Integr Psych Behav (2014) 48:143–160
DOI 10.1007/s12124-014-9266-2

REGULAR ARTICLE

Tokenism in Psychology: Standing on the Shoulders of Small Boys

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Published online: 11 April 2014

Abstract Tokenism is a situation in which a member of a distinctive category is treated differently from other people. This article is about the situation in which Tokens (people perceived as distinctive) are considered experts on something for having the properties of a token (the thing which makes them distinctive). Tokens who differ by appearance or by being born into another culture might be considered experts on cultures grouped into the same racial/cultural category. Tokens who differ by being skilled in number-related mathematics might be considered experts on the mathematization of phenomena. Tokens might say that some result is valid for all people in some racial/cultural category without sufficient evidence, or use number-related mathematics as a mathematization of psychological phenomena without trying to find more abstract mathematizations. This harms psychological research. A possible future genesis of cultural and number tokenisms is discussed, and some suggestions to improve the discourse offered. The effect of tokenism might be diminished if psychologists focus on more proper thinking about psychological phenomena.

Keywords Tokenism · Race · Culture · Statistics · Quantitative science · Mathematics

Jednooký mezi slepými králem.

In the land of the blind the one-eyed man is king.

(Czech proverb)

Yolanda Flores Niemann (2003) defines tokenism as "a situation that handicaps members of racial/ethnic minority groups who find themselves working alone or nearly alone among members of another social category" (p.100). These people are considered to be representatives of their social category; they are asked for expert opinions about

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this category, treated according to the stereotypes about it, and face other problems related to their distinctiveness. Niemann describes tokenism as a situation that happens to people who are separated from their surroundings by their race/ethnicity. She applies this term only to situations that *handicaps* these people. In this article I use it in a broader sense: Tokenism is a situation where a member of a distinctive category is treated differently by people who don't belong to this category. Such a category might be race or ethnicity, cultural background, or some other thing which makes this person distinct. I call this thing *token* in this article. Person who possess the properties of a token might be handicapped by it, but he or she can use it as an advantage as well. In this text I focus on scholars and people working in academia. A scholar possessing a token might be considered an expert on issues that people believe individuals with this token should be experts on. I call a *Token* (with capitalized T) an academician whose token properties are used as a sign of a scholarship that he or she doesn't possess. Tokens in the sense of this article are not people out of academia or people who possess the scholarship related to their token. Tokenism as referred in this article is therefore a situation when Tokens are considered as experts in some field just because they have their tokens. Tokenism also works in a negative way, when people who have good knowledge about some field but lack the token properties associated with it are considered lesser experts on that field than those who have the token.

More precisely, tokenism might be defined this way: Let's have human groups G_1, G_2, …, G_n. Members of group G_1 typically possess knowledge/experience γ_1, members of group G_2 typically possess knowledge/experience γ_2, members of group G_n typically possess knowledge/experience γ_n. Let's G be a union of all groups G_1, G_2, …, G_n and Γ a union of all knowledge/experience domains γ_1, γ_2, …, γ_n. Tokenism is a situation where member of group G_i, who possess knowledge/experience γ_t and lacks all knowledge/experience of γ_1, γ_2, …, γ_{t-1}, γ_{t+1},… γ_n, is considered to possess knowledge Γ just because he is a member of the larger group G.

I feel the source of many problems in psychology lies in tokenism. Tokens–having limited knowledge about the area that is associated with their token–are considered to be experts on this area, and psychological research is organized according to their opinion, while the voice of scholars having the knowledge but lacking the token properties is not heard. This produces research of poor quality which is unable to reflect reality outside that of psychological journals. I will describe two examples of tokenism in psychology: cultural tokenism and number tokenism, I will describe their possible evolution in the future, and offer some solutions for mitigating their effects on psychological research.

Cultural Tokenism

I will begin this section with my own experience. I was born in country labeled as Central European. I spent a year as a Korean language student in Seoul and then I went to Taiwan. I was offered an opportunity to teach a course at university there, not in my area of expertise, but a course about Central Europe. I have spent altogether ten days in countries labeled as Central European other than my native country, and I can't speak their languages. I certainly have no good knowledge about these countries or their cultures. However, I am considered an expert on countries/cultures having the Central

(or Eastern) European label, because in the international environment I differ by being from a Central European country. This difference forms a token, which might make me to be considered an expert even though I lack any real knowledge.[1] After a year in Taiwan I spoke about the psychological differences between Taiwan and Korea with a Taiwanese psychologist educated in the US (and probably having no direct experience with Korea). "There are no differences between Korea and Taiwan", said the psychologist. "How do you know it?", I asked. *"Because I am Asian."*

Many people from East Asian countries go abroad to study (usually to English-speaking countries) and then return to their native country to become university scholars. Mok (1998) reports that ethnical Asians living in the US and exposed to media portraying Asians as homogenous community might accept this portrayal, and introject the characteristics assigned to Asians by the media. As could be deduced from Liu and Ng (2007) description,[2] the introjection of "Asian" characteristics can happen to Asian scholars as well. Similar way as for (East) Asians it might work also for people with other tokens.

Asians living in the US or other non-Asian countries might think they understand Asia because they met so many Asians there. Having seen how people from different cultures behave in a foreign environment might make someone believe that all those cultures are similar, because all these people might behave similar way when facing the same circumstances in a foreign country. That doesn't mean that these people would behave the same way in their native environments. Nevertheless, a scholar spending many years in such environment might start to believe that s/he possesses the knowledge about how people behave in different environments that have the same label as his or her native environment, because people coming from these environments might behave similar way as s/he behaves. S/he introjects a token giving him or her the same label as the people coming from different environments. And s/he might believe that s/he can use this token as a tool to tell him/her about the psychological experience of people sharing the same token. This might work for people in the kind of foreign environment where having the same token attributes might bring someone similar experience. However, a token can't work as a tool to get knowledge about the native environments of people sharing it, because this token is the product of a foreign environment and doesn't exist in the countries/cultures of origin. Nevertheless, some scholars might use this token as a tool for generating hypotheses and research questions about the native environments of those people, and believe that this provides them expertise about these environments.

The scholars whose appearance/origin serves as a token proving their expertise about every group dumped into the same racial/ethnic/cultural category (without having significant first-hand experience with some of these groups other than their native group) might be called *Cultural Tokens*. Consequently, *cultural tokenism* is

[1] Similar experience are reported from other environments. A German scholar of a Korean heritage might be considered a better expert on Korean culture than other Germans having longer experience with Korea just because of his half-Asian appearance (Froese 2010). Minority scholars in the United States may be given a job at university to be used as representatives of their race, or to be forced to research about diversity issues (Kim, Hall, Anderson, and Willingham 2011; Joseph and Hirshfield 2011).

[2] "A majority of social psychologist who currently self-identify as 'Asian' (rather than solely Chinese, Japanese, Pilipino, or Indian etc.) have the common shared intellectual experience of receiving their advanced social psychology training in Western or Westernized university departments."(Liu and Ng 2007, p. 4)

a situation where people who are native to or have experience with some cultural/racial group are considered to be experts on all groups being dumped in the same larger cultural/racial category as the group they have experience with. Here, G_i is some human group (e.g. Chinese, Czech) defined by appearance/nationality/language and G some larger group (e.g. Asian, Central European) where some other human groups are merged with G_i on the basis of geographical/racial/language closeness or similarity. γ_ι is the experience of being person belonging to G_i (e.g., being Czech, being Chinese) and Γ is the experience of being a person belonging to G (e.g., being an Asian, being a Central European).

Cultural Tokens are individuals who have good knowledge about two cultures, and sometimes speak two languages related to these cultures. They might believe that all people possessing the same token attributes have a similar psychological experience, and use their experience of belonging to some larger group based on this token as a tool to help them do research about these people. The psychological experience of other people grouped into the same social category might be different, and the origin/appearance of Cultural Tokens might be an inappropriate tool, but this token might be still accepted as a sign of expertise, and other scholars might cite them and follow their ideas. Conversely, people having experience with several cultures grouped into the same category might be considered unknowledgeable about them if they lack the token attributes related to that category. Using a token as a tool creates a misleading line of research, when information about particular groups sharing the same token attributes are collected and presented as information about all these groups altogether, while these groups are never compared with one another (see examples of the research discourse assigning labels to Chinese, Japanese and Koreans without comparing them in Linkov 2013). This way the research might produce labels given to large human groups, while different smaller groups included in these large groups might differ in those particular characteristics, but these smaller groups are never compared. Such research harms both people belonging to these groups (who receive inaccurate labels) and psychological science (which receives inaccurate information on which to base its theories).

Number Tokenism

The currently dominant mathematization[3] of psychological phenomena prompts the following example: Imagine that you have a line and an ellipsis in a plane, and you are to find how these two objects differ. Someone develops a method by which you measure minimum distance among these objects, and people start to use it. The answer to the question "what is the difference between a line and an ellipsis" would be therefore a number. Articles answering such questions would start to publish numbers characterizing the differences between objects in a plane, and a body of literature would be developed. However, the correct answer to the question "what is difference between a line and an ellipsis?" is to find that these two objects can be represented by equations and to give these two equations as an answer, because only this can provide full information about the difference between a line and an ellipsis. Scholars would become accustomed to answering this question by giving a number; and some of them will

[3] By the term mathematization I mean mathematical representation of objects.

protest and say: "Look how many good articles I have published about these phenomena using numbers and how many people cite me." Given a simplicity of number as an answer, these scholars might be successful giving a simple numerical answer, and using numbers as answers to questions about the differences among objects in a plane might continue. However, the science of objects in a plane would not understand its topic well because of this.

Psychologists are used to using numbers as a mathematization of psychological objects. At high school as well as secondary school they were probably taught mainly numerical mathematics. If they don't study something other at university, they will study again number-related mathematics, because mathematicians working with numbers are considered experts on the mathematization of psychological objects, and are invited to departments of psychology to teach. Expertise with using numbers to represent objects might be called the *number token*. Consequently, *Number Tokens* are people whose expertise in numerical mathematics is used as a sign of ability to develop good mathematizations of phenomena even if they know nothing about these phenomena. Here, G_i is a group of mathematicians working with concepts based on numerical structures (e.g., statistics, calculus) and G is the group of all mathematicians. γ_1 is the knowledge how to make abstract numerical models of psychological phenomena (e.g., making statistical models, making system dynamics models), and Γ is knowledge about making abstract mathematical models. Number tokenism is a special case of considering experts on some particular mathematical structure or set of structures to be experts on mathematization of phenomena as a whole. This tokenism might be called *structural tokenism*. Here, G_i is a group of mathematicians working with concepts based on that particular structure or set of structures, G the group of all mathematicians, γ_1 is the knowledge of how to make mathematical models of (psychological) phenomena based on that particular structure or set of structures and Γ is knowledge of making abstract mathematical models. I feel the number tokenism is one of the most important kinds of tokenism influencing the current state of psychological science, because the use of number-related mathematizations like statistics or system dynamics without thinking about whether they are really appropriate makes psychology produce research that is remote from reality. Rest of this section will focus more deeply on number tokenism.

Number tokenism works much like cultural tokenism. Scholars possessing the number token may receive many job or cooperation offers from psychologists because they are considered experts on the mathematization of phenomena. Number Tokens might even believe they are experts, because other scholars acknowledge it every day, so finally they introject their token in a similar way to Cultural Tokens. Conversely, mathematicians with non-numerical background are not invited to psychological departments to teach because they are not considered to be experts on the mathematization of psychological phenomena.

The image of mathematics as seen by psychologists considered to be experts on mathematization in psychology is visible when we look at what the parts of mathematics are that some members of Society for Mathematical Psychology "all agreed are desirable if not indispensable for our graduate students to acquire" (Iverson 2006, p.218). These are "basic Matlab skills, basic R programming skills, Linear Algebra (color perception, Matlab, signals and systems), Fourier methods (signals and systems, auditory and visual psychophysics), Probability Theory (calculus based), Statistical

Estimation and Inference (calculus based, including signal detection theory and experimental design), Stochastic Processes (in time and across space; applications to fMRI, EEG-MEG, cognitive modeling)" (Iverson 2006, p.218).

Mathematical reasoning has different levels of abstraction. Students of mathematics usually first study simple operations with natural numbers. Natural numbers have very friendly attributes–for example there is the operation of adding, which is commutative (a+b=b+a) or numbers can be ordered and you can decide if a<b, b<a, or a=b. Then they study more complex operations with real numbers. Real numbers have friendly attributes as well – for example it is possible to compute a cube root. Then they start to study more complicated relations between more complicated numbers – e.g. mathematical functions on complex numbers. These objects still keep a high level of friendliness – for example they still possess the attribute of commutativity. However, students finally arrive at objects with higher level of abstraction, which don't possess any friendly attributes at all. There operations like cube root might not exist. If some operation with these objects exists, it might not possess characteristics like commutativity. Or these objects can't be ordered. Or binary operations (operations with two objects) may not exist there at all. All the parts of mathematics recommended by Iverson (2006) for students of psychology are on lower levels of mathematical abstraction. Why are the more abstract parts of mathematics not recommended for psychologists?

Experts on methodology and mathematization in psychology usually come from fields like physics, economics or engineering (Thissen 2001; Iverson 2006). Mathematical training of physicists, economists or engineers is limited, however. They usually study only those parts of mathematics that are useful for physics, economics or engineering. Those parts of mathematics are often those less abstract: those which assume that objects being studied should possess some friendly attributes. The same is valid for many scholars coming from applied mathematics. Applied mathematicians are usually trained only in those mathematical disciplines that are considered important by the social and natural sciences (and therefore are applied there – that is why it is called applied mathematics). They might lack training in the mathematical disciplines with a higher level of abstraction than number-related mathematics. Scholars who come to psychology from these fields use numerical mathematics like "small boys" using a hammer as Kaplan (1964, p. 28) puts it: "Give a small boy a hammer, and he will find that everything he encounters needs pounding. It comes as no particular surprise to discover that a scientist formulates problems in a way which requires for their solution just those techniques in which he himself is especially skilled." Number Tokens might use their number-related ability as a tool in psychological research simply because they don't have any other tool they are so good at.

Physicists are sometimes surprised how well mathematical models fit into the physics (Heller 1997; Brown 1997). They call the appropriateness of these models for physics "mysterious", "miracle" or "a wonderful gift" (Brown 1997). Brown (1997, p. 24) makes an important point: "It should be noted that the mathematical representation of the world need not be with numbers. From the Greeks to Galileo and after, geometrical objects did the representing. The increasing speed of a falling body, for example, was represented by Galileo by a sequence of increasing areas of geometrical figures." The switch to a number-related mathematical representation of the world was easier, because many physicists believed that "the world had been created by God

following mathematical principles" (Obradovic and Ninkovic 2009, p. 352). So the crucial question is: If there exist more abstract parts of mathematics than those that are number-related, if other than number-related parts of mathematics were used to represent real world objects in the past, and if even physicists themselves are skeptical about the appropriateness of using number-related mathematics to represent real world objects, why do psychologists insist on using number-related mathematics to represent psychological objects? Is the underlying assumption of psychological science (mentioned by Michell 2011) that humans mirror mathematical objects present in number-related mathematics?

Obradovic and Ninkovic (2009, p. 353-354) note that for a long time mathematics omitted discrete approaches (approaches that are not based on the assumption that mathematical objects are continuous or ordered like real numbers): "Mathematical analysis or the mathematics of continuous functions has been much more developed than the discrete mathematics. A possible reason for this is that continuous pictures of nature had been preferred from Newtonian times towards deep in the twentieth century. This approach is due to the assumed continuity of space and time lying in the basis of the classical physical theories. It can be said that discreteness is a possible approach in mathematics obeyed by all theories based on the atomistic concept." The part of mathematics used by physics is limited, and it is questionable whether the same part of mathematics is useful for psychology.[4] Psychological objects are more complex than physical objects; they quite likely need more abstract mathematical representation as well. To find mathematical representations of psychological objects that better fit psychology's needs would require an enormous amount of research. Number Tokens, who use number-related representation of objects studied by psychology as a kind of "hard obscurantism" (Elster 2012), have led psychology to a place where it often can't see the inappropriateness of this representation, and where it is not able to launch research programs able to develop mathematizations of psychological objects that fit better human psychological reality.

Tokenism as a social barrier to knowledge construction in psychology

Tokenism makes psychology to accept knowledge that has its roots in tokens and not in a deep understanding of human reality. Both Number and Cultural Tokens produce research based on limited knowledge or experience. Tokens cite one another and support one another in defending their token attributes as being necessary to do "good" research in psychology. This creates whole groups of Tokens who defend one another's opinion and create new "knowledge". Tokens may form a majority in a given research field where the terminology and methods in the field are created by them, and advancing new terminology and methods against the majority in the field can be difficult. In this way a tokenist standard of research can form a social barrier to knowledge construction in psychology. Doing research using predefined approaches or grouping people in the predefined way constitutes a "prescription in abstraction" (Michell 2005, p. 261). The knowledge may be not abstract enough, or conversely too

[4] Furthermore, as shown by Radder (2001), current physics doesn't contain any universal ontology which might be borrowed by psychology.

abstract, because people with the necessary experience to create the more abstract models, as well as people who have specific experience in more different environments sharing the same label (necessary to recognize inappropriate abstraction), may be no more than a small minority in token-organized research.

These social barriers are formed in two ways. First, people who have good knowledge about the token-related domain might have difficulty when joining the research community related to that token. For example, people, who don't possess the particular token attributes might not be given an opportunity to join activities related to that token. Mathematicians who might come to psychological departments with knowledge that would cause psychologists to make more abstract psychological models are usually not invited to cooperate on psychology research projects or given an opportunity to teach psychologists, because they don't do number-related research.

Second, people lacking the token attributes might feel incompetent to produce token-related research. Psychologists might assume they have lesser knowledge about some problem than the Tokens, so they are afraid to criticize the Tokens' research: "He is Asian, so he should have good knowledge about Asians." "She is European, so she should have good knowledge about Europeans." "She has degrees in engineering and physics, so she should know a lot about mathematics." "He has published so many articles about the problem, he should understand it very well." Scholars possessing the token attributes can become leaders in psychological research because people lacking these token attributes think they might not produce such good research about area associated with the token. Like in the proverb at the beginning of this article, incompetent people can become the leaders of those who are blind to this incompetence. If psychologists would realize the Tokens' incompetence, it might be a first step in making tokenism less powerful.

The Future of Cultural and Number Tokenisms

In the previous sections, two types of tokenism were described – cultural tokenism and number tokenism (which is a special case of structural tokenism). These tokenisms are historically given, so in this section it will be described how they might evolve in the future.

The way people are merged into groups depends on political authorities, who want to construct a unified nation or other social group to justify their power over it. Example from historical science could be the situation when China changed its official version of history in 2004 and stated that the current North Korea was a province of China in the past. There was a consequent hostile reaction from South Korea (Roehrig 2010) because grouping North Korea into the same entity with China in a historical science might be used to justify of renewal of this grouping after the North Korean regime collapses. Historical science serves here as a "strategic weapon" for an expected conflict in future. Constructing an "Asian" entity in psychological science might benefit China the same way, and legitimize its rule over people having the "Asian" label. Thus psychology might be used as a "strategic weapon" in the same way as happened to history. It, too, may work also with other entities constructed in psychological research, because grouping people into an entity is usually good for that "subgroup" that forms a majority in new entity or is the strongest one there. The strongest group in some larger

constructed entity has usually an interest in having its own Tokens serving as a knowledge source about this entity, because in this way this group can organize the knowledge according to its needs. To admit differences and break up the token symbols is not something the strongest group might want to happen. Cultural tokenism will continue, because there are people that have political interest in creating various cultural tokens.

There is also a strong political interest in using number-related mathematizations in human sciences. Industrial society needed mechanical workers to serve it, so sciences mechanizing human behavior were developed to fulfill this need, mechanical quantitative psychology being one of them (Brinkmann 2008). Statistics as a tool emerged through the 19th century because it was supported by governments for which it provided a way to standardize governmental policies and centralize the government. Democratic states made it possible for common people to take public offices, so "people who have no practical experience in public affairs can rise to high office. Statistics can help to compensate this lack of practical experience" (Porter 1995, p.84). The increase in the use of statistics in public life caused statisticians to became "more confident of their collective expertise" (Porter 1995, p.80); they began to believe that statistics is a useful tool for all aspects of human life. Quantification brings a way of controlling people, and provides a tool for the organization of large political entities, so that "the language of quantification may be even more important than English in the European campaign to create a unified business and administrative environment (Porter 1995, p.77). Psychologists are consequently motivated to adopt quantifications, because in this way they may receive "the package of economic and social rewards reserved by society for applied scientists" (Michel, Michell 2000, p.660). The tokenist approach in the mathematization of psychology and other human sciences might continue despite it being shown that it brings low quality knowledge and bad decisions,[5] because the political interest in doing science this way will continue. Nevertheless, political interest in number tokenism is lower than political interest in cultural tokenism, because it is not directly tied to the geographical spread of power. If political reasons for the use of statistical methods vanish, or if psychologists receive funding for non-quantitative research more easily, the relevance of term number tokenism in psychology might vanish as well. To describe how number tokenism might evolve in such circumstances, I will use a combination of two classifications: the Aristotelian and Galilean mode of thought, and mathematical opportunism and optimism.

Lewin (1930) describes two modes of thought, which he calls *Aristotelian* and *Galileian*. Aristotelian thinking doesn't assume that all things are lawful. To be lawful, phenomena need to be regular and frequent. Mainstream psychology adopts the Aristotelian mode of thought and looks for frequent phenomena, because "it is still considered a question whether and how far the psychical world is lawful" (p. 152). Psychology which "does not recognize lawfulness as inherent in the nature of the psychic, and hence in all psychical processes, even those occurring only once" (p.152) needs a criterion to decide if the phenomenon is lawful – and frequency of recurrence is taken as such. In this way an individual event becomes "fortuitous, unimportant, scientifically indifferent" (p. 151). On the other hand, the Galilean mode of thought assumes that all things happen according to general laws, so how often some

[5] Elster (2012) thinks that the utilization of statistical models in the economy is responsible for the bad decisions which led to current economy crisis.

phenomenon happens is not important when deciding about its lawfulness. In Lewin's opinion, what mainstream psychology needs is to quit the mode of thinking where "lawfulness and individuality are considered antitheses" (p. 155), and move to the Galilean mode of thinking. If all events in psychology are considered lawful, then "even a 'particular case' is then assumed, without further ado, to be lawful" (p. 162) and "nothing prevents relying for proof upon historically unusual, rare, and transitory events" (p. 169).

Wilson (2000) describes two strategies taken by mathematicians who apply mathematics in sciences. The first strategy is *mathematical optimism*, when it is believed that all circumstances and phenomena studied by a particular science can be mathematized, and the mathematical objects useful for this goal are searched for. The mathematical optimist believes that the large set of possible mathematical structures contains "an adequate copy of any 'physically possible structure' … on the grounds that if a structure is coherent at all, it must have a suitable representative within mathematics. In other words, somewhere deep within mathematics' big bag must lie a mathematical assemblage that is structurally isomorphic to that of the physical world before us" (Wilson 2000, p. 296-297). The second strategy is *mathematical opportunism*, when a mathematician looks for special circumstances suitable for the usage of the kind of mathematics that he wants to apply in a particular science, and ignores other circumstances and phenomena studied by that particular science: "the 'mathematical opportunist' openly seeks or engineers appropriate conditions for mathematics to get hold on a given problem" (Stöltzner 2004, p. 121). Which of the two strategies will be used depends on the status of the particular science in question. If the science in question is mature and has clear concepts, mathematical optimism is likely to be chosen when applying mathematics to this science. However, if the science in question is only provisional in its basics concepts, mathematical opportunism will be chosen: "especially in the early stages of a research field, opportunistic axiomatics will be openly opportunist because it does not yet consider the framework in which it operates as satisfactory" (Stöltzner 2004, p. 124).

Aristotelian/Galilean and opportunist/optimist dichotomies might be used to create a historical chronology of possible psychologies. Each of these possible psychologies may be subject to its own version of tokenism depending on the relationship between mathematics and psychology.

The first type of psychology is *Aristotelian-opportunist psychology*, which uses Aristotelian mode of thought and adopts mathematical opportunism when using mathematics in psychology. Aristotelian thinking with its "emphasis on frequency and categorization" leads "psychology to adopt statistical methods … constructing psychological concepts based on the definition of the 'average'" (Tateo 2013, p.523). This is the kind of psychology which has become mainstream today and which is based on clear mathematical opportunism, that only those things which are frequent and regular are worthy of research, and that statistics is the kind of mathematics that should be used when applying mathematics to psychology. This mathematical opportunism can be successful in psychology only if it has not-very-clear concepts (and consequently has low status). The Aristotelian-opportunist psychology is prone to number tokenism, which is connected with knowledge of statistical methods.

The second type of psychology is *Galilean-opportunist psychology*, which uses the Galilean mode of thought and adopts mathematical opportunism. The Galilean-

opportunist psychology can exist in three versions depending on the position of numbers and other mathematical structures in the interplay between mathematics and psychology. The first version might be called Galilean-opportunist numerical psychology. When psychologists abandon the Aristotelian focus on averages, they will change their way of approaching psychological phenomena. Such a change might happen as a "Copernican reversal" in modeling, when instead of creating a model from variables, the model is created first and variables are identified with observations "only as a second step" (Aubin 2001, p.267). This change seems to be suggested by Rodgers (2010). However, the Pythagorean faith that numbers are sufficient to describe the whole world "has permeated not just psychology, but other currents withing our culture" (Michell 2004, p. 311), so psychologists will still be accustomed to using numbers as a mathematical representation of psychological phenomena. They will stop using statistics as the main mathematical method, and turn to other numerical approaches. The Aristotelian-opportunist credo that scientists are able to apply statistics everywhere might be changed to a Galilean-opportunist credo that "they could build dynamical models for all sorts of sciences" (Aubin 2001, p. 267) (or that they could build any other kind of numerical models for all sorts of sciences). Approaches like system dynamics or differential equations might be used. These mathematical methods would be applied to psychology the opportunist way, which ignores phenomena for whose numerical representation is not suitable. Numerical representation of psychological phenomena will still be considered a must, so the term number tokenism will be still relevant in a Galilean-opportunist numerical psychology.

The second version of Galilean-opportunist psychology might be called Galilean-opportunist structural psychology. It would adopt non-numerical mathematical structures (e.g., finite automata), so the term number tokenism becomes irrelevant in this stage. However, the adopted mathematical structures might be applied to psychological phenomena in the same opportunist way as numbers once were. This psychology ceases "to be modeled upon quantitative natural science" and influenced by its "irresistible shadow" (Michell 2003, p. 12). However, mathematicians will choose an opportunist strategy to find some psychological phenomenon to which their favorite mathematical structure might be applied, and they will not worry too much whether this structure is really relevant for the phenomenon or not, out of the belief that structural methods offer "the best hope for truly scientific social and human sciences" (Aubin 1997, p. 320). Some other structure or structures might achieve a similar status as that of number related mathematics today. The ability to work with these structures would became necessary to be considered an expert on mathematization in psychology, and this type of structural tokenism might replace its number counterpart. Number tokenism will be succeeded by structural tokenism in this version of Galilean-opportunist psychology.

The third version of Galilean-opportunist psychology might use parts of mathematics that are characterized by something other than a particular structure or set of structures. The terms number tokenism and structural tokenism will be not relevant here. An example of such mathematics might be mathematics that differ from current mathematics in terms of their underlying philosophical assumptions, and that are based on the realization that human beings are only capable of doing finite operations, so the infinite can't be actual for us (Rodych 2000) and reasons why usage of the term infinity in mathematics succeeded were not logical, but theological (Trlifajová 2005). One mathematics based on this realization is L. E. J. Brouwer's intuitionist mathematics,

which builds mathematics step-by-step by language-less thought construction from intuition. Because human mind is finite, such a construction must be always finite. For intuitionist mathematics, an assertion is true if and only if there exists a finite constructive proof of this assertion; otherwise it is an empty linguistic form (Pourciau 2000). If psychologists began to regard intuitionist mathematics as meaningful, many mathematical techniques based on the infinite constructions used previously by psychologists (perhaps including statistics or structural approaches based on set theory) would become meaningless. Some other type of mathematics might become the type of mathematics preferred by psychologists for mathematization of psychological phenomena (intuitionist mathematics serves here only as an example). Galilean-opportunist psychology based on that type of mathematics might be prone to another type of tokenism, which might be called *mathematical tokenism*, where the ability to mathematize a phenomenon might be taken as the equivalent of the ability to research a phenomenon. A Galilean-opportunist psychology might hold that only phenomena that can be mathematized are worthy of research, and only those researchers who use these mathematizations are true experts in psychology. A "serious methodological error" (Michell 2003, p. 21) that psychology should be quantified might be succeeded by another methodological error: that psychology should be mathematized.

In mathematical tokenism, G_i is the group of psychologist working with mathematized psychological phenomena, G is the group of all psychologists, γ_ι is knowledge of how to make mathematizations of psychological phenomena, and Γ is knowledge of how to do psychological research. Psychology may face serious problems with mathematical tokenism. The whole currently-developed mathematics be applied to psychology the opportunist way, and mathematical opportunists will ignore those parts of psychology that are not suitable for mathematization. This may cause two types of problems. First, there might be parts of mathematics which are beyond human comprehension, and humans are not able to understand them (Salmon 2001). Phenomena to which we are unable to discover the possible related mathematics might be discarded from research if mathematical tokenism occurs. Second, such a tokenism would also discard phenomena that could not be mathematized at all (however, it is impossible for humans to recognize whether a phenomenon cannot be mathematized or if such a mathematization is not understandable to humans).

The third type of possible psychology is *Galilean-optimist psychology*. The opportunist strategy of looking for phenomena for which some concrete mathematical structure or approach might be relevant will be discarded here. On the contrary, psychology will first examine a phenomenon, and then try to construct some mathematical structure suitable for representing this phenomenon. While statistics, system dynamics, different mathematical structures, or other current types of mathematics might still be used for the psychological phenomena for which they are suitable, a Galilean-optimist psychology would bring new mathematical approaches as yet unknown to mathematicians, and help mathematics with its principal emphasis on the invention of new concepts (Wigner 1960). The advent of new mathematical approaches might increase the status of psychology, which will protect it from mathematical opportunism. A Galilean-optimist psychology might be the approach proposed by Jean Piaget, who believed that all

sciences should be based on structures, and that all structures are at least potentially mathematizable (Aubin 1997, p. 317).

The terms number or structural tokenism might be irrelevant in a psychology that tries to create a suitable mathematical structure for every phenomenon it researches. However, mathematical tokenism might still occur. The problematic dichotomy of the terms qualitative-quantitative in psychological research (Allwood 2012) might become obsolete, and many qualitative researchers might realize that opposite of qualitative is not quantitative, but algorithmized, formalized or mathematized, because mathematization alienates the world and this way humans „lose a lot. Especially when they want to … control things with which they should learn to meet with“ (Matoušek 2011, p. 296). Qualitative researchers who in Aristotelian-opportunist psychology needed to defend their approaches against “the ghost of Pythagoras” (Michell 2011) telling them that psychology should be quantified, might be in a Galilean-optimist psychology forced to fight off numerous other ghosts of the founders of various mathematizations of psychological phenomena. Fighting an army of ghosts might be tougher than fighting just one ghost, so a turn to Galilean-optimist psychology might not be necessarily positive for psychology as a whole.

How to Diminish Tokenism in Psychology

Scholars in psychology can inaccurately derive their scholarship from many other things than their cultural background or numerical ability, so many other tokenisms might possibly be found in psychology. This text has focused mainly on cultural and number tokenisms, but many other tokenisms might exist. What all tokenisms have in common is that there is some attribute considered as a sign of expertise in some field (or used as a tool), and Tokens possessing this token attribute are considered experts even if they lack the necessary knowledge. False knowledge is considered as valid, and research moves further and further from reality, while better knowledge could be attained if tokenism is recognized. How might psychologists diminish the influence of tokenism on psychology? They should apply “a radical and ceaseless critique to already given forms of knowledge” (Clegg 2010, p.248) and study psychological phenomena properly. Tokenism benefits from fragmentation of knowledge, so it might be ameliorated if psychologists study phenomena comprehensively, as a whole (Koffka 1935, chapter 1).

Valsiner (2006) writes about the “first induction” defined by C. Lloyd Morgan. First induction is a scientist’s internal induction. Any kind of knowledge starts with the scientist developing a “personal, only introspectively available, intuitive understanding of the phenomenon in question” (p. 599). This internal induction is subjective, and is based on scientist’s personal and cultural history.[6] Introspection as a source of insight for researchers has been discredited in psychology, which has led to a “focus on

[6] The research practice, where only external induction (empirical methods for collecting and analyzing data) is discussed and internal induction is omitted, is a direct cause of tokenism’s possible survival in psychology. When the discussion of why a psychologist chooses a certain representation of psychological phenomena, and why s/he groups subjects the way s/he does is not part of the standard research process in psychology, it is easy to defend a tokenist position.

behavior" (p. 600), the exclusion of relevant phenomena, and the production of hypotheses whose "grounding in real-life phenomena and general theoretical schemes usually remains out of focus" (p. 604). I agree that psychology should reinstall "the centrality of phenomena in psychological research" (p. 609) and focus on generalizations of knowledge about these phenomena. The absence of an introspective knowledge about the phenomena in question lies at the heart of some types of tokenism. For example, Number Tokens have no idea whether numbers are really suitable mathematization to represent a phenomenon in question (often because they have no knowledge about this phenomenon). If psychologists would more often use their own experience with the phenomena, and if introspection is reinstated as a mainstream method of psychological research (Dobroczyński 2013), it will allow psychologists to rethink their mathematical representations of psychological phenomena more thoroughly.[7]

To fight tokenism, psychology might use several approaches. Psychologists could be required to cite sources published in multiple languages, which will diminish the dependency on English-only sources in many psychological articles (Draguns 2001) and detach the discourse from the concrete term network that creates tokens. Samples from multiple cultures might be required by psychological journals in order to minimize inaccurate groupings (Allik, Massoudi, Realo, and Rossier 2012). A higher proportion of psychologists educated in non English-speaking-countries could be required to be represented in international psychological journals (Arnett 2008). Research teams should also include researchers of all possible cultural backgrounds related to the human groups studied in the concrete research (Medin, Bennis and Chandler 2010).

The cultural tokenism is connected with the Aristotelian version of number tokenism, because this number tokenism creates an environment where the averages might serve as an information about groups, while information about individuals or subgroups in these groups are ignored. Phenomena for which there is little belief that something can be captured by statistical methods, for example the differences between groups believed to be the same because of a shared cultural token, are ignored. Changing the number-related research paradigm in psychology will therefore also diminish cultural tokenism.

The research paradigm created by number tokenism might change if the mathematical education of psychologists changes. Kaplan (1964, p. 29) writes: "The price of training is always a certain 'trained incapacity': the more we know how to do something, the harder it is to learn to do it differently." The main effect of excessive quantitative training of psychological students is probably an inability to understand the need for different mathematization of psychological phenomena. Moving from the perception that mathematics is a science about numbers to the awareness that mathematics is a science about relationships between objects will take time, and students now wasting time with numerical disciplines will have no

[7] Scientific discovery based on introspection might be close to the intuitive scientific style of mathematician Henri Poincaré as discussed by Miller (1997). Poincaré never used notes, never had any plan or goal in mind, nor any idea if the problem is solvable when conducting research. He began writing his papers without knowing what his conclusion would be. For Poincaré, it was necessary to do science as *something more* than pure logic or evidence of the senses, because with increasing abstraction "the senses would soon become powerless" (p. 56). This *something more* he called intuition.

remaining time to make this move. I therefore recommend removing quantitative courses from compulsory part of the psychological curriculum.[8] In the long term of twenty or thirty years this might produce other mathematizations of psychological phenomena different from those in physics and natural sciences. Cartier (2008, p. 76) notes that "after a long and fruitful marriage, over the last four centuries, between mathematics and physics there comes a time to understand mathematically" the other sciences. Psychology could be one of them. If compulsory quantitative training in psychological curricula is abolished, it will allow psychologists to make move from Aristotelian-opportunist to Galilean-opportunist research. Such a move is necessary to prepare the ground for the creation of a Galilean-optimist psychology. Publications like the book *Qualitative Mathematics for the Social Sciences* (Rudolph 2013) show that this time is slowly coming.

Conclusion

Tokenism is a "pathology of science" (Michell 2000, p. 640). While it is normal that scientists make errors in their reasoning, it is also normal that these errors will be corrected by critical inquiry. The pathology of science comes when critical inquiry is systematically abolished and reasoning errors continue. This is the case with the cultural and number tokenisms in current psychology, and it may also be the case with possible future tokenisms (e.g., mathematical tokenism described above). This pathology of science is possible when psychologists fail to discuss the quality of their research from a broad point of view. The term "quality of research could not be relieved of the social and cultural anchoring of science and every concrete research". It is necessary to consider "who (in which position) is the person who creates the knowledge". It should be observed "what is being omitted in research, deprecated as 'inappropriate and unworthy' research, or researched only partly, from only a particular point of view" (Bačová 2003, p. 270). Tokenism causes psychology to discard many possible views and research methods. Research questions asked from the position of superficial cultural groups and research organized according to the assumption that everything should be transformed into numbers, do not help psychology produce good quality knowledge. However, this doesn't mean these views should be discarded from psychology.

Asking a research question from the position of a cultural group based on some token property (e.g., Asians) is meaningful when it is asked in an environment (like the USA) where this label distinguishes some group of people: in this way the token might create a new cultural group when these people lose their original cultural heritages. Using numbers to represent phenomena is meaningful for phenomena that are really quantitative (e.g., body temperature). Researchers know from their own research work that "the making of science is disorganized, then corrected, subsequently finalized, pragmatic and pluralistic. Many consider the question 'is methodological eclecticism or pluralism a good solution, or has it already became research reality?' to have been

[8] The situation in this regard is improving, at least in the United States, since doctoral students' training in statistics and numerical approaches is deteriorating there (Aiken, West, and Millsap, 2008). American psychologists are therefore thinking more and following algorithms less.

answered already." (Bačová 2003, p. 264) Psychology is a multi-paradigmatical science and "the existence of multiple research programs/traditions is normal for psychology" (Marček and Urbánek 2011, p. 232). Old research traditions–like quantitative psychology–should continue to exist, however they should not be treated as mandatory. If we want "psychology to proceed further and change, it implies destroying old opinions and hypotheses" (Vybíral 2006, p.165), otherwise psychology will "stagnate in inertia" (p. 214). Psychology should not take on a similar goal as Bourbaki's mathematics (see Aubin 1997)–to be unified or at least to strive for unity. Human beings are variable; they have diverse viewpoints–and the science studying them should be just as variable, and have as many diverse viewpoints as well.

I understand that some Tokens (and not only people without substantial knowledge in their alleged area of expertise, which was the meaning of the term Token used in this text) might feel injured by this text. I should note that the fact that Tokens produce the kind of research criticized in this text doesn't mean they are doing it on purpose or that they have some evil intention. Using tokens to categorize people is an act of cognitive economy (Baron 1986, p. 29), when people simplify reality in order to overcome cognitive overload. Some Tokens at some point realize the inappropriateness of this simplification, but they cannot change it. Many of them do it because it is their job and they have to. Both Number and Cultural Tokens may have been successful in research related to these tokens and it may be hard for them to keep up their publication level if they decide to do another type of research. Many Tokens must therefore continue in tokenist research because it is the only way they can keep their job in academia. Their situation is similar to that of Adolf Eichmann as interpreted in Arendt's (1995) book *Eichmann in Jerusalem*. Eichmann was only following orders when organizing Jewish genocide; he had no personal evil intent. From this perspective he might be also considered a victim of the war, because he was executed even though, as in Arendt's interpretation, he may have felt that he'd done nothing wrong, just followed the system. Tokens in academia are victims in the same sense: they just follow the system of psychological science, and produce the tokenist type of research. Nevertheless, the primary victims of tokenism are not academicians, but the masses of people harmed by stereotypes (created by inaccurate grouping in research) and policy changes (made according to bad mathematizations) caused by the research that Tokens help to create. I hope this text will help give these victims of tokenism a voice.

Acknowledgments I was a recipient of Taiwan scholarship received from MOE of Taiwan (R.O.C.) when I began writing this text. I thank Vladimír Marček, Jaan Valsiner, Todd Hammond and anonymous reviewers for advices on how to improve this text, and Kao Yuang-Kuang (高永光) for introducing me to Kaplan's book. I also thank Lubomír Kostroň for inspiration.

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