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Systems Methodologies：from Hard to Soft，from West to East

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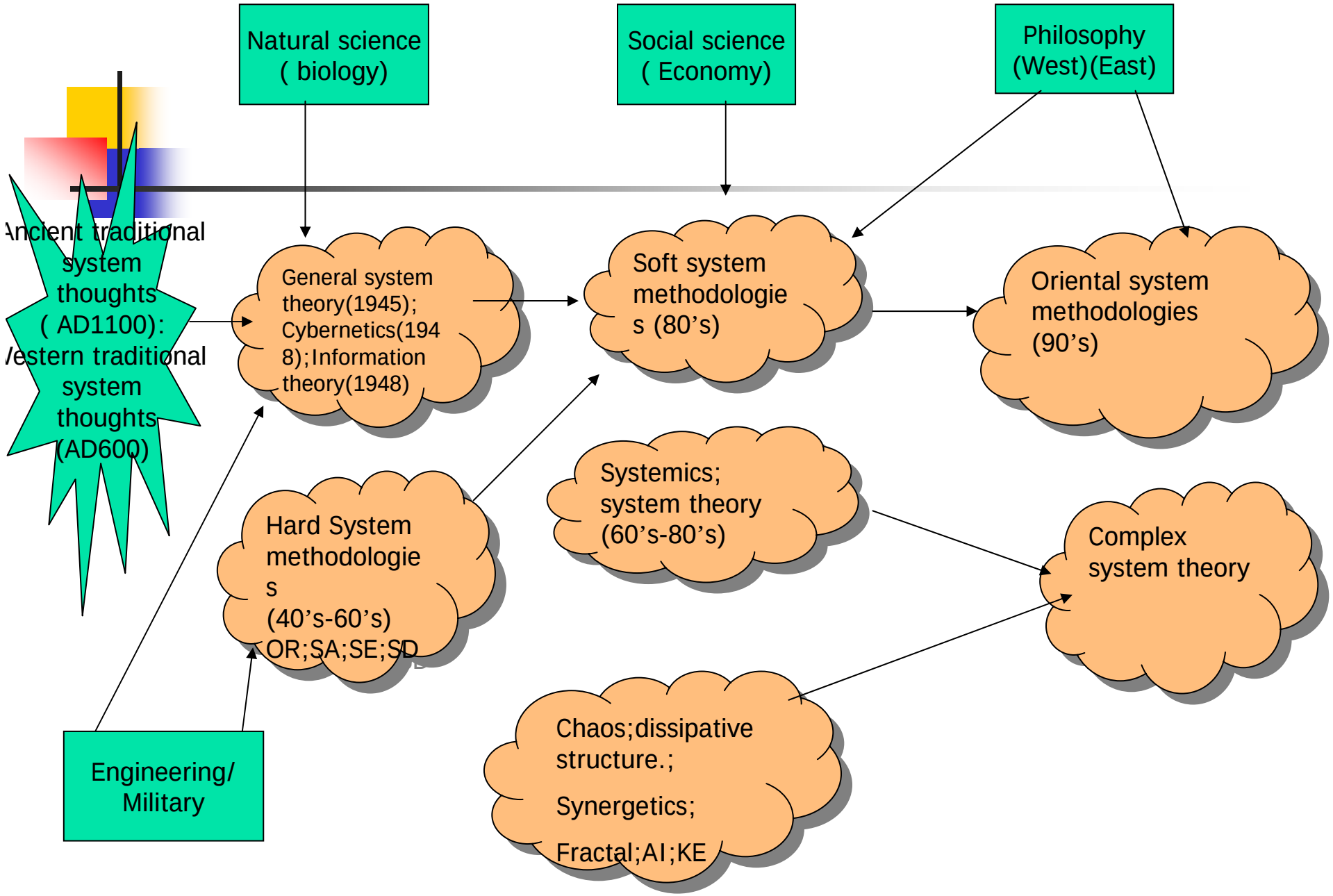
1 System Movement Diagram

- In 1980’s Checkland distinguished the Hard and Soft—put emphasis on the human factor, but too soft
- In 1990’s Sawaragi , Qian and Gu distinguished the West and East— put emphasis on the human factor with the social, cultural aspects, stands for combination of hard and soft, human and computer interaction with emphasizing on human.

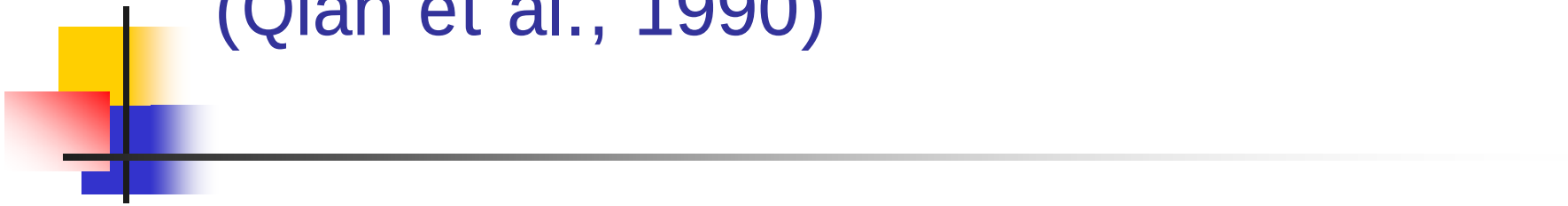

Natural science
(biology)
Social science
(Economy)
Philosophy
(West)(East)
Ancient traditional system thoughts (AD1100): Western traditional system thoughts (AD600)
General system theory(1945); Cybernetics(1948);Information theory(1948)
Soft system methodologies (80's)
Oriental system methodologies (90's)
Systemics; system theory (60's-80's)
Hard System methodologies (40's-60's) OR;SA;SE;SD
Complex system theory
Chaos;dissipative structure.;
Synergetics;
Fractal;AI;KE
Engineering/ Military

2. Introduction to some East system methodologies

2.1Shinayakana Systems Approach

Sawaragi, Nakayama and Nakamori (1987) proposed the Shinayakana Systems Approach for solving the complex systems with ill-defined structure. This approach is an interactive, intelligent and interdisciplinary (I^3)system approach with emphasizing the honesty, humanity and Harmony(H^3). It utilizes the combination between the computer and human, but emphasizing the human, both hard and soft methods. It extracts the useful thoughts from both western and eastern. Based on this approach the IMSS (Interactive Model Support System) and IDSS (Integrated Decision Support System) had been established and had been applied in Environment problems and some other problems in Japan and in other countries.

2.2 **Metasynthetic system approach** (Qian et al., 1990)



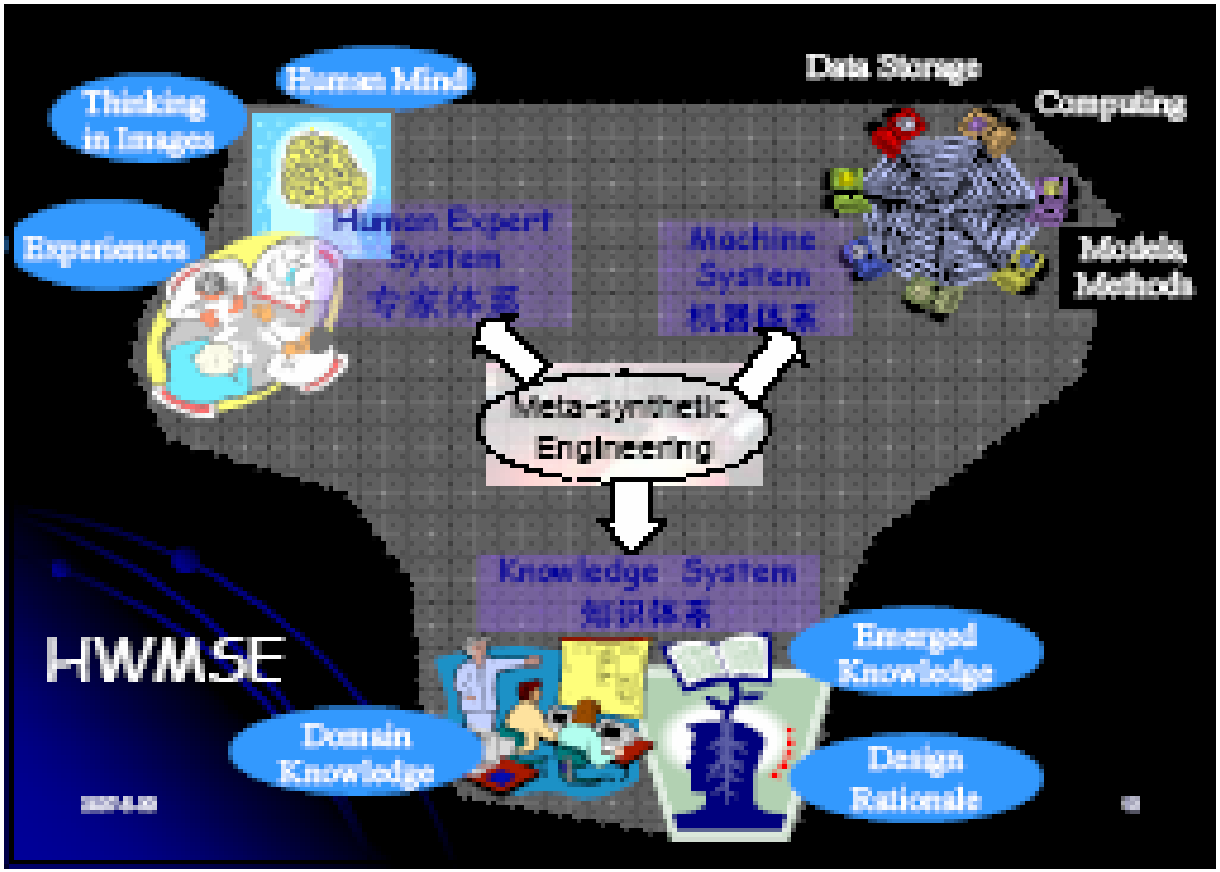
- It is proposed for solving the open complex giant system problems. The method emphasizes the synthesis of collected information, knowledge and wisdom of various kinds of experts, combining quantitative methods with qualitative knowledge and combining the human and computer with emphasizing on human. Later it is evolved into Hall of Workshop for Meta-Synthetic Engineering (HWMSE) as main tool, which emphasizes to make use of breaking advances in information technologies.

As we still concern data, information and model as other system approaches, but here more attentions are paid to the expert’s opinions which are supplement and augment to the quantitative research. Then it is very crucial to deal with the expert’s opinions.

Hall for workshop of Metasynthetic Engineering (HWMSE)

HWMSE or discussion hall is an important tool for implementing the Metasynthesis System approach. It consists of three systems:

Knowledge system Machine system; Experts system (Picture from Tan Zhang, Liu 2007)



2.3 **Wuli-Shili-Renli Systems approach** (Gu & Zhu 1994)

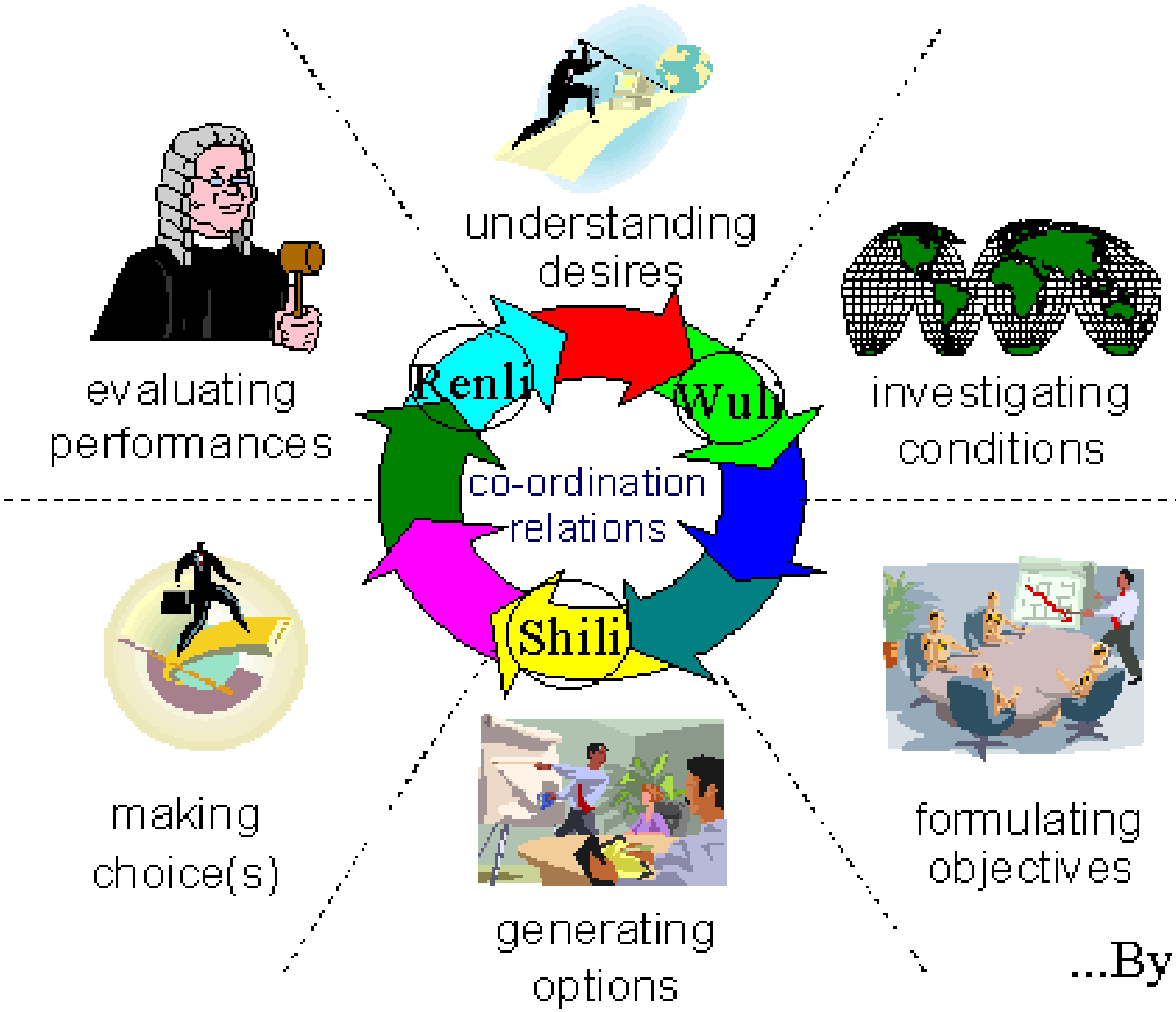
- Wuli is to know the fact, objective world. Shili will use the subjective world, emphasizing use of both mathematical models and conceptual models. Renli means the inter-subjective world, deals with human relations in the organization and society, which are influenced by philosophy, culture and tradition in local society. This approach wishes to integrate the Wuli, Shili and Renli totally and iteratively with qualitative and quantitative methods.

Table 1. Contents of WSR

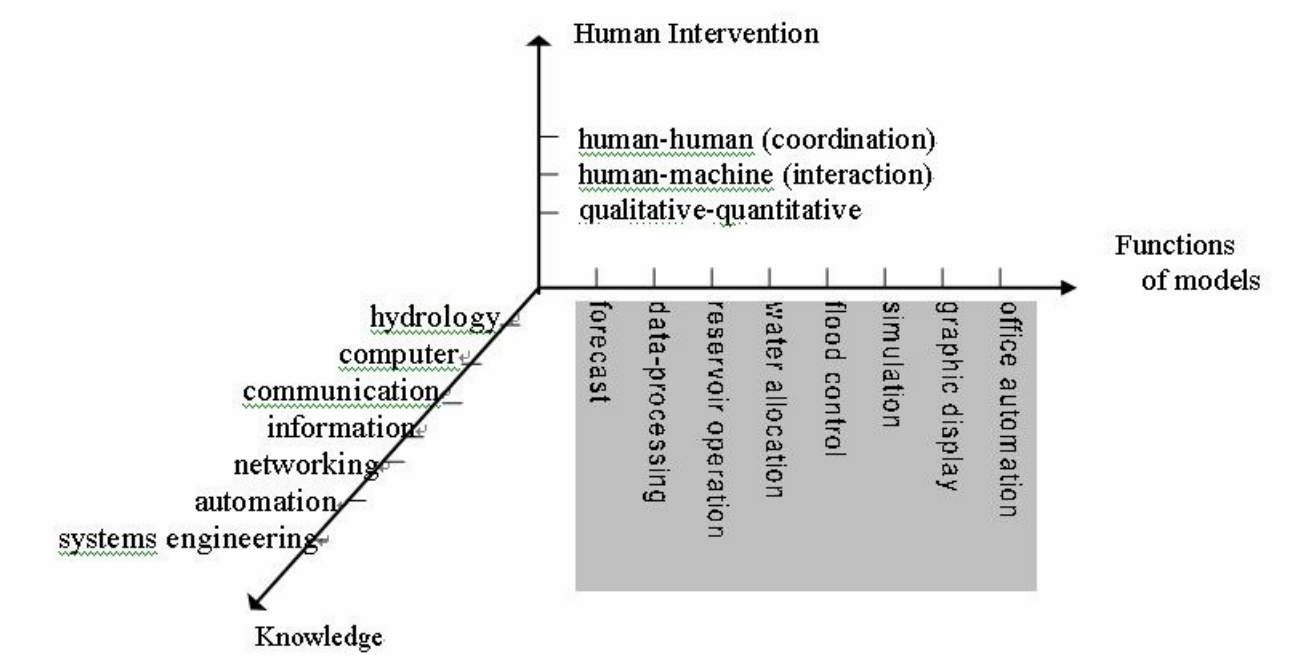
	Wuli	*Shili*	*Renli*
Implication	Theory of Physical world, *laws, rules and regulations*	Theory of managing, *Ways of doing*	Theory of humanity, *Disciplines, norm*
Objects	Objective *matter world*	Organizations, *systems*	Human, groups, *human relations, wisdom*
Focus	What is…? *Functional analysis*	How to…? *Logical analysis*	Shall we…? *Cultural analysis*
Principles	Honesty, truth *As correct as possible*	Harmony, *efficiency, As fluent as possible*	Humanity, *effectiveness, As flexible as possible*
Knowledge needed	Natural sciences	Management Science, Systems Science	Knowledge on humanity. Behavior science

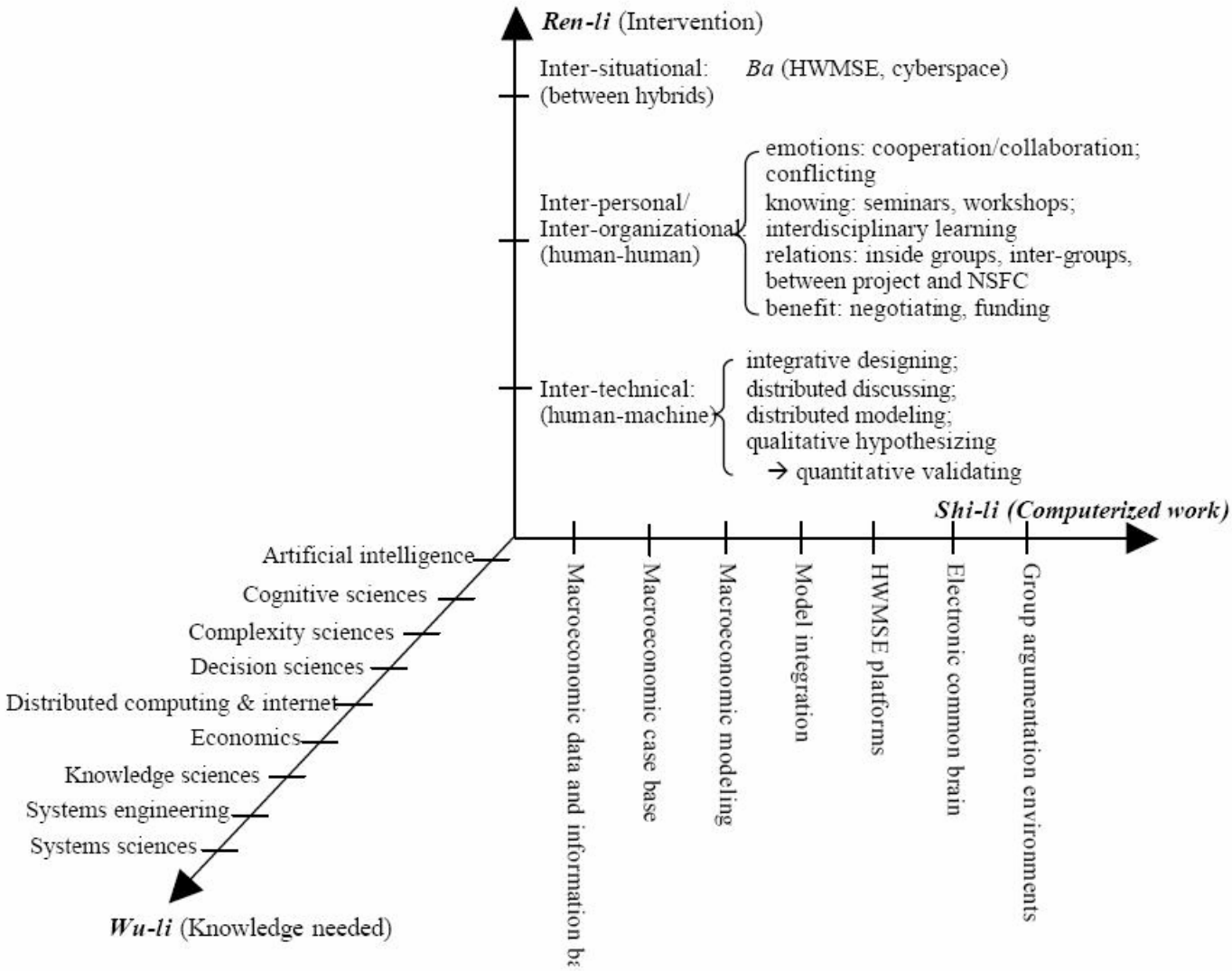
Process(2)

WSR for Decision Making



...By Dr.Zhu


Human Intervention
human-human (coordination)
human-machine (interaction)
qualitative-quantitative
Functions
of models
forecast
data-processing
reservoir operation
water allocation
flood control
simulation
graphic display
office automation
hydrology
computer
communication
information
networking
automation
systems engineering
Knowledge


Ren-li (Intervention)
Inter-situational:
(between hybrids)
Ba (HWMSE, cyberspace)
Inter-personal/
Inter-organizational
(human-human)
emotions: cooperation/collaboration;
conflicting
knowing: seminars, workshops;
interdisciplinary learning
relations: inside groups, inter-groups,
between project and NSFC
benefit: negotiating, funding
Inter-technical:
(human-machine)
integrative designing;
distributed discussing;
distributed modeling;
qualitative hypothesizing
→ quantitative validating
Shi-li (Computerized work)
Artificial intelligence
Cognitive sciences
Complexity sciences
Decision sciences
Distributed computing & internet
Economics
Knowledge sciences
Systems engineering
Systems sciences
Wu-li (Knowledge needed)
Macroeconomic data and information ba
Macroeconomic case base
Macroeconomic modeling
Model integration
HWMSE platforms
Electronic common brain
Group argumentation environments

Linstone,1999, Decision Making for Technology Executives-Using Multiple Perspectives to improve Performance, Artech House

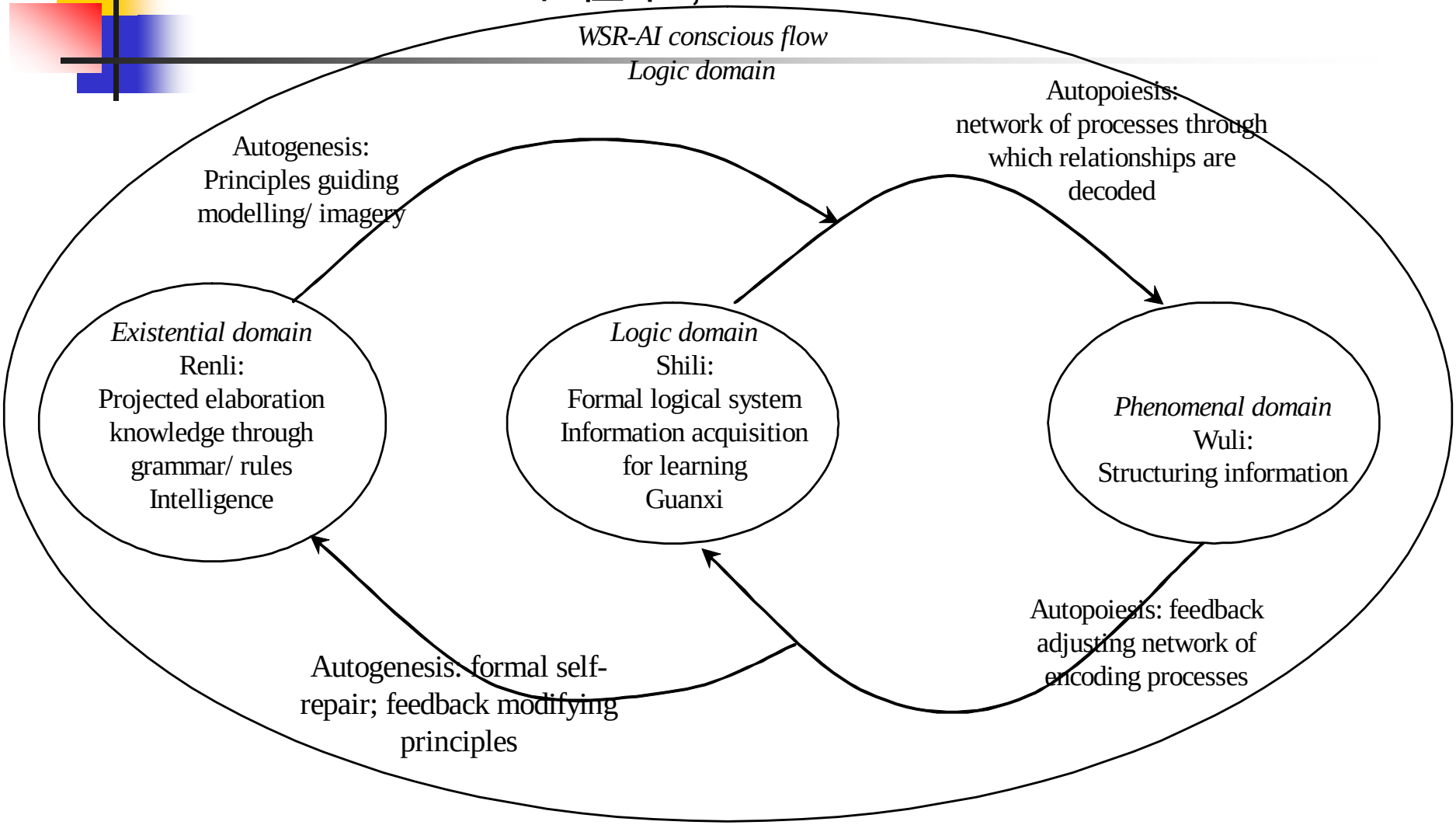
Allison 1971,Harvard	Rational act	Bureaucratic politics	Organizational process
Steinbruner, 1974,MIT	Analytic paradigm	Cognitive paradigm	Cybernetic paradigm
Andersen, 1977,MIT	Rational perspective	Cognitive perspective	Organizational perspective
Linstone, 1981,PSU	Technical perspective	Personal perspective	Organizational perspective
De Raadt, 1989, Sweden	Physical modality	Lingual modality	Social modality
Warfield, 1991,	Situational complexity	Cognitive complexity	Pluralistic complexity
Gu,Zhu,1995	Wuli	Shili	Renli

TOP-Linstone, 1981,PSU

- T - the technical perspective;
- O - the organizational or societal perspective;
- P - the personal or individual perspective
- T(W);
- T-O,T-P(S);
- O-P(R)

从东方系统思维到新信息论

叶祖德, M.Yolles



2.4 **SPIPRO principle approach** (Wang, 1992)

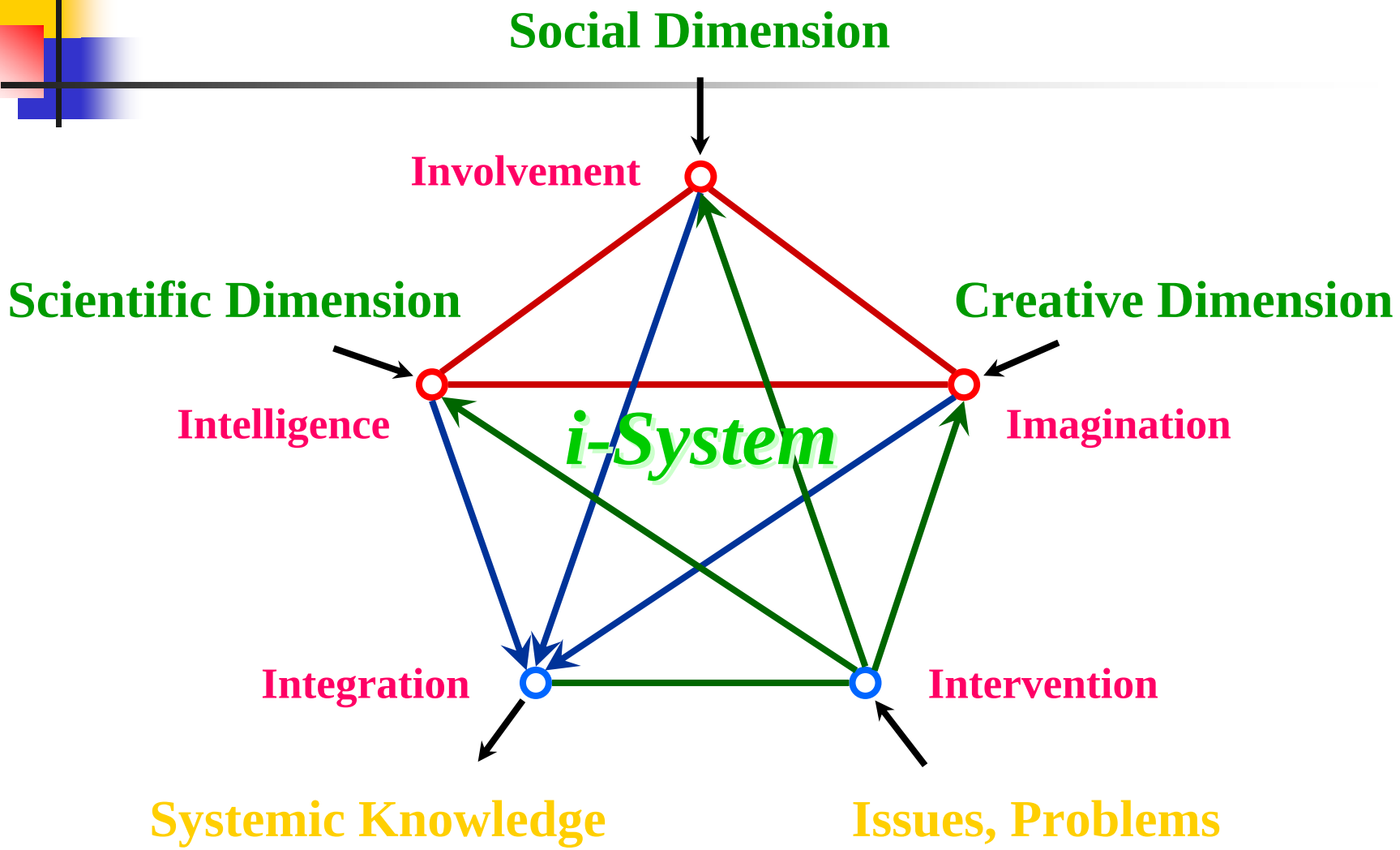
- SPIPRO Principle stands as Spiral Propulsion Principle. This approach is proposed for solving the self-increasing-difficulty systems. It solves a problem step by step, using various methods in cyclical combinations and following the tracks of the change and evolution of the corresponding system. Using this approach is akin to introducing a spiral advancing drilling tool when attempting to manually dig a hole in hard ground

2.5 ***i*-system** (Nakamori, 2000)

- On the base of Shinayakana system approach it expands the I^3 to i^5 (intelligence, imagination, involvement, integration and intervention.). ***i*-system** can be called as a knowledge-creating system based on the system theory and knowledge creation. ***i*-system** integrates statistical data and individual's fragmentary knowledge, and then creates new knowledge; therefore the system enables a process to convert tacit knowledge into explicit knowledge. It has five subsystems, they may circulates at first within five subsystems as a cycle, then may iterates from one cycle to the another cycle

A System of Creating Systemic Knowledge

Yoshiteru Nakamori



Intervention **Take action in a situation that we were not originally involved in.**

Consider what kinds of knowledge are necessary to solve the faced problem, and request three subsystems to collect them. (knowledge=problem)

Intelligence **Enhance our ability to understand and learn things.**

Collect necessary data and information, analyze them with a scientific attitude, and make a model for simulation or optimization. (knowledge=model)

Imagination **Build our own idea on new or exciting things.**

Simulate complex phenomena based on partial knowledge, using information technology. (knowledge=scenario)

Involvement **Raise our and other peoples' concern and enthusiasm.**

Hear opinions of people by organizing a meeting or questionnaire survey. (knowledge=opinion)

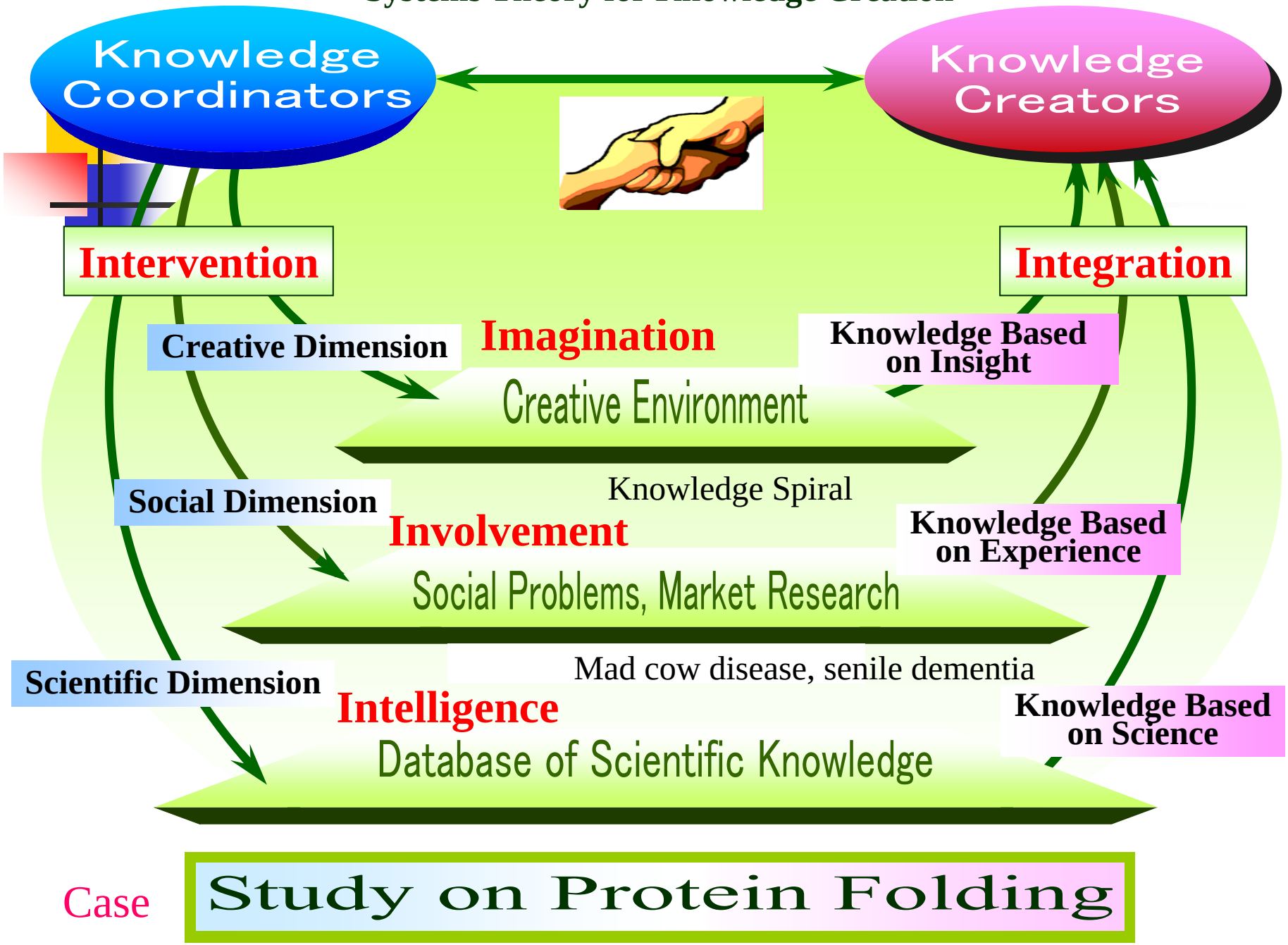
Integration **Combine different knowledge so that they are closely linked.**

Evaluate reliability and justifiability of outputs from three subsystems, and integrate them. (knowledge=solution)

Knowledge Science

Systems Theory for Knowledge Creation

Material Science



Case Study on Protein Folding

3. **The comparison between some East and West system methodologies in the aspects of model, human, human-machine, knowledge and emotion**

	West	East
Model	*****	***
Human	***	*****
Human-machine	*** *****	***** ***
Knowledge	explicit	tacit
Emotion	***	*****

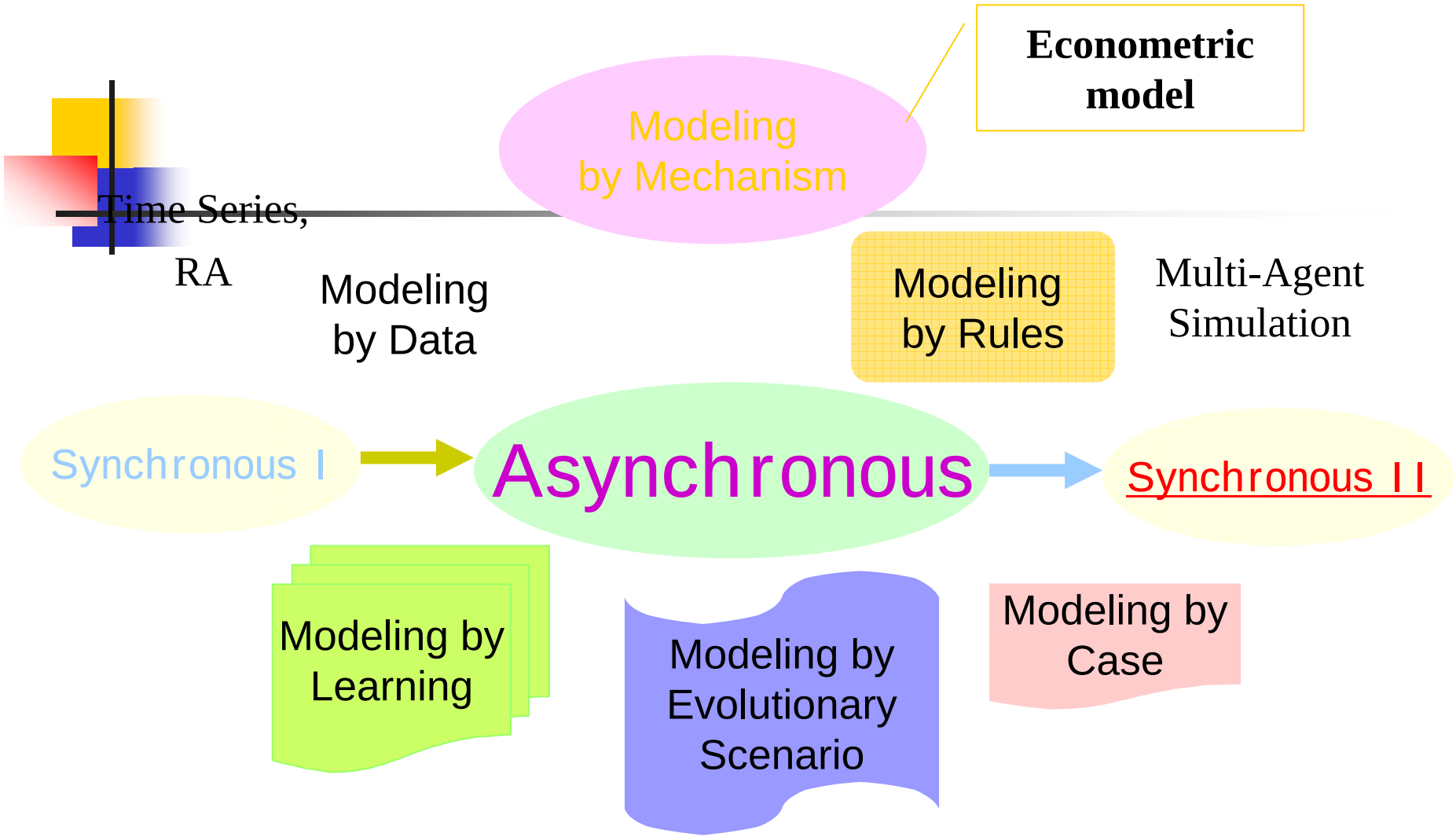
4. Some comments

4.1 Every methodology has its own advantage and disadvantage while in real use

4.2 For a messy problem the complementary principle is suitable

4.3 Stands for combination of qualitative and quantitative, but finally better from qualitative to quantitative

4.4. Stands for combination of human and computer, but emphasizing the human


Econometric model
Modeling by Mechanism
Time Series, RA
Modeling by Data
Modeling by Rules
Multi-Agent Simulation
Synchronous I
Asynchronous
Synchronous II
Modeling by Learning
Modeling by Evolutionary Scenario
Modeling by Case

WU

Objective conditions: resources, restraints, etc.

WULI

物理

Relations with ‘the world’ ;

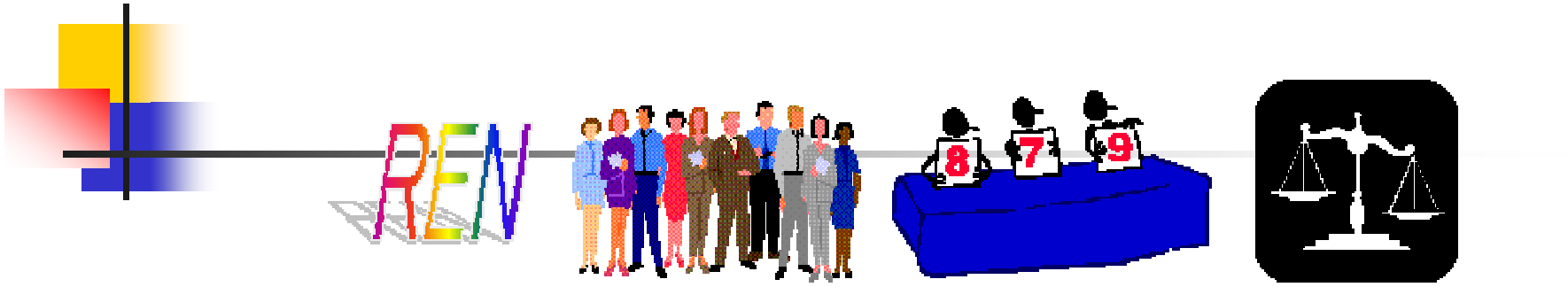
Patterns of connection/transformation

SHI

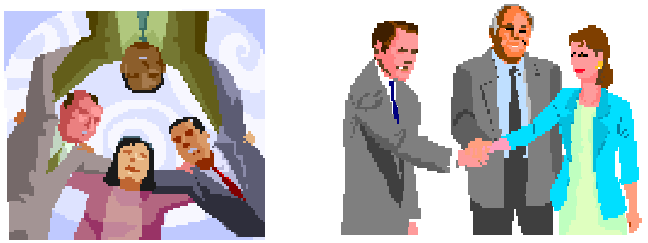
Subjective modeling: involvement, engagement, etc.

SHILI 事理

Relations with 'the self';
Ways of seeing/thinking/doing



Inter-subjective: values, interests, behaviors, etc.



RENLI 人理

Relations with ‘others’ ;

Principles of interaction/encounter