A Theoretical Consideration on Abstraction and Concretization from a Phenomenological Psychological and Educational Perspective

By

Mr. YOSHIDA, Akihiro. Ph.D.
Professor Emeritus
The University of Tokyo, Japan

Homepage address:
http://yoshidaaakihiro.jimdo.com/
“Scientific research consists in making what is discontinuous continuous and in making what is continuous discontinuous”

(Henri Poincare cited by Jean Piaget)
M. C. Escher  Sky and Water I. 1938

Continuous? Discontinuous?
"Incompatible!"
"Ambiguous!"
The first tradition regards ACF (Abstraction and Concept Formation) as

“disregarding the particulars and extracting the common features”

The second tradition, on the other hand, regards ACF as

“common response to dissimilar stimuli”

A falling leaf!
Yellow! (Red!)
It’s fall!  It’s Autumn!
Gravity!
The Law of Gravitation!
“Now it reveals the hidden side,

now the other,

-----thus it falls, an autumn leaf”

Ryokan (1758－1831)
1. A falling leaf!

2. Yellow! (Red!)

3. It’s Fall! It’s Autumn!

4. Gravity!

5. The Law of Gravitation!

6. “Now it reveals the hidden side, now the other,
-------------------thus it falls, an autumn leaf.
The Ideas Intuited (the far term)

“the way of one’s own dying”

“The Law of Gravitation”

“Gravity”

“Fall. Autumn”

“Yellow” (“Red”)

“A falling leaf”

The Sight observed (THE NEAR TERM)

The Subjects (Observers):

YOU : A Child, A Color specialist, A Botanist, Physicists, A Zen monk, etc.
The Intentional Structure of Abstraction

The Subject intends

The Far Term: The Abstract

via

The Near Term: The Concrete
(1) “shape, size, color” and “attribute, object, phenomena”
(2) “thing” and “nothing”
(3) “object” and “subject”
(4) “consciousness” and “unconsciousness”
(6) ”capital” and “value”(Marx)
(8) “Airplane” and “UFO: Unidentified Flying Object”
(9) “the exit of a building, and the exit of a forest”(Yoshida, 1980)
(10) “the multiplication of plus numbers, and the multiplication of minus numbers.”(Yoshida, 1977)

And so on. Ad infinitum.
The Intentional Structure of

Concretization

The Subject intends

The Far Term: The Concrete

via

The Near Term: The Abstract
Both ways “from C to A” and “from A to C” are:

One-to-many correspondences.

Far terms

Near terms

Abstraction

Concretization
Diversity of views in Mathematics
With respect to her own Ontology and Epistemology

1) Formalism
2) Creativism
3) Realism
4) Constructivism
5) Intuitionalism/Intuitionism
6) Conventionalism

And so on.
A Series of the Abstract Images of “Abstraction and Concretization”

From

(1) the “One-way Abstraction” from the Concrete to the Abstract,

(2) the “Two-way Round-trip of Abstraction/ Concretization”

between the Concrete and the Abstract, then to

(3) the “Circular movement between Abstraction and Concretization”.

And, to

(4) the “Spiral Ascending and Descending” of “Abstraction and

Concretization”. And, to (5) the “Double Spiral of the Series”.

And further, to (6) the “Multiple Spirals of the Series”. Ad infinitum.
仙崖
(1) Earth, Fire, and Water.

(2) Tendai (天台), Shingon（真言）, and Zen（禪）:

The three sects of Buddhism.

(3) Saikoro (Dice, サイコロ), Mt.Fuji, and the Globe.

(4) The Entire Universe.

And so on, probably with many other possible alternatives.
A Cross

A Circle

A Parabola

An Ellipse

A Hyperbola
Rudolf Arnheim writes:

...these geometrical figures were treated first as separate, static concept, they had to be restructured in order to emerge as aspects of one unitary dynamic concept. This perceptual restructuring, performed against the grain of the primary evidence, revealed the ellipse as a distorted circle, the straight line(*the Cross*) as a limiting case of the parabola. The discovery served, in the words of Poncelet “to broaden the ideas, to link by continuous chain truths that seem remote from each other, and to make it possible to embrace in a single theorem a throng of particular truths.” / The story of the conic sections shows how closely concept formation is related to the perception of structural simplicity.

Intentional Structure of Consciousness

(B) as the far term (Abstract)  (A) as the far term (Concrete)

↑Abstraction  ↑Concretization

(A) as the near term (Concrete)  (B) as the near term (Abstract)
The “Middle/Mediator”
Between the Abstract and the Concrete

Abstraction

<table>
<thead>
<tr>
<th>The Abstract</th>
<th>The M</th>
<th>The Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>(the far terms)</td>
<td>(the Middle terms)</td>
<td>(the Near Terms)</td>
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Concretization

<table>
<thead>
<tr>
<th>The M</th>
<th>The Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>(the far terms)</td>
<td>(the Near Terms)</td>
</tr>
</tbody>
</table>
A Set-theoretical Formulation
by W. Ross Ashby

$$S = T^{-1} S' T$$
The Middle Term in the Set-theoretical Formulation

Abstraction

The far terms: A

The Middle terms: M

The Near Terms: C

Concretization

The far terms: C

The Middle terms: M

The Near Terms: A
A Modification of the Set-theoretical Formulation

Abstraction

The far terms: A

The Middle terms: M

The Near Term: C

Concretization

A

C

The far terms: A

The Middle terms: M

The Near Term: C
An attempt had been made to show that “category theory provides a number of broadly useful, and yet surprisingly specific, guidelines for organizing, generalizing, and discovering analogies among and within various branches of mathematics and its applications”

(A Categorical Manifesto, by Joseph A. Goguen, 1989, p.12)
A Category-theoretical Formulation of Abstraction

The Far term

The Middle term

The Near term

The Abstract

The MAM

The Concrete

A

\( f \)

\( f^{-1} \)

\( g \)

\( g^{-1} \)

M

C
A Category-theoretical Formulation of Concretization

The far term

The Middle term

The Near term

The Concrete

The MAM

The Abstract

\[ f^{-1}, g^{-1} \]
Essential for Knowledge and Wisdom

MAM (Metaphor, Analogy and Model)

MAC (MAM and Abstraction and Concretization)

**MAM with MAC**

is Essential for Knowledge and Wisdom.
The essence of Phenomenology:

“To see oneself is to see the world, and to see the world is to see oneself. That is the fundamental attitude of Phenomenology.”

(by Jiro Watanabe, 1978)
The essence of Education:

“Let us grow together!”

(by Enosuke Ashida, 1952)
My message: Simultaneously,
(1) by “Seeing the world and ourselves”,
(2) by “abstracting and concretizing” with MAM (Metaphor- Analogy- Model), and also
(3) by “cognizing and communicating”,
“Let us grow together!”
to embody Knowledge and Wisdom for enjoying Life to live “Diversity in Harmony”
MAM with MAC!

Aki Yoshida
“My other piece of advice, Copperfield,” said Mr. Micawber, “you know. Annual income twenty pounds, annual expenditure nineteen nineteen six, result happiness. Annual income twenty pounds, annual expenditure twenty pounds ought and six, result misery.”

(From Charles Dickens *David Copperfield*. 1952/1849, p.176.)