

【資料】

「基本用語索引（日本語－英語）」（2016年版）の 試作にあたって

人間発達研究所が、「人間発達を自主的集団的に研究し、発達科学の創造的発展と実践・研究の今日的課題にこたえること」（規約第2条）を目的として、1985年に設立されて30年が経つ。30周年を迎えて、「発達保障」の思想と実践、「可逆操作の高次化における階層－段階理論」などを世界の共有財産とすべく、日本国内のみならず広く海外に紹介・発信してはどうかという意見が、「田中テキスト勉強会」や「紀要編集委員会」において出されるようになった。

そこで、渡部が呼びかける形で、荒木穂積、中村隆一、西垣順子、川地亜弥子、赤木和重の6名が遣り取りする中で、英語論文を執筆する際に参照できる「基本用語索引（日本語－英語）」を試作することが提起された。まずは今回、既発表の著作や論考で使用されている用語を一覧表に整理した。

一つには、荒木穂積が執筆した英文論考を立命館大学人間科学研究所（旧教育科学研究所）の許諾を得て転載するとともに、そこで使用されている基本用語を一覧にした。もう一つとし

ては、田中昌人（1980）『人間発達の科学』青木書店、同（1987）『人間発達の理論』青木書店において、著者自身によって英語表記が付されている用語を抜き出した（ピアジェ等にかかわるフランス語表記に関しては割愛）。ご検討・ご活用たまわれれば幸いである。

今回の試みが、「発達保障」や「可逆操作の高次化における階層－段階理論」等をめぐる国際的な共同の検討や意見交換の手掛かりとなればと願っている。なお、末尾になったが、転載をご承認下さった著者並びに立命館大学人間科学研究所の関係者に記して感謝したい。

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タイトル：A little known theory of developmental psychology in Japan —— “The theory of hierarchies and stages on reversible operations in human development”

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（文責 渡部昭男）

A Little Known Theory of Developmental Psychology in Japan

: The Theory of Hierarchies and Stages on the Reversible Operations in Human Development

Hozumi Araki

Abstract

Some theories of developmental psychology have originated in Japan in the 20th century. However most are not well known abroad, due to a language obstacle. I introduced the theory of hierarchies and stages on the reversible operations in human development by Masato Tanaka as one of these little known theories in Japan in this article. I mentioned two of the most distinctive points of this theory. The first point is that the reversible operation is seen at every period of developmental process from birth to adolescence or above. In addition every stage contains two phases”; the stage of formation” and “the stage of reversible operation”. The second point is that Tanaka originally expresses an idea relating to the driving force of the developmental process. According to his view a new driving force occurs at each hierarchy at each third stage of “formation”. As one example above I explained the theory of young childhood from one year old to seven years old.

Masato Tanaka and his theory

A number of theories of developmental psychology have been constructed, and some have had world wide influence. But others are not well known even now, due to a language obstacle. For example, some theories of developmental psychology have originated in Japan in the 20th century. However most are not well known abroad. I would like to introduce one of these little known theories in Japan in this article.

Almost all of my colleagues’ and my own research have been based on the theory of hierarchies and stages on the reversible operations in human development by Masato Tanaka (1980,1987 etc.).

Tanaka was born in Tokyo in 1932. After graduating from the University of Kyoto, he worked as a research assistant of psychology for several years at the Faculty of Education in the University of Kyoto. Then he moved to “Ohmi Gakuen” where there was a home for orphaned children by the Pacific War, including children with developmental retardation. Children with developmental retardation increased in number there every year. Tanaka and his colleagues concentrated their research on education and development for such children He built the foundation of his theory at this place. He came back to the University of Kyoto in 1970 as an associate professor and continued working on his theory. He published his first theoretical book in 1980 and his second book in 1987. He also published

several books about child development, especially child development and its diagnosis from birth to seven years old with his colleagues in 1980's. He is now professor emeritus of the University of Kyoto and professor at Ryukoku University.

Tanaka's theory has not yet been translated from Japanese into English, and is almost unknown abroad. It is quite unique, and should be interesting to many researchers in developmental psychology, education, pediatrics, social welfare, and so on, who are involved in work with children.

One of the reasons why it is difficult to translate is that Tanaka uses many new and unique terms. I think his theory has been influenced by Piaget's theory. Tanaka's theory emphasizes a critical period and a turning point in developmental process: he regards the relation between the function and the structure of the mind as important. Both Piaget and Tanaka think there are double or triple hierarchical structures in human development. They think the main structure is composed of certain sub-structures. However there is a philosophical difference between them. Piaget based his theory on the philosophical methodology which is called structuralism, on the other hand Tanaka bases his on dialectical materialism.

In addition there are some significantly different points between Piaget's theory and Tanaka's theory. One of the different points in their theories is how to think about reversible operations. In Piaget's theory, the reversible operation is achieved at the period of seven years old and above: the concrete operational stage and the formal operational stage. On the other hand, in Tanaka's theory, the reversible operation is seen at every period of developmental process from birth to adolescence or above. Tanaka thinks that the reversible operation is one of the important core concepts to explain the phenomena of human development. Moreover he thinks that the dynamic phenomena of human development are better suited to be based on dialectical materialism than on structuralism.

Piaget found four main structures named the sensori-motor stage, the pre-operational stage, the concrete operational stage, and the formal operational stage. He also found sub-structures under the main structure, for example six sub-structures under the sensori-motor stage and two sub-structures under the pre-operational stage.

Tanaka found five main structures named as follows: the hierarchy of the reversible operation, "Rotation"; the hierarchy of the reversible operation, "Connection"; the hierarchy of the reversible operation "Dimensional operation"; the hierarchy of the reversible operation, "Transformation"; and the hierarchy of the reversible operation, "Abstraction". He found three sub-structures under each main structure. He named each main structure "hierarchy" and each sub-structure "stage" (see Table 1).

Tanaka's theory, the theory of hierarchies and stages on the reversible operations in human development (M. Tanaka: 1980), is built on the double construction described above. In this article I will focus only on two of the most distinctive points of his theory, because I have not enough space to explain all elements of his theory fully.

Table 1 The theory of hierarchies and stages on the reversible operations in human development
(Tanaka, 1987)

The hierarchy of the reversible operation, “Rotation”

- The stage of the formation, “Rotation having one axis” (0 ~ 1 month)
- ①The stage of the reversible operation, “Rotation having one axis” (1 month)
- The stage of the formation, “Rotation having two axes” (2 months)
- ②The stage of the reversible operation, “Rotation having two axes” (3 months)
- The stage of the formation, “Rotation having three axes” (4 months) : **Driving Force**
- ③The stage of the reversible operation, “Rotation having three axes” (5 months)

The hierarchy of the reversible operation, “Connection”

- The stage of the formation, “Connection of genus 1” (6 months)
- ①The stage of the reversible operation, “Connection of genus 1” (7 months)
- The stage of the formation, “Connection of genus 2” (8 months)
- ②The stage of the reversible operation, “Connection of genus 2” (9 months)
- The stage of the formation, “Connection of genus 3” (10 months) : **Driving Force**
- ③The stage of the reversible operation, “Connection of genus 3” (11 months)

The hierarchy of the reversible “Dimensional operation”

- The stage of the formative “One dimensional operation” (1:0)
- ①The stage of the reversible “One dimensional operation” (1:6)
- The stage of the formative “Two dimensional operation” (2:0 ~ 3:6)
- ②The stage of the reversible “Two dimensional operation” (4:0)
- The stage of the formative “Three dimensional operation” (5:6) : **Driving Force**
- ③The stage of the reversible “Three dimensional operation” (7:0)

The hierarchy of the reversible operation, “Transformation”

- The stage of the formation, “Linear transformation” (7:0 ~ 8:6)
- ①The stage of the reversible operation, “Linear transformation” (9:0)
- The stage of the formation, “Quadratic transformation” (10:0 ~ 11:0)
- ②The stage of the reversible operation, “Quadratic transformation” (12:0 ~ 13:0)
- The stage of the formation, “Cubic transformation” (14:0) : **Driving Force**
- ③The stage of the reversible operation, “Cubic transformation” (16, 17 years)

The hierarchy of the reversible operation, “Abstraction”

The stage of formation and the stage of reversible operation

The first point is that every stage contains two phases. One phase is stable and another phase is a period of crisis. A stable phase is called “the stage of formation” and a period of crisis is called “the stage of reversible operation”. A period of crisis alternates with a stable phase in the developmental process. At the period of a crisis it is more difficult to acquire some new abilities of this period and it is slower to progress within this period.

A child needs much more effort to get over the period of crisis but the developmental progress is less than at the stable phase. Her parent, care giver and teacher also need much more effort to support her doing this (see Fig.1). In the case of children with physical and mental impairment it might be harder to get over this period: a mental delay would become more conspicuous at this period of crisis. Of course in most cases they would be able to get over it. If children had more mental delay at this period of crisis, some of them could catch up at the next stable phase. Others, who could not catch up, also would get over it step by step over a long period. The tendency which children have to experience some difficulties to learn and some conflicts in making human relations when they acquire new abilities would be more noticeable at the period of crisis and would be less at the next stable phase. Children need big efforts to acquire new abilities at the period of crisis and some of them sometimes do not succeed to get over at this period (at the stage of the reversible operation) (see Fig.2). On the other hand, children need less efforts to acquire new abilities at the stable phase and pass more easily at this phase (at the stage of the formation) (see Fig.3).

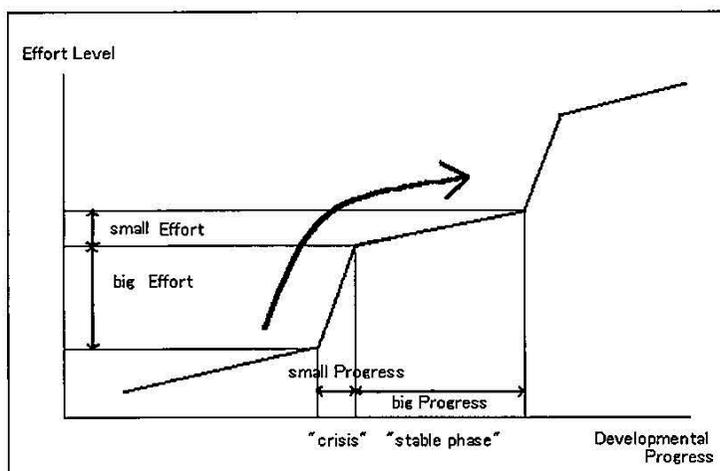


Figure 1 The conceptual image of the relation between developmental progress and the effort level

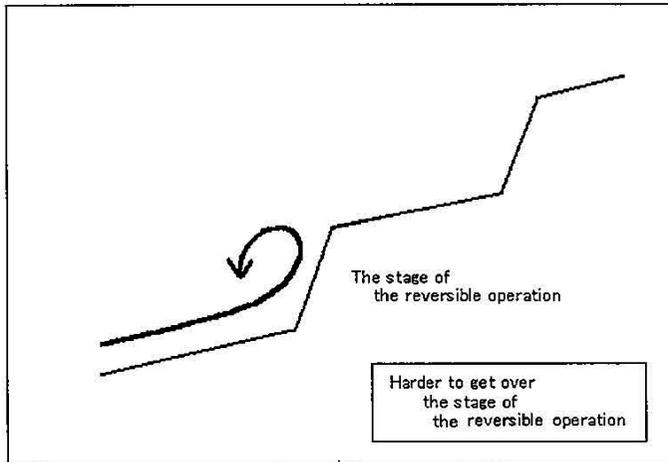


Figure 2 The conceptual image of difficulty of getting over the stage of the reversible operation

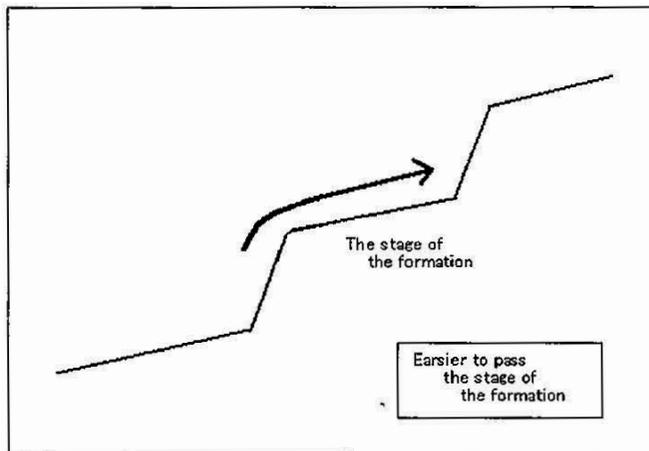


Figure 3 The conceptual image of passing the stage of the formation easily

The origin of this idea relating to “the period of crisis”, namely that a stage of reversible operation alternates with a stage of formation in human development, was found in the works of Gesell and Vygotsky. Tanaka’s idea was also based on the practice of educational treatment for children with learning difficulties.

The driving force in development

The second point I would express is an idea relating to the driving force of the developmental process. Tanaka expressed a criticism of Piaget’s theory (Tanaka, 1987). Piaget found some structure in the human developmental process but he did not adequately describe how the developmental driving force transferred from one structure to the next structure. Tanaka thinks that it is necessary to

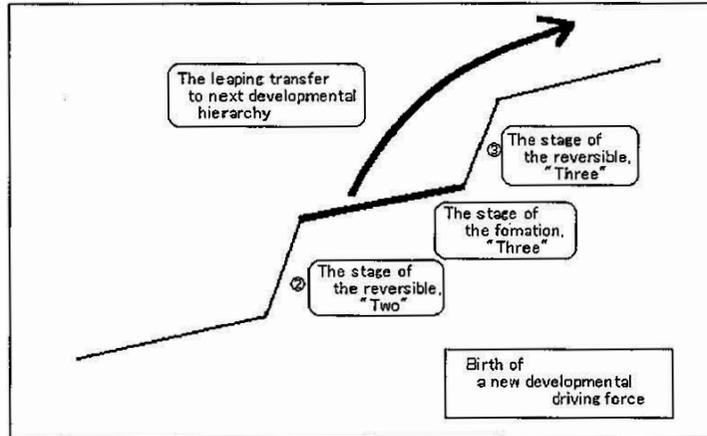


Figure 4 The conceptual image of the birth and transference of a new developmental driving force in human developmental process

transfer from a lower structure to higher structure. When or where does the driving force originate? According to his view a new driving force occurs at each hierarchy at each third stage of “formation” (see Fig.4).

His idea is quite unique at this point because he does not think that a new driving force occurs at the third stage of “reversible operation”, it occurs at the stage of “formation”: between the second stage and the third stage of “reversible operation” at each hierarchy. A new driving force is formed at the stage of “formation” in the former hierarchy and developing itself by the time of the first stage of “reversible operation” in the next hierarchy. Therefore, at this period, a child has to do two developmental tasks: she is getting over the last stage (the third stage of “reversible operation”) within this hierarchy and at the same time she is going into the next hierarchy. When she reaches the first stage of “reversible operation”, the transference will pass from the former hierarchy to the next hierarchy.

According to his theory a new driving force originates four times (at 4 months old, 10 months old, 5 and a half years old, and 14 years old) until childhood is finished (see Table 1).

Young childhood and its world

As one example I will focus on the theory of around 4 years old of young childhood. There are three stages at the hierarchy of young childhood, named the hierarchy of the reversible operation “Dimensional operation”. The stages, namely the periods of crisis, are at around one and half years old, four years old and seven years old.

The first stage is called the stage of the reversible “One dimensional operation” (the Reversible 1 Dimensional World; R-1DW; at around one and half years old).

The second stage is called the stage of the reversible “Two dimensional operation” (the Reversible 2 Dimensional World; R-2DW; at around four years old).

The third stage is called the stage of the reversible “Three dimensional operation” (the Reversible 3 Dimensional World; R-3DW; at around seven years old)

① One and half years old (the Reversible 1 Dimensional World)

On the Reversible 1 Dimensional World (R-1DW) a child can operate only one of the reversible operations. For example before this stage, namely the Formative 1 Dimensional World (F-1DW), she can go to the instructed place but can not come back without the next instruction. In this stage, however, she can both go to the goal and also come back to the start place with one instruction. “Go and come back” (return) is one of the important characteristics of R-1DW.

I will give one more example. An experimenter places 8 cubes and 2 dishes on the desk in front of a child. An experimenter asks her to put 8 cubes into dishes. Then she can alternately distribute 8 cubes to two dishes. Nevertheless she has not yet understood the concept of numbers. She can distribute four and four or five and three, because she alternately puts into the cubes left and right. At that time she can sometimes not stop her performance herself. She goes on to take one dish and turns it over on the other dish. Ultimately 8 cubes are on one dish, on the other dish there are no cubes. On the Formative 1 Dimensional World (F-1DW), he/she put the cubes into only one side, the left or the right dish and also finishes at that time.

On the Reversible 1 Dimensional World (R-1DW) I think almost all of her performance contains one reversible operation as linear behavior not parallel behavior in one dimension. Tanaka names this the world of “Go and come back” or “Do not do this, but do that”.

She can go and come back at her performing level and understand the concept of difference and sameness between the objects at the Reversible 1 Dimensional World (R-1DW). It seems she lives in the Reversible 1 Dimensional World with operating some of the reversible 1 dimensional operations.

② Two or three years old (the Formative 2 Dimensional World)

After two years old, the Reversible 1 Dimensional World (R-1DW) becomes stable. Then we can say R-1DW changes to the Formative 2 Dimensional World (F-2DW).

A child develops the Formative 2 Dimensional World (F-2DW). She becomes able to understand the early comparative concepts, for example bigger and smaller. She can compare one thing with other thing along two directions on one dimension. She acquires a base understanding of many comparative concepts.

In the case of children with autism it is sometimes difficult to acquire the comparative concept because of not completely establishing representation as the base of conception in their mind. It seems they cannot easily operate one reversible operation in their mind: they can not successfully relate one concept with another one on the same dimension, although they may be able to say an object is big,

they may not be able to compare it with a smaller object and state the difference. They may say this is big and that is an orange. However, they will be able to operate one reversible operation along two directions at the Formative 2 Dimensional World more easily step by step as their representation of comparative concepts becomes clearer in their mind.

When a child has acquired some visible comparative conceptions, we may say she has formed polarization. However it does not mean that she has acquired the invisible comparative concept at the Reversible 2 Dimensional World (R-2DW) (See Fig.5).

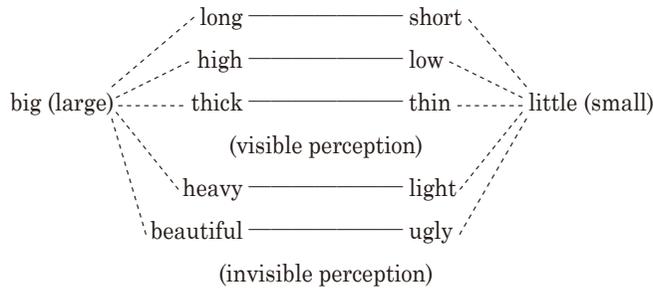


Figure 5 Polarization (the Formative 2 Dimensional World: F-2DW)

She can draw a cross (a cross contains two dimensions, vertical and horizontal). She can also repeat two numbers and understand the concept of possession, “Yours and Mine” at the later Formative 2 Dimensional World (F-2DW). It seems she lives in the Formative 2 Dimensional World. This means she lives in “Two dimensional World” but she has not yet acquired the ability to operate “the 2 dimensional operations”. She seems to have a pairing world but only for visible stimuli. She is not yet able to have it for stimuli world cannot be seen. She still understands pairing world by operating a lot of “the reversible 1 dimensional operations” repeatedly. She has not yet been able to operate “the reversible 2 dimensional operations” until the next stage.

③ Four years old (the Reversible 2 Dimensional World)

The Reversible 2 Dimensional World (R-2DW), which includes operating the reversible 2 dimensional operations, starts at about 4 years old.

A child can operate two reversible operations and integrate them in two different dimensions. One example of the performance level on the Reversible 2 Dimensional World (R-2DW) is the posture of stepping on one leg. She has to go forward holding one leg bent. At that time, we can say that the posture of hopping on one leg is integrated into the posture of going forward with the posture of bending the other leg. She has to control two postures: going forward and bending one leg at the same time. A child integrates two postures into one posture.

She begins to be able to understand the invisible comparative conception at this stage. For example when she compares two cubes of different weight but the same shape, she can give the correct answer: heavy and light. She also understands the concept of beautiful and ugly. Furthermore she can

immediately repeat four numbers, 4 7 3 9: she firstly repeats the two numbers of former block, 4 7, while she is holding the latter memory block in her memory and then she repeat another two numbers of the latter block, 3 9. Then, when she is asked a question in a hypothetical situation: what do you do if your house is on fire when you are inside, she can give the correct answer: she runs away from the house and/or calls a fire engine.

On the Reversible 2 Dimensional World (R-2 DW) a child can integrate two reversible operations of the different dimension at the same time: she can operate one reversible operation while holding another reversible operation in her mind. We can call it the world of “While doing this, doing that”. At that time it seems she lives in the reversible 2 Dimensional World which includes operating some of the reversible 2 different dimensional operations at the same time. We can say she indeed lives in a “Two dimensional world”.

Later in the Reversible 2 Dimensional World a child can more easily operate two reversible operations in her mind not only with spatial tasks (heavy-light, beautiful-ugly) but also with sequential tasks (yesterday-today, short -long in time). A child can compare the former situation in time with the latter one. When a child can operate two reversible operations on a sequential task, I think, a child also succeeds in the task of the first order theory of mind: the False-Belief task of “Theory of Mind”.

④ Five and half years old (the Formative 3 Dimensional World : the new driving force occurs at three times from birth)

After 5 years old, the Reversible 2 Dimensional World (R-2DW) becomes stable. We say R-2DW changes into the Formative 3 Dimensional World (F-3DW). She becomes able to understand the concept of serializing, much bigger or much smaller (See Fig.6).

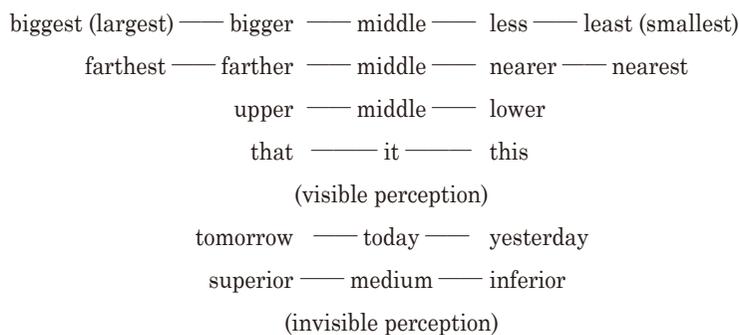


Figure 6 Serialization (the Formative 3 Dimensional World: F-3DW)

At this period she can draw circles in a serializing order and after that, she points to the biggest circle, the smallest circle and the middle circle when asked to do that. She can also comprehend the three aspects' images of object, front, back and side. We can say she acquires the three different points of view in her mind like the three mountains task by Piaget. She can understand the concept of the time order: the day before yesterday, yesterday, today, tomorrow, the day after tomorrow.

It seems she lives in the Formative 3 Dimensional World. This means she lives in “Three dimensional World” including big-middle-small, far-middle-near, upper-middle-lower, that-it-this, yesterday-today-tomorrow, superior-medium-inferior, wrong-medium-bad, and so on but she has not yet been able to operate “the reversible 3 dimensional operations” until the next stage.

A new driving force also occurs at the Formative 3 Dimensional World, at around five and half years old, as the transference from the hierarchy of the reversible “Dimensional operation” to the hierarchy of the reversible operation, “Transformation”. We could say this transference is from the Speaking World to the Writing World.

When she is acquiring a new driving force, she can acquire an early literacy: adding one and/or subtracting one, counting the number from one to twenty without speaking, writing her name and/or some letters, drawing the map from her house to school and so on. She also immediately makes a friend with the friend of her friend and plays a lot. She easily builds much bigger or larger creative works than her body by cooperating with her friends as in the example of building a house of cardboard boxes. In addition, she understands the rule and morals of a citizen: not to borrow anything without permission, not to throw rubbish away on a road because of keeping the road clear and so on. We can say she is already a little citizen.

⑤ Seven years old (the Reversible 3 Dimensional World)

The Reversible 3 Dimensional World (R-3DW), which includes operating the reversible 3 dimensional operation, starts at about 7 years old. On the Reversible 3 Dimensional World (R-3 DW) a child can integrate three reversible operations of the different dimension like the principle of the former stages. At that time we can say she lives in a “Three dimensional world”. She begins to get over the double periods which are from the stage of the reversible “Three dimensional operation” to the stage of the formation, “Cubic transformation” and from the hierarchy of the reversible “Dimensional operation” to the hierarchy of the reversible operation, “Transformation” (See Table 1).

A child is just discovering a new world at that time. We might say a child is being born again.

Note: I should have to work on my report to revise the wording; a new developmental driving force and so on. in future.

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Key words: theory of developmental psychology, reversible operation, driving force, young childhood, Tanaka

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注) 再掲にあたって「可逆操作の高次化における階層－段階理論」の英訳を“The theory of hierarchies and stages on reversible operations in human development”からThe theory of hierarchies and stages on the reversible operations in human developmentに変更した(荒木穂積).

索引1. 荒木穂積論考における基本用語（日本語－英語）

（記載ページ順）

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形成期	stage of formation	1
可逆操作期	stage of reversible operation	1
発達の原動力	driving force of the developmental process	1
新しい力	new driving force	1
発達の臨界期および質的転換期	a critical period and a turning point in developmental process	2
構造主義	structuralism	2
唯物弁証法	dialectical materialism	2
人間発達におけるダイナミックな現象	dynamic phenomena of human development	3
回転軸	Rotation	3
連結	Connection	3
次元（操作）	Dimensional operation	3
変換	Transformation	3
抽象	Abstraction	3
階層	hierarchy	3
段階	stage	3
危機期	period of crisis	3
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時期を乗り越える	to get over this period	4
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並列化行動	parallel behaviour	6
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日本語	英語	ページ目
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書き言葉の世界	the Writing World	10
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二次変換	Quadratic transformation	10
三次変換	Cubic transformation	10
乳児期前半	early period of infancy	11
乳児期後半	later period of infancy	11
幼児期 I	younger childhood I	11
幼児期 II	younger childhood II	11
幼児期 III	younger childhood III	11
児童期	childhood	参考
学童期	school child age	参考
思春期	early adolescence, puberty	参考
青春期	adolescence	参考
青年期	young adulthood	参考
成人期	adulthood	参考
老年期	old age	参考
胎生期	prenatal period	参考
胎児期	fetal period	参考
胎芽期	embryonic period	参考
胞胚期	geminal period	参考
創出可逆操作の階層	The hierarchy of the reversible operation, “Generation”	参考

注) 創出可逆操作の英訳を the reversible operation “Generation” としたが, 田中昌人は英語名を付けていない(荒木穂積).

索引 2-1. 田中昌人著作における基本用語（日本語－英語）『人間発達の科学』1980

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索引 2-2. 田中昌人著作における基本用語（日本語－英語）『人間発達の理論』1987

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回転可逆操作の階層	The hierarchy of the reversible operation, "Rotation"	4
連結可逆操作の階層	The hierarchy of the reversible operation, "Connection"	4
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