience

BRAIN
Nonlinear 3-Layered Structure

Conscious layer (Language)

Autonomous-automatic behavior control layer

Bodily layer

SOCIETY
Nonlinear 3-Layered Structure

Social System
Administration and Enterprise
• Majority decision   • Money-based economics
• Prioritization by value   • Single-valued exchange

Family and **C**ommunity
- - - - - - - - - - - - -
Individual

Acquired as *formal* laws and social mechanisms

Acquired as *formal* social norm or common sense

Acquired as individual experience and habit

Inter-layer connections:
• Established through individual experience and bodily experience

Success
Trajectory of behavioral outcome
1) Amplitude of success
Traditional models aim at constant increase of outcome
2) Direction of absolute outcome
3) Absolute amount of outcome
Living standard
Failure
Time

MSA-based Intelligent Autonomous Agents

An intelligent autonomous agent must be sensitive to the individual differences in the processes to achieve a goal and provide sophisticated support for individuals to achieve that goal.

Three critical factors to make people feel satisfaction

The amount of satisfaction feeling is influenced by the factors that characterize the shape of trajectory of behavioral outcome:
1) **Amplitude of success**: the greater the amplitude, the greater the satisfactory feeling,
2) **Direction of ultimate outcome** needs to increase to feel greater satisfactory feeling, and
3) **Absolute amount of outcome** needs to exceed the living standard line, and to exceed the initial value.

Working of MSA-based intelligent autonomous agents

The main functions of an MSA-based intelligent autonomous agent that aids the achievement of a happiness goal would include:
1) Promoting a state in the autonomous-automatic behavior control layer to a state in the conscious layer,
2) Supporting decision making, and
3) Activating interaction between the conscious layer and the unconscious autonomous-automatic behavior control layer.

References
Morris, D. (2006). *The nature of happiness*. 48 Catherine Place, London SW1E 6HL: Little Books Ltd.
Prigogine, I. (1997). *The end of certainty*. Free Press.

GOAL

• At every moment, an individual tries to achieve one of the happiness goals.
• By accomplishing the goal, the individual experiences satisfaction.

HAPPINESS GOALS
And their Relation to Social Layers

Happiness Types		**I**ndividual level	**C**ommunity level	**S**ocial system level
Target Happiness	The Achiever	+++	+++	+++
Competitive Happiness	The Winner		+++	+++
Cooperative Happiness	The Helper		+++	+++
Genetic Happiness	The Relative	+++	+++	
Sensual Happiness	The Hedonist	+++	+++	
Cerebral Happiness	The Intellectual	+++	+++	++
Rhythmic Happiness	The Dancer	+++	+++	
Painful Happiness	The Masochist	+++		
Dangerous Happiness	The Risk-taker	+++		+
Selective Happiness	The Hysteric	+++	++	+
Tranquil Happiness	The Mediator	+++		
Devout Happiness	The Believer		+++	++
Negative Happiness	The Sufferer	+++	++	
Chemical Happiness	The Drug-taker	+++		
Fantasy Happiness	The Day-dreamer	+++		
Comic Happiness	The Laughter	+++	+++	
Accidental Happiness	The Fortunate	+++	+++	+++

+'s denote the degree of relevance of each goal to each layer, i.e., Individual, Community, and Social system, respectively.
+++: most relevant, ++ moderately relevant, +: weakly relevant.