Breaking the *Status Quo:* A Third Vision on the Relations of Numeric System and Psychological Measurement

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Abstract This chapter examines the correlation between the prevailing numerical system and the assessment of psychological variables in contemporary psychology. As a science, psychology primarily relies on analysing data generated by a linear numerical system. However, such an approach presents limitations as it is challenging to accurately interpret dynamic and multilinear processes using a single linear system. Using linear numbers in a non-linear system can lead to unpredictable outcomes, and comparing linear variables with other linear variables can result in oversimplifications and a multitude of generalised conclusions. This chapter proposes an alternative perspective and a potential solution to address this problem.

Keywords Psychology; Systems; Analytics; Quasi-linearity; Generalisation

Introduction

A person, a complex total of physiology and the psyche, is born *from* the world (developing in and evolving from this world), not *into* the world, as is commonly said. The apple tree gives away its fruits – the apple comes *from* the tree, not *into* the tree. Following the same logic, it should be that mathematics used to measure psychological phenomena are derived from psychology. Axiomatically, psychological measurements are changed to fit into the preset borders of linear universal mathematics. However, is this axiom fitting the phenomena?

It is possible to have a non-linear system that visually represents a curved line. Nature provides no straight lines, while human technologies are mainly based on organising their products in linear orders – straight lines, fixed corners, etc. (Valsiner, 2019). Likewise, the social sciences methodologies are built upon the notion of linearity – turning complex non-linear phenomena into artificially "measured" entities (Mitchell, 1999). Forcing the non-linear into a process of linearised "measurement" operations creates an irreversible loss of the relevant features of the phenomena (Valsiner, 2019).

Psychology is fond of considering its data-making as an act of "assigning numbers". As semiotically seen, the assignment of numbers is an act of a sign in the making, nothing more. Assigning a number establishes the *arbitrary* relation between the assigned sign and the object. In the act of psychological measurement, that "relation" entails projecting the property of the number onto the object the number is assumed to represent. Psychology is focused on variation between cases (interindividual variation). Thus, results are considered generalisable to understanding and explaining variation within single cases (intraindividual variation) (Molenaar, 2009).

Contrarily, when examining the act of creating a sign during the measurement process, emphasis must be placed on the concept of relationship. This term embodies the correspondence between two interconnected system components, where each component operates independently and is unaffected by the other. Compare the following act with two assignments:

> Act: Jimmy hits Johnny.
> Quantitative assignment: Number 8 out of 10 represents Jimmy's aggressivity.

Qualitative assignment: Jimmy is aggressive.
The label “aggressive” has ties with the act, but number 8 does not.

If we view the present through lenses constructed by the past, then clearer vision comes through locating the historical conditions shaping them (Michell, 1999). So, one can argue that when you understand what affects you, you are no longer affected—as the reflection by understanding is already an act of psychological distancing. From the moment you understand what effect something in the past had on you, the “effect” leads to self-reflexive sign-making. A reaction you can control or at least learn to manage by way of psychologically distancing yourself in the present from the events in the past.

The question about psychology, in general, is as follows – what is the role of number assignments in revealing or hiding psychological realities? Is it a social norm to turn phenomena into quantities or establish new relations between sign and what it signifies? Examples from psychology give these accounts:

> Measurement may be defined as the application of rules for assigning numbers to objects (Kaplan & Saccuzzo, 1993, p. 30).

> Assignment of numerals to objects or events according to rules (Stevens, 1946, p. 667).

> Tests are designed to measure the attributes of the test taker, and measurement implies the assignment of numerical values (Friedenberg, 1995, p. 6).

All these definitions have a setback – they assign a value to something, and value comes on behalf of the assigner; it is inserted into the act. The systems mentioned above try to simplify and codify multistage phenomena in a continuum (irreversible and time-inclusive) and categorise the phenomena. There have been powerful but forgotten counter-voices to this practice:

> The (…) quantitative method, brought over into psychology from the exact sciences, physics and chemistry, must be discarded; for its ideal consisted in reducing the more complex to the simpler, the whole into its parts, the later-evolved to the earlier-existent, thus denying or eliminating just the factor which constituted or revealed what was truly genetic. Newer modes of manifestation cannot be stated in atomic terms without doing violence to the more synthetic modes which observation reveals (Baldwin, 1930, p. 7).

Our contemporary science has failed to formalise such logic, despite substantial efforts in this exact direction (Baldwin, 1906, 1908, 1911, 1915). Constructing any theory about the order of a complex developing system is a complicated intellectual task that requires breaking an existing order to develop a new one. In other terms, the epistemological puzzle is to understand the order in the apparent disorder of development (Valsiner, 2017).

Understanding thinking and relating with the world of objects—focusing on aesthetic objects as the highest level of development—should be the apparent rationale for abandoning the quantitative method. In psychology, that method has been the principal tool for creating misplaced and illusory precision of knowledge about non-existing objects such as intelligence, personality, etc. Instead, the processes of meaning construction—ongoing construction of new nuances of meaning—need to be investigated, because these are presented within generalised feelings about the world (Baldwin, 1930, p. 7).

Numeric System Tailored for Psyche

The human mind does not work on linear Boolean systems. Emotion and experience are not linear, nor Boolean, also due to being interconnected, nor do they affect just themselves. Emotions are interconnected. Within psychology, it is supposed that sensation intensity and intellectual ability are both quantitatively related to other attributes. Therefore, human emotions and the irreversible experience cannot be described with the linear Boolean equation 1.1.

$$f(x + y) = f(x) + f(y)$$

Figure 1. Equation of linear Boolean function.

Gestalt psychology already captured the aforementioned idea in 1890, but the misfit of measurement onto phenomena continues. Gestalt is defined as an organised whole that is perceived as more than the sum of its parts. Psychology needs a sharp vicissitude from being too nomothetically science-oriented. The relevance of idiographic and nomothetic forms of science has been the subject of fierce debates within psychology, and there has been a false tendency to see these two terms as antagonistic rather than complementary (Limmer, 2011). Idiographic knowledge aims at describing and explaining particular phenomena (Windelband, 2001 [1901]). Nomothetic knowledge, on the other hand, aims to find generalities common to a class of particulars and derive theories or laws to account for these generalities (Limmer, 2011). The origins of contemporary confusion over the term 'nomothetic' stem from a long-held misconception that nomothetic research requires large samples and group-based statistics such as means and variances (i.e. the 'Galtonian' paradigm), when in fact, nomothetic research has another paradigm at its disposal that can be termed the 'Wundtian' paradigm, which relies on smaller samples, and a case-by-case form of analysis (Lamiell, 2003).

It is also essential to understand that the nomothetic approach is not the opposite of the idiographic approach. Nevertheless, an idiographic approach is the necessary first step in discovering the new phenomenon that leads to generalisation. The uniqueness of psychological phenomena makes it unfeasible for science to rely exclusively on the inductive generalisation that works through an accumulation of empirical evidence provided by aggregated collections of specimens either within a single case (accumulation over time) or by assuming equivalence of exemplars across single cases subsumed under the same general class (a category viewed as a population). An abductive generalisation can solve the class <> individuals relationship problem by characterising the dynamics of the unique case while it arrives at generalisation (Salvatore & Valsiner, 2010).

Quasi-linear Open System

The dynamics of linearisation <> curvilinearisation of the structure of the human *psyche* can be seen as the basic principle of the human mind. We become trapped in the insoluble web that united "love" and "hate" at times (curvilinearised state) in some relation (toward a displeasing political figure or abusive parent) while being completely linear in relation to subjectively trivial details of daily life, such as linearisation (Valsiner, 2019).

For example, the variations in the feeling of "*love*". The phenomenon of love can be differentiated from states of indifference and, in certain cases, from the occurrence of friendship. It is important to note that the presence of love is not an inherent requirement for the formation of a friendship. Friendship can also function due to experiencing joy together or be based on symbiosis. For example, a study group. In a study group, people in the group can get along well, enjoy spending time together and can be called friends, yet there is no love between the friends in the group. Additionally, the concept of "love" can be differentiated from the concept of relationship. For instance, an individual may not experience love towards their grandmother yet possess a strong sense of familial relationship with her. The absence of love does not necessarily equate to hatred. This exemplifies the distinction between love and relationship, as the connection to the grandmother is defined by a feeling of relatedness rather than love, hence positioning it within the realm of relationship and, therefore, inside the domain of love. One of the only "non-love" fields is "hate", which can't be included in the "love" field in any logical way.

Open and Closed Systems

The difference between an open and isolated system is the interaction between the stimuli and the direction and direction of effect of the interaction. In physics, an open system exchanges energy and matter within its immediate proximity. An example of a real situation of an open system would be an orchestra. The functioning of an orchestra is contingent upon a multitude of factors, including revenue generated from concert ticket sales, financial support from investors and donors, the acquisition and aptitude of new musicians, availability and suitability of performance venues, as well as political circumstances. These factors, both historical and current, significantly impact the ultimate output of the orchestra, which is primarily in the form of musical performance. Therefore, the output is dependent on many factors that are both in the past and present, and the output is mostly singular – music.

Adapting the idea to fit psychology would be an open system that exchanges stimuli both ways during every interaction. An open system can understand and translate the past, fit the past into the present and help predict even the patterns of occurrences - perhaps even the future. For example, our Jimmy hits Johnny and is considered quantitatively with aggressiveness 8/10 or plainly as "aggressive". Yet, the past – the circumstances motivating the aggressive behaviour and other aspects – is disregarded as unnecessary in the assessment of Jimmy's aggressiveness. In this case, Jimmy is just aggressive.

Therefore, to avoid the situation of trying to describe Jimmy's aggressiveness, an open system can provide us with the means to a deeper understanding of the aggressiveness of Jimmy by taking into account the past and the present. In the process, possibly defining the cause for aggressiveness of Jimmy and measuring the probabilistic chance of the aggressive behaviour happening again – using the past and the present to generate a potential future outcome.

In an open system, the system tries to address as many stimuli and emotions as possible. Yet, some stimuli or emotions can be more relevant than others. Happiness catalysed by a birthday party is more overwhelming and supported than the sadness of not getting the gift hoped for. Both emotions are active, but is the effect on the behaviour and overall psyche identical? To illustrate, it is not uncommon for an individual to experience feelings of fear, tension, and discomfort while viewing a horror film, yet still find themselves captivated by the movie and unable to disengage from its narrative. This phenomenon highlights the complex interplay between emotions, dissonance and cognitions.

One can think of it as a utopian numeric system where everything is relative to each other. A symbiosis between the nomothetic function and the idiographic approach. Boolean

logic, nor any other linear closed system, does not fit into a system where multiple processes can co-exist. Therefore, the linear and Boolean systems both fail to adequately translate the human mind. Furthermore, the aim of psychophysical measurement, as conceived by its founder, Fechner, is to qualify the intensity of sensations (Michell, 1999). Yet, there is an error in measuring the intensity of sensations. The natural state of ambivalence in the psyche can never be represented by one or many real numbers.

The Utopian Nature of Psychological *Measurement*

In pursuit of establishing a scientifically rigorous discipline, psychology cannot afford to rely on flawed measurement and numerical methodologies. The incorrect logic is defined as "The measurement being the process of assigning numerals to objects or events according to rules" (Corsini & Auerbach, 2004 983?). Implying incorrect logic from the start results in consistent errors and mishaps in the results. Concealing inaccuracies under euphemisms or the guise of occasional correctness is akin to a broken clock being right twice a day or intentionally altering its display to create a false correlation with the actual time. Achieving consistent and accurate results in psychology can be facilitated through the development of a customised numerical system that is tailored to the specific needs and requirements of psychology.

Furthermore, the dynamic nature of many processes within psychology presents a significant challenge that must be addressed in order to advance the discipline. Static characteristics vary slowly or remain constant. Dynamic processes vary rapidly and are in active change. The contents of one's mind change erratically. Trying to measure a dynamic process with an instrument designed to determine a static process results in a meaningless output from meaningful input. Furthermore, considering the individual differences in dynamics.

For example, trying to effectively measure the *ATP* (*Acute Tryptophane Depletion*) effect on depression with a huge testing audience is almost impossible. *ATP* is mostly caused by creating dietary differences in the sample group mainly because one cannot consider every difference in individual metabolism or the actions engaged in before the evaluation process. Physical movement consumes more energy than sleeping; therefore, the leptin and ghrelin hormones trigger differently. How can the evaluation be subjectively accurate if every test subject has a different reaction and intensity of the reaction from the stress conditioned by hunger?

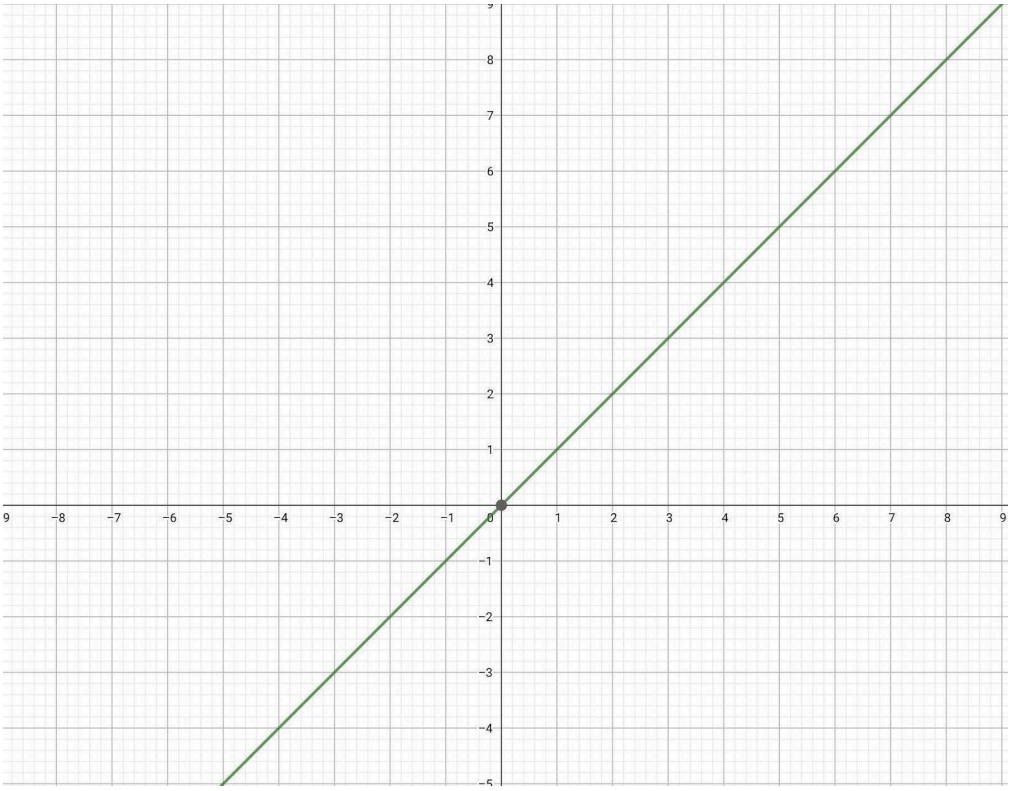

Figure 2. Linear numeric graph.

The most acute problems of the linear system are that data elements are arranged in a linear order where each and every element is always directly attached to its previous and next adjacent, single level of informational data flow is processed and data elements can be traversed in a singular manner only. For example, *1 – 2 – 3 ... N* and *N ... -0.1 – 0 – 0.1 ...N*. If a graph were created by the previous numbers, the line going through all the points would be a straight line; therefore, the *1 – 2 – 3 ... N* is considered as a linear system.

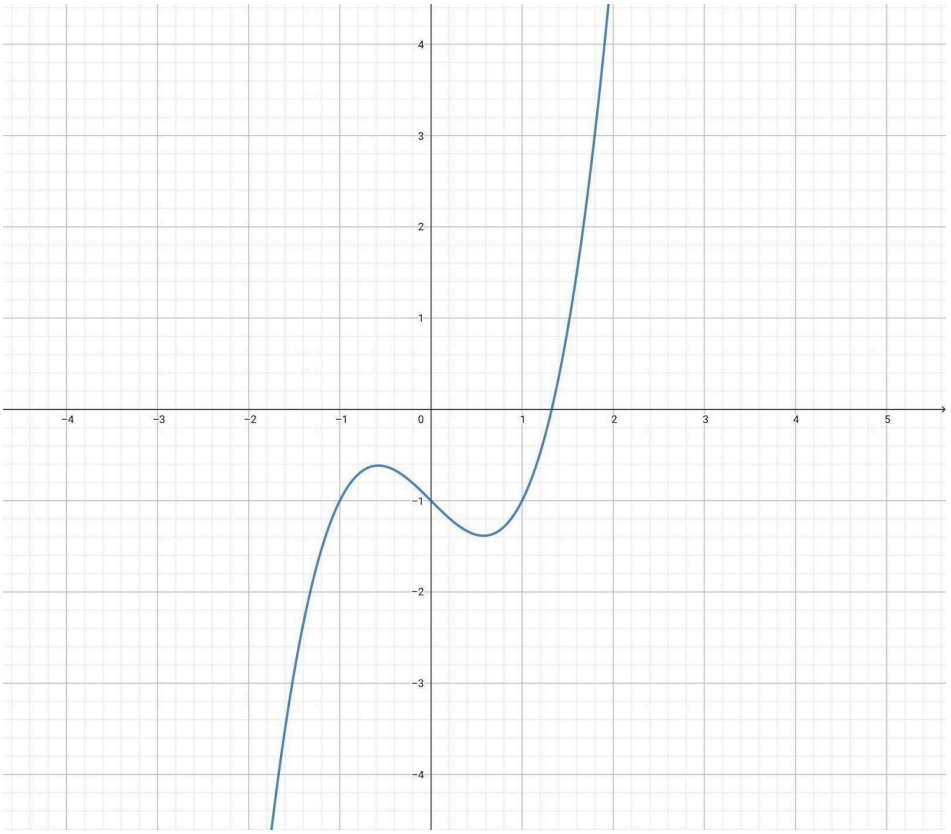

Figure 3. Non-linear numeric graph.

In non-linear data structures, data elements are attached to each other in a hierarchy, there can be multiple levels of informational data involved, and in non-linear structures, the data elements can't be traversed in a single run. For example, a numeric sequence of *2 – 4 – 12 – ... – 240 – 1440 ... N*. The graphical representation of the previous numerical data would exhibit a curvilinear pattern, indicating that the relationship between emotions and the corresponding approaches and hierarchies of their effect is not linear but rather follows a non-linear trajectory. This suggests that the nature of the relationship is complex and that different emotions in various situations demand a nuanced and dynamic approach.

Numerous non-linear systems are employed across various disciplines outside of psychology. Yet not every non-linear or complex system would fill the informational black-out in results reported by the linear system. The non-linear system utilised to measure and translate the human psyche should be specifically designed and tailored to meet the unique requirements of the discipline. The system that can measure non-linear, multistage informational flow and respect the highest order of derivatives in the unknown factor is the *quasi-linear* system (H. M. Atassi "Class notes on quasi-linear partial differential equations").

Yet such quantification of a linear scale is an epistemological impasse (Wagoner & Valsiner, 2005) as it inadequately represents the nonlinearity of the phenomena it is supposed to measure. Most objects we seemingly easily rate on a linear fixed scale are complex multifaceted wholes, the Gestalt qualities that vanish in the act of superimposition of the subjective linear order–rating scale (Valsiner, 2019). How do emotions co-relate with each other? How does the past affect the current, and how does the subject perceive the current?

Quasi-linearity in Human Minds

A quasi-linear open system is crucial for understanding emotions and the effects of one emotion on another, and finding the singular from the *synnomic* (universal). For example, how does "anger" affect the other emotions, or how does *"happiness"* affect *"anger"*? How can an emotion representing *"happy anger"* -- the unity of opposites -- <> -- be defined by the linear system? Furthermore, measuring "*ugly*"/"*beautiful*" with a linear 1-10 system does not assume the relationship between the two feelings.

Consider *"ugly*" and *"beautiful"* – these are considered polar mutually exclusive opposites that can even be turned into quantified indexes if put on a linear scale. However, the aftermath of a nuclear explosion presents a paradoxical landscape that can be perceived as both desolate (ugly) and magnificent (beautiful). The physical destruction and desolation of the land co-exist with a sense of purity and consistency, creating a striking dichotomy between the perceived ugliness and beauty of the environment. The self-portrait below is painted by Otto Dix (1891–1969). The painting can be described as *"ugly"* and grotesque, but it also looks beautiful in its own dreamlike manner. Is it possible to assign a number to the feeling the painting evokes?

Figure 4. Otto Dix "Longing – Self-Portrait".

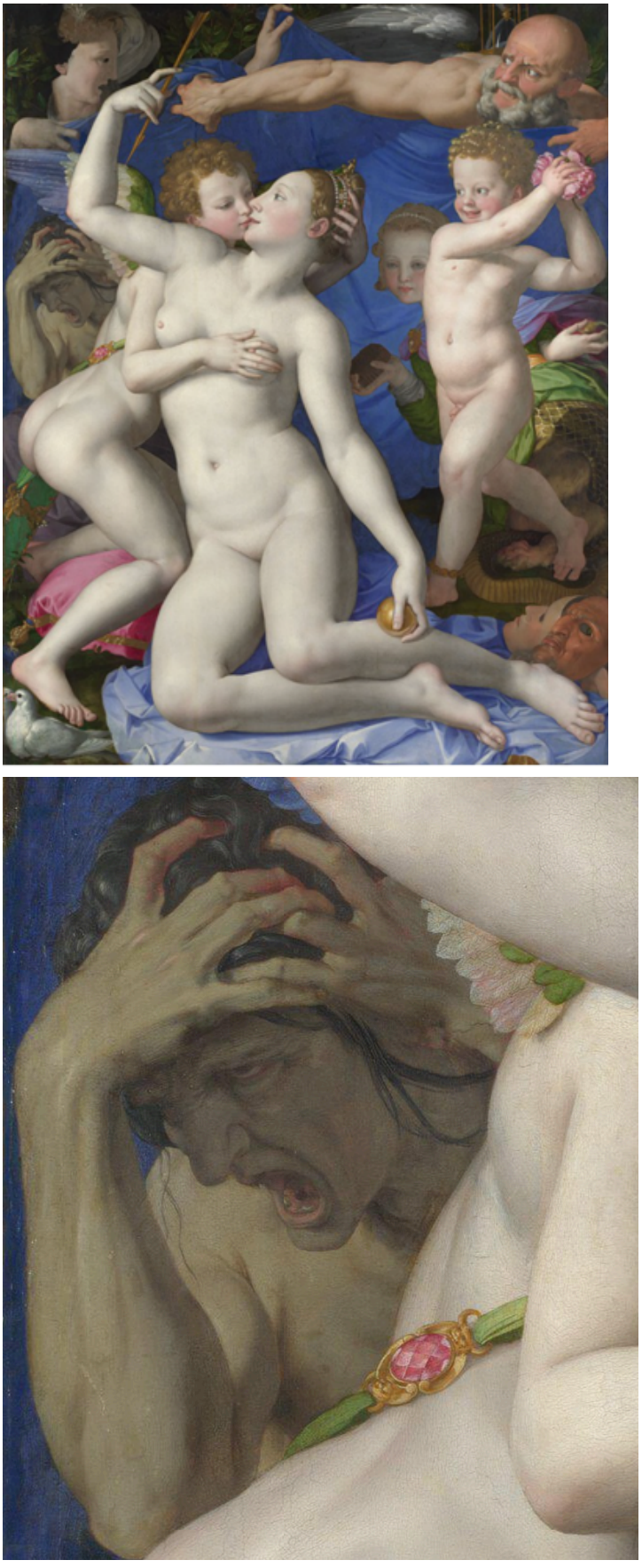

Figure 5. Agnolo Bronzino “Allegory of Lust”.

This duality of perception is also evident in the painting "Allegory of Lust" by Agnolo Bronzino (1503–1572), where the seemingly dichotomous themes of temptation and morality are depicted in a single work of art. The painting embodies a rich narrative with nuanced and underlying meanings, offering the viewer a visually compelling and intellectually stimulating experience. Yet one fragment of the painting cannot be translated or simply put into *"ugly"* or *"beautiful"*. The translation is more complex than just 1 or 0, *"ugly"* or *"beautiful"*. Please note the emotive visage depicted on the left side of the painting. The face and hands are distorted and twisted in a multifaceted sentiment that cannot be singularly defined with a number. The face is howling and expressing ire and misery. Yet, the way the face is portrayed, the purity and singularity of the depicted emotion can only be described as *"beautiful"*.

As stated before, the potential scale that would efficiently measure the "*ugly*"<> "*beautiful*" cannot be linear. Nor can it look like a continuous wave, rising and falling in the beginning and the end. The scale would need to rapidly fall and rise multiple times in the beginning and vice versa in the end. The relatively regular "*ugly*" or "*beautiful*" is in the middle. Therefore, there cannot be any repetitive high or low-altitude lines. On both ends will be an acute rise or a rapid fall–a psychological and emotional paroxysm.

The primary question at hand is the determination of an effective measurement system. In order to address this question, it is necessary to evaluate the inadequacies of the linear system and the reasons for its inefficiency. Additionally, the notion of "0" concerning depressive tendencies is inherently subjective and continuously evolving. This highlights the dynamic nature of many physiological processes, such as the digestive rate and the body's response to hunger, which are subject to change based on various factors. This illustrates the complex nature of measurement, which involves assigning a value to a variable, X, based on the correlation between X, Y, and Z, where all attributes are subject to change. Thus, it becomes apparent that the logic for measurement must be tailored specifically to the system in question, in this case, the measurement of depression.

Why Quasi-linear?

The double feedforward— "meaning attaches to that which symbolises it" (Baldwin, 1915, p. 108) guarantees that human psychological worlds inevitably become projected into the object world. If meaning X symbolises object Y then Y becomes saturated with X (beyond the previous presentation) and feeds into further transformation of X, and so on (Valsiner, 2008). Furthermore, the dynamic semiosis offers a necessary concept of constant negotiation with the self and environment. It is in the interaction with others that the conditions for meaning-making and creation and use of signs are mediated (Zittoun et al., 2013). Signs can be defined as an intricate part of a triadic structure, in which the sign represents its object to the interpretant, and the latter presents the object with a new form of meaning that emerges in this triangular process (Cabell & Valsiner, 2014, p. 89).

The starting axiom of these perspectives is the acceptance of the premise that universality is necessarily present in the particulars (Valsiner, 2016). The concept of universality can be viewed from two distinct perspectives. Firstly, universality is relative to the particularities, implying that universality is comprised of the particularities themselves. Secondly, it can be posited that every aggregation of particularities can be condensed or simplified into a universal form. For instance, without the multitude of individual trees, there could not exist the universal concept or symbol of "forest." These dual understandings of universality highlight the interplay between generalisations and specific instances, and

emphasise the importance of considering the relationship between the universal and the particular in various intellectual pursuits.

The relationship between the universal and particular is a complex and multifaceted one. When considering the example of a forest, we can see the interplay between these two concepts in action. On the one hand, a forest is a concept that is comprised of numerous unique and disparate trees, each possessing its own distinct characteristics and qualities. These trees can be differentiated and classified based on various Boolean parameters, such as size, location, or age. This demonstrates the particularity of the trees within the forest and their individuality within the greater whole.

However, it is also noteworthy that certain physical parameters, such as size, are universal across diverse entities such as animals, humans, and even buildings. This highlights the universality of certain features across seemingly disparate systems and reinforces the interplay between the universal and particular within a given context. In this way, the concept of the forest can be reduced or simplified to its constituent elements, and yet, without many different trees, there cannot be a symbol dedicated to the "forest".

The crux of the matter is that extracting universal principles from individual elements in the field of psychology is far more challenging than categorising objects through physical characteristics. This is due to the fact that psychological processes exhibit multilinearity, irreversible nature, are constantly evolving, and thus pose considerable difficulties in measurement. The complexities inherent in psychological processes require a delicate and sophisticated approach in the quest for a scientifically detailed system for understanding human behaviour and cognition.

Again, to illustrate, is the irreversible effect of *trauma-a* on the *person-a* parallel with the effect of *trauma-b* had on the *person-b*? It is evident that certain universalities exist in human psychology; however, it must also be acknowledged that individuals such as *person-a* and *person-b* possess distinct experiences and backgrounds that inevitably shape their perspectives, leading to differential perception and reception of information. Hence, the answer to the previous question is negative: non-linear system cannod be measured with a linear system.

Expanding the last thought, the different experiences, perspectives, backgrounds and flow of information can still lead to the same conclusion. Nearly identical situations are close to impossible to ever happen. Therefore, there is a considerable amount of possibilities to the developmental perspective of a person and to where the person ends up. Driesch presented an idea of *equifinality*, the possibility of receiving the same result or effect from different situations - the multilinear experience ultimately leading to similar outcome. In the end, the *trauma-a* to the *person-a* might result in the same effect as the *trauma-b* to the *person-b* – multiple pathways (*equipotentiality*) leading to the same conclusion (*equifinality*).

From the last thought, the second axiomatic postulate entails the irreversible process of form (Gestalt) reconstruction which is an inevitable premise for any developmental perspective (Valsiner, 2016). Biological order is the developmental order (Valsiner, 2017), therefore differentiating from classical logic. Development is a puzzling phenomenon: it happens over irreversible time, its current forms are unfinished, and it is open-ended as to what may happen in the future (Valsiner, 2017). A living sentient entity will develop most of its conscious life. Yet, if there is a missing part in Gestalt, e.g. a trauma that interrupted the "normal path" of development, the effect should be measured if a crucial part in the “normal path” of development of one’s psychology is non-existent. How would you define the effect and how to measure it?

The Sign-mediation Process and its Complexity

> Every snowflake is unique, as is every wave in the sea. Yet all snowflakes, like all waves, are governed by the same immutable laws of nature. Human beings are like this too. (Marinoff, 2003)

One of the important characteristics of the sign-mediation process is its redundancy (Sato et al., 2013). One can observe so many signs around him/her throughout their lives. Despite being surrounded by signs, almost all of them are selectively used – at one place and at one time, a sign causes a person to react in a certain way. Although one sign affects many people, this is not essential to understanding the sign's meaning. (Sato et al., 2013)

It is important that irreversible time is introduced into this concept – a sign is created by a person within a chronotope (Sato et al, 2013). Time and place are not opposite components in human lives. In philosophical thinking, we can divide the two notions in the sphere of ideas.

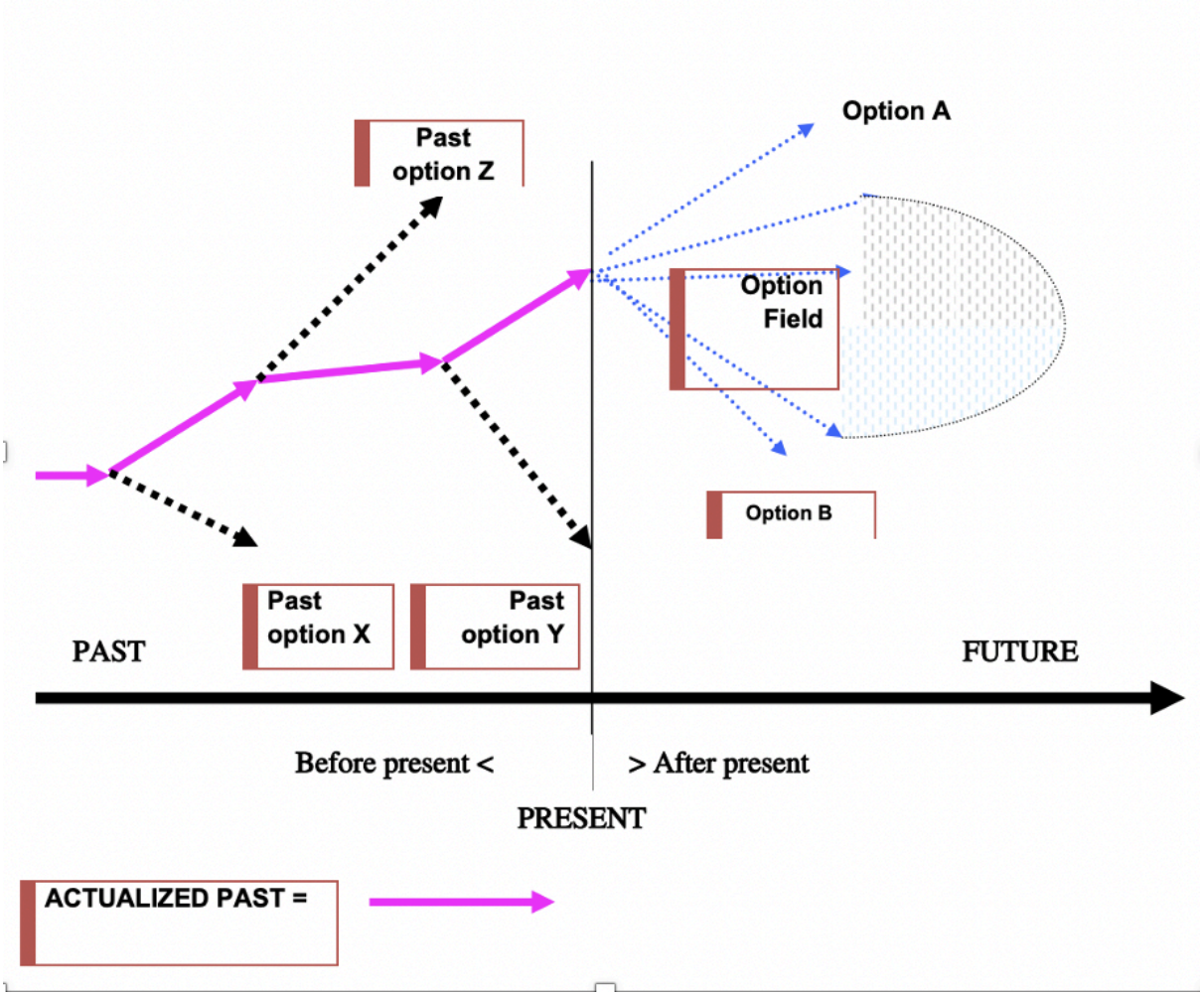

Figure 6. The Asymmetry of the Past and the Future

Philosophy of science is a cruel arbiter for empirical investigations in any science. When the first assumed axiom of a science is wrong, the whole enterprise of a science built on it cannot be adequate – this is the cruelty of empirical efforts in areas where the first axiom was built inadequately (Valsiner, 2019). The past and the future are not symmetric (Figure 1.1). All the possibilities that existed in the past (when that time period was still future) have been turned into actualities (which are singular). In contrast, while facing the future, the possibilities are open. This is the structural asymmetry of the classes of past (occurred) events (given without their context of those possibilities that were there in the past, but were not used), and future

(potential) events. It leads scientists to probabilistic predictions of the actualisation of future potentials into the continuous past (Valsiner, 2008). Figure 6 above describes the previously discussed concept graphically.

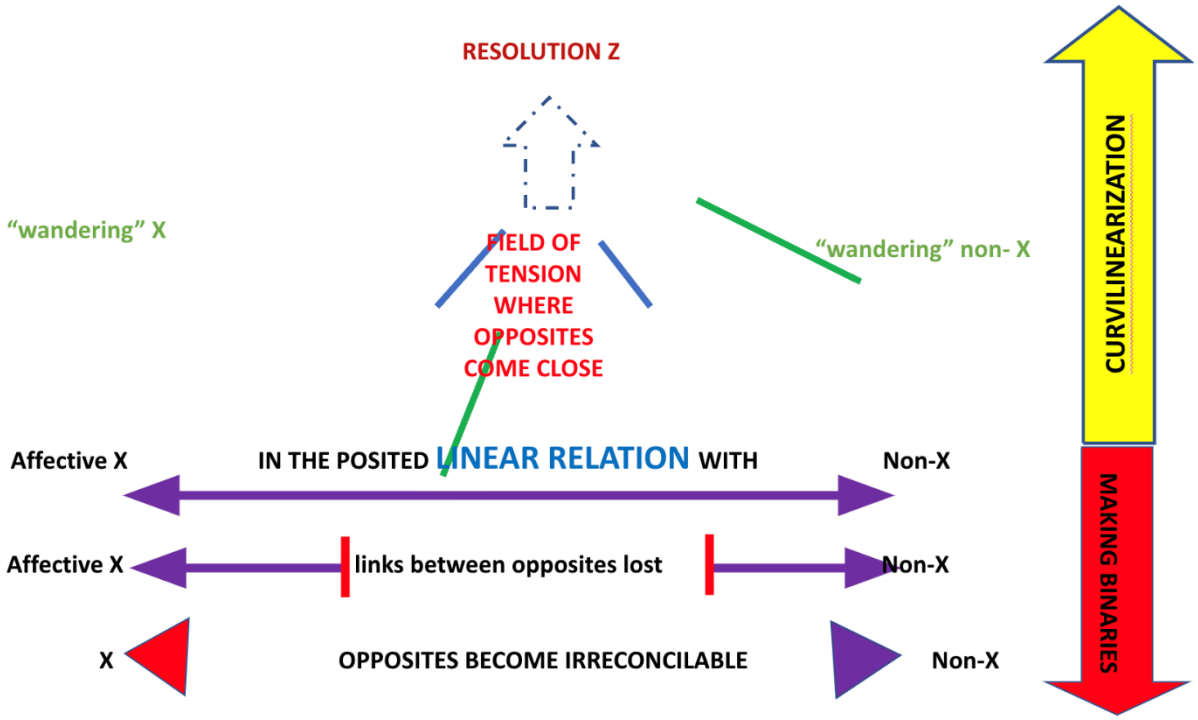

Figure 7. Conversion from binaries to curvilinear (Jaan Valsiner, personal correspondence).

The accompanying illustration presents a graphical representation of the conversion process from binary to curvilinear representation. At the bottom of the table, you can notice how the opposites can be considered binary – either the conclusion is an X, or it is a non-X. A curvilinear numerical system is necessary when it is essential to simultaneously incorporate both opposing elements, as is the case in psychological assessments aimed at evaluating emotions such as anger and happiness. Missing from the graph are the systems above the resolution "Z". Resolution "Z" is irreconcilable and unmergeable. There are times when several parallel yet separate lines will intersect at certain points, but they cannot be compared as parallel or similar phenomena. Additionally, the two distinct phenomena are interrelated and possess the capability to impact one another. This implies that the presence or absence of anger can have a direct effect on happiness and conversely.

The higher we reach on the levels in the figure above, the more immutable the synthesis becomes. When opposites are irreconcilable, the synthesis is nearly absent. Yet, as the opposites start to come closer, the field of tension will start the synthesis between the X and non-X. As soon as the resolution "Z" has been reached, the synthesis becomes immutable, and the X and non-X will collide, creating a new concept in the process of collision.

Aesthetic synthesis is a form of "meaningful nothingness"— hyper generalised feeling field that lacks object reference (="nothing") while being filled with meaningfulness—the "no-thing" is filled with "some-(thing)-meaning." (Valsiner, 2008). Aesthetic synthesis entails retaining the object-subject differentiation (i.e., the subject does not "fuse" himself with the object), yet it simultaneously entails the emergence of a novel feeling that overwhelms the subject. In other words: What we are justified in taking the real to be is that ideal with which the free and full aesthetic and artistic consciousness finds itself satisfied. We realise the real in achieving and enjoying the beautiful (Baldwin, 1915, pp. 276-277).

In the current standard quantitative model of contemporary psychology – Galtonian approach – data is collected for a group of cases, or into multiple groups (e.g. experimental/control). Each group is analysed as a whole, using cross-case statistics such as frequencies, means, standard deviations, variance, and correlation coefficients. Rather than individual cases, group parameters are the key units of analysis in this form of research. Significance testing will pertain to effects observed at a group level to explore relationships between variables, or in an experiment to infer cause-and-effect by viewing group-level differences between an experimental group and a control group (Limell, 2011). A prediction of what the average person will do is often of little or no value in dealing with a particular individual. The issue at hand is an issue with the psychological practice in general.

Science is helpful in dealing with the individual only insofar as its laws refer to individuals. A science of behaviour which concerns only the behaviour of groups is not likely (Limell, 2011). It is not feasible to make accurate predictions regarding the impact of a stimulus on an individual's future based on their past experiences, as the diversity of prior experiences among individuals within a group is too extensive.

Making Psychology Person-oriented

Psychology can potentially explain why being shy in social gatherings could be explained by a trait of “introversion” that is located in “self-system”, therefore causing discomfort in public. Psychology, as well as other social sciences, is rich in such causal attributions, yet most of these are discursive tricks that cover up the need for further analysis of how particular outcomes happen (Valsiner, 2019). In considering the concept of "introversion" and the behaviour of being shy at social gatherings, what additional factors are relevant and contributing to this phenomenon? Furthermore, when investigating the “introversion” and shyness, the variables discourse elevates the researcher into the role of power in working with the phenomena. The researcher is assumed to perform the act of “random sampling” (Valsiner & Sato, 2006) despite the reality that any sampling of human beings depends upon their agreement to be “sampled”. The “sampled” persons are the most *invited* (rather than “taken from population”) and can counteract the “sampling” by refusing or avoiding participation in research (Valsiner, 2019). There is also the “illusion of power”: the researcher is assumed to have full control over the manipulation of the “independent variables” – which in reality of interaction of the goals-oriented researcher with resisting band divergently oriented “research participants” is a comforting illusion. Adaption to this limitation is taken to the symbolic level where fixed indexes (gender, socioeconomic status, etc) become treated as if these could be varied at the will of the researcher – statistically. The social sciences are dealing with phenomena for which the axiom of nonlinearity is appropriate – all biological, psychological, social, economic, and political phenomena are inherently non-linear in their organisation (Navarro, 2009). The human mind is a system on the border of the two object worlds – its biological substrate (brain) functions as any biological system would (nonlinearly), but the “moulding of the mind” by human political and educational systems superimposes a linear order (Valsiner, 2019). The human mind is inherently resistant to linear administrative control through the utilisation of cognitive heuristics. It can be argued that parallel measurement of the process and the action being performed is a crucial aspect in this regard.

Innovations are necessary in psychology if it were to become person-oriented. Firstly, looking for the universal in the particulars; secondly, accepting the irreversibility of developmental life events; and thirdly, conceptualising transformation of complexity in terms of qualitative structures of dynamic hierarchical order (Valsiner, 2016). There is one more innovation necessary to support all the previously listed essential improvements for

psychology to become person-oriented: The innovation of a quasi-linear open numeric system. Simply put, everything is interconnected, and the *x* can be considered variable.

Interconnection of Information and Translation

The process of environmental scanning occurs both at the subconscious and conscious levels. For instance, while walking, the next step is largely determined subconsciously. The conscious attentional scanning system, which operates linearly, examines the world as if illuminating it with a flashlight, examining one thing at a time, such as consciously seeing and smelling a flower. However, in psychology, not everything is processed by the subconscious in a linear manner. Rather, we experience a multidimensional continuum, with everything happening everywhere simultaneously.

In 1872 Felix Klein launched the Erlangen program where he proposed a system to classify and compare the existing geometrics at the time, now called Klein geometry (Wahlström, 2020).

The idea was to use algebra to describe the transformations that preserve the invariants of the underlying space of geometry. The transformations form an algebraic group which acts on the space, making it homogeneous. Therefore, the underlying space can be described as the quotient of the group of transformations with one of its subgroups that has certain properties. The group belongs to a specific type of groups called Lie groups. Lie groups are smooth manifolds such that their group structure coincides with a certain topological property, and therefore they are useful for describing the symmetries of a space.

Although the figure being originally created to classify and compare the existing geometrics of 19th century, the visual interconnected figure could be used here to display one of the main points of this paper. Figure 8. could be used visually and topologically to describe one dimension of the informational flow, that is a part of a larger continuum, everyone is faced with on daily basis.

In order to effectively illustrate the concept of interconnection within this argument, it would be necessary to not only depict arrows pointing outward, but also inward, emphasising the significance of both the receipt and emission or even bidirection of informational flows by the individual.

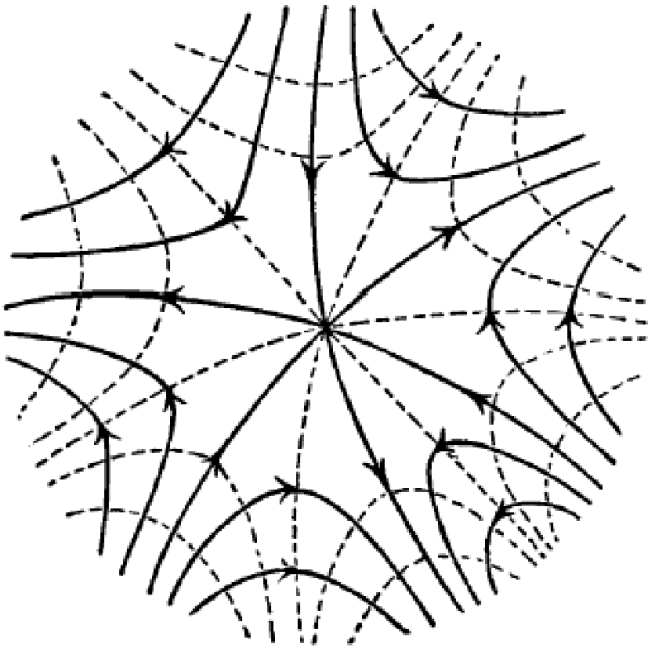

Fig. 1.

Figure 8. Klein-Riemann Geometry (Klein, 1893).

A graphic explanation from a potential real-world situation: We are experiencing both stress and happiness from driving fast, we must simultaneously understand and measure the risks about what speed to maintain passing through the next curve. And at the same time, we are trying to reach the limits of the car whilst being afraid of being stopped by the police or crashing. All of this is happening whilst we are consciously focusing on driving the car at high speeds.

Therefore, information with different value and importance comes too quickly to be scanned and translated continuously by a linear closed numeric system. For example, using deep learning and artificial intelligence to beat, in principle simple, Snake game. A system based on deep learning that is constructed on genetic algorithm. Genetic algorithm is a metaheuristic inspired by the process of natural selection that belongs to the larger class of evolutionary algorithms (Bialas, 2019). The inputs given to the system were simple and mostly Boolean,

- if there is a body part or wall on the left side of the snake's head (0 or 1 value)
- if there is body part or wall in front of the snake (0 or 1 value)
- if there is a body part or wall on the right side of the snake's head (0 or 1 value)
- a value of sinus of angle on which the food is inclined relative to the snake (Bialas, 2019). In this case, the protagonist of the game had 3 possible outputs, turning left, going right or moving forwards (Bialas, 2019).

Assuming an organism initially demonstrates random responses, some of which are beneficial, it is necessary for growth that these productive responses be reinforced through repetition, thus increasing their influence relative to harmful or ineffective responses. If any of the productive responses lead to a direct replication of their own stimulus, they must be maintained, serving as the foundation for the organism's development. These responses, characterised by imitation, are referred to as "imitative reactions." Thus, it is that a thing in nature once endowed with the reacting property might so select its stimulations as to make its

relations to its environment means to its own progress: imitative reactions, as now defined, being the only means to such selection (Baldwin, 1894, p. 29; emphases added, Valsiner, 2014). Genetically, A = (that is, becomes, for which the sign "((“is now used) B; but it does not follow that B = (becomes, (( ) A. (Baldwin, 1906, p. 21)

Even in a basic game involving the choices of left, right, or forward, without any other considerations, it can be challenging for the program to determine the most active or optimal option. The neural net, or the decisions motivated by inputs, created many radically different options. Yet, the output was always only limited to three options that can be seen on Figure 9. Additionally, a neural network utilised by an artificial intelligence system to categorise dog breeds is depicted in Figure 10. The graphical representation provides a visual demonstration of the intricate nature of the human mind, which is required to make a simple determination of a dog's breed. The likeliness of the artificial intelligence with the neural network below in Figure 10 getting the dog breed completely wrong is just 3.6% - better than a human (Russakovsky et al., 2015).

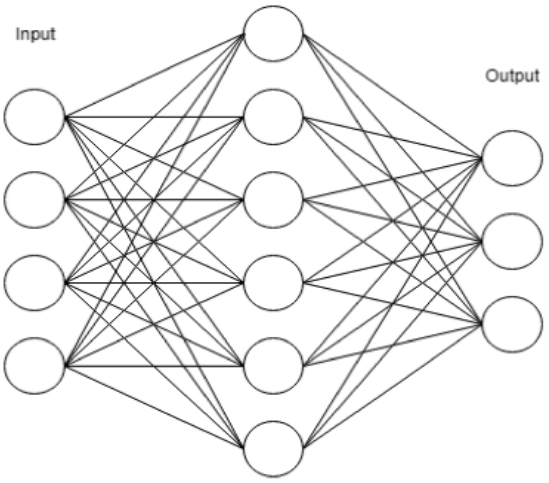

Figure 9. Neural network of the Snake game.

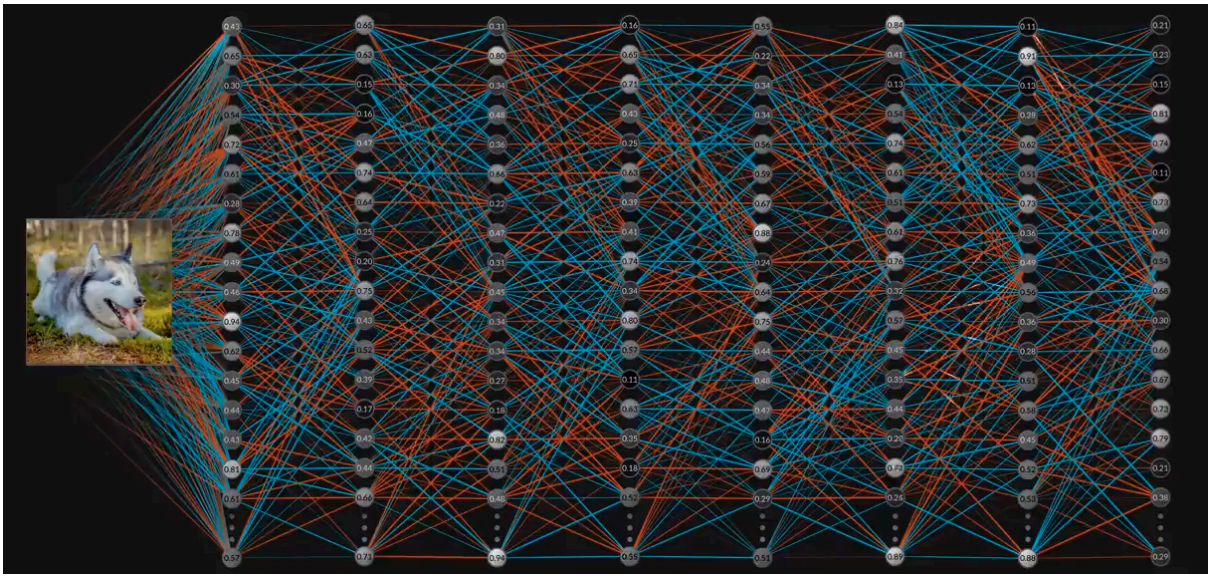

Figure 10. Neural network trying to decide a dog breed.

There are also similar decision-making processes in practice of medicine. Breiman and colleagues (1984) created a decision tree similar to neural net regarding treating a patient potentially having a heart attack as a low-risk or high-risk patient. A person is a high-risk patient if a life is truly threatened, therefore, one should receive the most expensive and detailed care to minimise the risks of potential death. Although the doctor's decision can save or cost a life, the doctor does not have the luxury of extensive deliberation. The medic must decide under time pressure using only the available cues, each of which is, at best, merely an uncertain predictor of the patient's risk level (Gigerenzer & Todd, 1999). Similarly to the Snake game input, the medic gets a decision tree to simplify the process of placing the patient in either a high-risk or low-risk group. The decision tree system is absolutely robust. Robustness goes hand in hand with speed, accuracy, and especially information frugality. Fast and frugal heuristics can reduce overfitting by ignoring the noise inherent in many cues and looking instead for the "swamping forces" reflected in the most important cues (Gigerenzer & Todd, 1999).

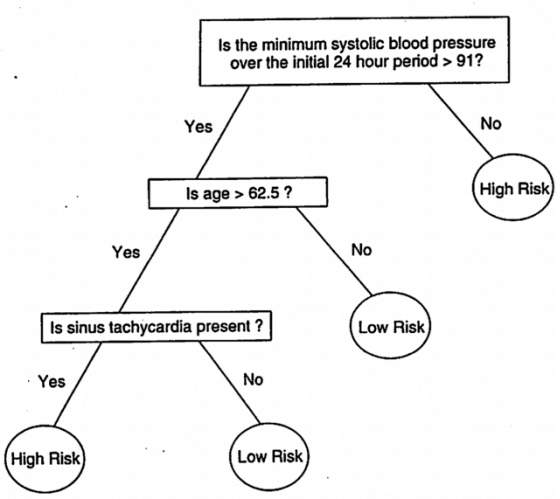

Figure 11. High/low mortality risk decision tree.

Yet, the frugal system in question ignores a great majority of possible measured predictors. For example, the system ignores the quantitative data by using Boolean, 0 or 1 logic. That is, the system is not concerned about how much older or younger the patient is from the threshold of 62.5. Also, the decision tree is a step-by-step process, meaning it could end with the first question. However, limited information and time pressure require a way to decide when to stop searching for new information. In this case, we are looking only at three questions. Therefore, the decision concluded has a probabilistic exposure to high risk. It is quick, rational and frugal – the three important aspects when evaluating someone's health risk. The decision tree is statistically viable. Furthermore, the fast frugal does not involve calculations nor make it possible to act instantly based on feelings of danger.

Different modals and their characteristics are an important part of understanding the systems already created.

> **Modal Relevancy.** No psychic event can be taken out of its mode and treated as belonging in or with events of another mode. This is opposed by the Fallacy of Modal Confusion, i.e., treating an event or meaning characteristic of one mode as remaining what it was, when it is used in a synthesis of another mode.

> **Modal Unity.** No psychic event or meaning can be treated as being what it is except in the entire context of the mode in which it arises. Here the context-specificity of development is emphasised: any developmental event emerges only in the given context, and none other. The opposing Fallacy of Division or Abstraction consists of treating an event or meaning as a static and separable "element" or "unit". (Valsiner, 2008)

A critical issue in Baldwin's conceptualisation of sameness of phenomena lies in the equalisation of intra-personal and inter-personal spheres of application of the principles described above. In order to detect "sameness" of A and A, the opposite comparison (A with non-A) must be possible. If we cannot make a distinction A versus non-A, then detection of "sameness" of "this A" and "that A" is logically impossible. Thus, he claimed:

> The process whereby the meaning of 'sameness' attaches to an object is the same whether the recurrences of the meaning thus identified as the same be in one mind or in more; for there is either actual reference [or: conversion] or the presupposition of it, from one experience to another in both cases alike... a judgement of singular identity is possible on the basis of a single person's recurrent experience; and... it is a judgement in community, having the force of commonness for all thinkers alike[1] (Valsiner, 2008).

Finally, all the uniqueness of developmental psychic events is context-bound; hence, Baldwin demands that scientific analysis maintain the linkages with the context (Canon of Modal Relevancy) and is not transposed to another context (Canon of Modal Unity) (Valsiner, 2008). These axioms create a possibility of properly classifying and analysing the *circumstances, conditions* and *persona* perceived by numbers (Valsiner, 2008).

The Many Faces of Probabilistic Perspectives

Both artificial intelligence trying to beat the Snake game and Breiman's decision tree are based on probabilistic conceptions, an idea of a chance to better the unknown future. The probabilistic conception of the snake game is based on the previous generations of snakes, and Breiman's decision tree is based on various previous patients experiencing fatal heart attacks.

Probabilistic conceptions of the mind have led to many elegant theories but also to thorny problems. When one moves beyond the simple constrained settings (such as the Snake game) to real-world situations that people live through, the time, the knowledge, and computation that probabilistic models demand grow unfeasibly large. Consequently, when these models meet the rigours of reality, they turn into a psychology more applicable to supernatural beings than to mere humans (Gigerenzer & Todd, 1999). In the end, all comes down to variables and the linear process of continuously receiving multiple variables through senses. The AI in the constrained Snake game is receiving four lines of continuous variables regarding the processing of the next decision. In psychology, however, we must vehemently go beyond the information given, taking into consideration emotions, reaction to visual change of the habitat, religion and so on.

Any variable is a linear process. When you play Bach's Fugues, for example, there are four different lines—four different linearities, sounds in this case. Yet, the Fugue is a whole, a prime example of a Gestalt. Physics has millions of variables at the same time, most of which we cannot measure exactly, at least not at the same time. So, to still acquire accurate information, statistics is used. Statistics is not the perfect solution for something that could be measured perfectly using a symbiosis between nomothetic and idiographic approaches. Yet, it

[1] (Baldwin, 1907, p. 397)

gives enough universal information to get the comprehensive result. The human mind is more similar to physics, consisting of millions of interconnected variables.

Assignment of Numbers is Construction of Signs

Measurement is the attempt to discover real numerical relations (ratios) between things (magnitudes of attributes), and not the attempt to construct conventional numerical relations where they do not otherwise exist (Michell, 1999). If I measure a room and it appears to be 4 metres long, the number 4 is not assigned to my room and vice versa. In this case, one is not dealing with assignment, but with predication. That is, it is not that the room or its length that is *related to* the number four, but the length of the room relative to the metre *is* the number four (Michell, 1999).

Furthermore, Michell has said that from what the scientists can glean initially by unaided observation, and by analogy between what they presume to be similar systems, they form hypotheses about the workings of the systems they are studying, and then submit these hypotheses to test. Therefore, the answer about a hypothesis being correct or wrong derives from looking at the quantitative or qualitative data, and analysing if the data fits into the equation created to match the initial hypotheses. If observations are made, predictions can be concluded, or hypothesis checked against the data, and science moves a step forward: the hypothesis is confirmed or falsified, and this general procedure is repeated (Michell, 1999). Science is not just the development and testing of theory; it is also the endeavour to describe and explain objects and events. Events, by definition, only happen once, and objects, by definition, are singular (Limmer, 2011).

A person can never be absolute, true or false – receiving emotions as 0 or 1, 3 or 8. It is not possible to measure something fundamentally interconnected measurable by plain true-or-false. Scientific methods are imperfect tools, and all observations, idiographics, nomothetic approaches are in principle, fallible (Michell, 1999). If psychology can let go of the approach of measuring minds and behaviour by linear static numeric systems, it will find itself with a more complete conception of nomothetic science, and the much-needed bridge between idiographic and nomothetic schemes. This will surely help to rectify the contemporary confusions that abound in this area (Limmer, 2011).

Conclusion

Scientific methods are not isolated from life, they are dynamic in their existence. Because of the imperfection of scientific methods, it is only safe to use them critically, and continue developing them to be more appropriate. Caution in science requires investigating one's methods while using them. For example, in psychology, “standardised methods”. The user has no clarity what is included in the substance, but an institutional declaration of being “standardised” (Michell, 1999). This means that often methods and models that are built on unknown axioms or unidentified elements for the applier of the methods and models. This in turn results in approximate results that do not mirror the effect and reality.

The requirement for a more advanced mathematical framework is imperative and can no longer be ignored. Scientific disciplines such as physics and chemistry have continually sought to identify and rectify their shortcomings, whereas psychology has persistently clung to traditional linear mathematical methods. Thus, a fresh and inventive perspective is necessary. By employing a quasi-linear system that assigns symbols rather than traditional numerical values to actions or phenomena, the root causes of incidents such as Jimmy striking Johnny can be more effectively uncovered.

In order to fully comprehend a numerical system capable of quantifying and evaluating psychological phenomena in individuals, it is crucial to acknowledge that impediments to progress are ultimately temporary. The human mind is notoriously intricate, and its multilinearity further complicates efforts to comprehend and translate its workings. The purpose of this chapter was not to unveil a previously unrecognised issue with the existing numerical framework employed in psychology, but rather to succinctly articulate a previously identified problem, while offering a potential solution in the form of a conceptual proposal that will be subjected to further elaboration and examination.

References

Baldwin, J. M. (1906). *Thought and things: A study of the development and meaning of thought, or genetic logic. Vol. 1. Functional logic, or genetic theory of knowledge.* Swan Sonnenschein & Co

Baldwin, J. M. (1908). *Thought and things: A study of the development and meaning of thought, or genetic logic. Vol. 2. Experimental logic, or genetic theory of thought.* Swan Sonnenschein & Co

Baldwin, J. M. (1911). *Thought and things: A study of the development and meaning of thought, or genetic logic. Vol 3. Interest and art being real logic.* Swan Sonnenschein & Co

Baldwin, J. M. (1915). *Genetic theory of reality.* G. P. Putnam's Sons

Baldwin, J. M. (1930). *James Mark Baldwin. A history of psychology in autobiography.* C. Murchison (Ed.). (pp. 1–30). Russell & Russell

Bialas, P. (2019). Implementation of artificial intelligence in Snake game using genetic algorithm and neural networks. Faculty of Applied Mathematics Silesian University of Technology. Retrieved April 30, 2022, from https://ceur-ws.org/Vol-2468/p9.pdf

Breiman, L., Friedman, J. H., Olshen, R. A., & Stone, C. J. (2017). *Classification and regression trees.* Routledge https://doi.org/10.1201/9781315139470

Cabell, K. R., & Valsiner, J. (2014). *The Catalyzing Mind*. Springer

Corsini, R. J, & Auerbach, A. J. (2004). *Concise Encyclopedia of Psychology.* (pp. 983). John Wiley & Sons

Friedenberg, L. (1995). *Psychological Testing: Design, Analysis, and Use*. Allyn and Bacon.

Gigerenzer, G., & Todd, P. M. (1999). *Simple heuristics that make us smart.* Oxford University Press

Kaplan, R. M., & Saccuzzo, D. R. (1993). *Psychological testing: Principles, applications, and issues*. Thomson Brooks&Cole Publishing Co.

Klein, F. (1893). *On Riemann's theory of algebraic functions and their integrals. A supplement to the usual treatises*. MacMillan and Bowels

Lamiell, J.T. (2003). *Beyond individual and group differences: Human individuality, scientific psychology, and William Stern's critical personalism*. Sage

Limmer, A. (2011). The idiographic / nomothetic dichotomy: Tracing historical origins of contemporary confusions. *History & Philosophy of Psychology, 13*(2), 32–39

Marinoff, L. (2003). *The big questions.* Bloomsbury

Michell, J. (1999). *Measurement in psychology*. Cambridge University Press

Molenaar, P. C. M. (2009). *A manifesto on psychology as idiographic science: Bringing the person back into scientific psychology, this time forever.* Taylor & Francis Online

Navarro, V. (2009). What we mean by social determinants of health. *Global Health Promotion, 16*(1), 5–16

Russakovsky, O., Deng, J., Su, H., Krause, J., Satheesh, S., Ma, S., Huang, Z., Karpathy, A., Khosla, A., Bernstein, M., Berg, A. C., & Fei-Fei, L. (2015). Imagenet large scale visual recognition challenge. *International Journal of Computer Vision, 115*(3), 211–252. https://doi.org/10.1007/s11263-015-0816-y

Salvatore, S., & Valsiner, J. (2010). Idiographic science on its way: Towards making sense of psychology. In S. Salvatore, J. Valsiner, S. Strout-Yagodzynsky, & J. H. Clegg (Eds.), *YIS: Yearbook of Idiographic Science*. Firera and Liuzzo Publishing

Sato, T., Yasuda Y., Kanzaki, M. & Valsiner, J. (2013). From describing to reconstructing life trajectories: How the TEA (Trajectory Equifinality Approach) explicates context-dependent human phenomena. Retrieved March 12, 2022, from http://www.psy.ritsumei.ac.jp/~satot/TEA/Sato%20Yasuda%20Kanzaki%20Valsiner%209-26-13.pdf

Stevens, S. S. (1946). On the theory of scales of measurement. Science, 103, 677680.

Valsiner, J. (2008). *Baldwin's Quest: A universal logic of development.* Transaction Publishers

Valsiner, J. (2016). The nomothetic function of the idiographic approach: Looking from inside out. *Scandinavian Society for Person-Oriented Research.* https://doi.org/10.17505/jpor.2016.02

Valsiner, J. (2017). *From methodology to methods in human psychology.* Springer Nature Switzerland AG

Valsiner, J. (2019). *Social philosophy of science for the social sciences.* Springer Nature Switzerland AG

Valsiner, J., & Sato, T. (2006). Historically Structured Sampling (HSS): How can psychology's methodology become tuned in to the reality of the historical nature of cultural psychology? In J. Straub, D. Weidemann, C. Kölbl & B. Zielke (Eds.), *Pursuit of meaning* (pp. 215–251). Transcript

Wagoner, B., & Valsiner, J. (2005). Rating tasks in psychology: from static ontology to dialogical synthesis of meaning. In A. Gülerce, A. Hofmeister, I. Staeuble, G. Saunders, & J. Kaye (Eds.), *Contemporary theorising in psychology: Global perspectives* (pp. 197–213). Captus Press

Wahlström, J. (2020). An introduction to Kleinian geometry via Lie groups. Department of Mathematics Uppsala University. Retrieved April 20, 2022, from http://uu.diva-portal.org/smash/get/diva2:1476670/FULLTEXT01.pdf

Windelband, W. (2001). *A History of Philosophy.* Paper Tiger. (Original work published 1901)

Zittoun, T., Valsiner, J., Vedeler, D., Salgado, J., Gonçalves, M., & Ferring, D. (2013). Melodies of living. Cambridge University Press