ISSN 1799-2591
Theory and Practice in Language Studies, Vol. 10, No. 7, pp. 749-760, July 2020
DOI: http://dx.doi.org/10.17507/tpls.1007.05

Towards Post-postmethodism: Embracing a New Generation of Methodism

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***Abstract*—Postmethod is the offspring of language teaching methods failure in meeting their objectives, a failure which led to disillusionment with the concept of method. To solve this pedagogical challenge, postmethod stigmatized those taking the initiative to develop new methods as making a futile attempt. Therefore, it exerted a deterrent effect on the developmental trend of language teaching methods. All these measures were taken following postmethodism's major precept: it is the concept of method which should be to blame. True, the concept of method, as grasped so far, is both "limited and limiting" (Kumaravadivelu, 2003, p. 1). But what if there is another possibility? What if future methods can surpass the boundaries of the past methods? By making an analogy between the developmental trend of assessment and that of language teaching methods and by referring to the potentials of Artificial Intelligence, especially those of intelligent computer assisted language learning (ICALL), this study attempts to provide compelling evidence about the inevitability of a methodism resurgence in the language teaching profession and the emergence of dynamic methods as a new generation of methodism.**

***Index Terms*—method, postmethod, dynamic assessment, ICALL, intelligent tutoring systems, dynamic methods**

I. Introduction

The failure of many language teaching methods in meeting their objectives during the last decades of the 20th century led to growing disillusionment with the concept of method. Prabhu's (1990) article entitled "There is no best method-why?" (p. 161), published during the same period, deterred the language teaching profession from developing new methods, since it stigmatized those taking the initiative as beating the air. Postmethod is the offspring of such attitudes. The writings of leading scholars (e.g., Kumaravadivelu, 1994, 2003, 2006a, 2006b, 2012) and the academic works which followed suit all held the same opinion as regards the presented pedagogical challenge: it is the concept of method which should be to blame. Although upon facing a challenge there are always two general options to choose, i.e., a) embracing the challenge and fighting against it, or b) abandoning the challenge altogether, postmethod chose what should be chosen as a last resort: it selected the latter and decided to abandon the concept of method.

While, as an influential movement, postmethod has rather stunted the evolution of methods, nothing seems to be strong enough to deter the explosive growth of knowledge and the advent of unpredictable changes in the third millennium (Maftoon & Taie, 2016). This knowledge boom in an era where "interdisciplinarity is both desirable and inevitable" (Chettiparamb, 2007, p. 1) can set the ground for the emergence of revolutionary Kuhnian (1970) paradigm shifts across different disciplines, especially in education. True, many current issues in language teaching are not particularly new (Kelly, 1969), but in the "global village" (McLuhan, 1962, p. 21) of the third millennium's multimedia we will soon witness a media metamorphosis or, in Fidler's (1997) words, a "mediamorphosis". Following McLuhan (1994), if "the medium is the message" (p. 7), then the advent of new revolutionary media such as 5D optical data storage, quantum teleportation in space, and time crystals[1] can bring about paradigm shifts across different disciplines, hence, inevitably, the history of science will no longer lead us to the future. So, in such a context "the history of language is no longer a guide" (Crystal, 1997, p. 178), and the likelihood of the repetition of the same language teaching pattern is rather slim. One possibility in this context would be the resurgence of language teaching methods, *but* in a metamorphosed shape.

The exponential growth of technology (Kurzweil, 2004), especially the Artificial Intelligence (AI) with its evolutionary chain of descendants from machine learning, and Artificial Neural Networks (ANNs), to deep learning (Bini, 2018), and neuroscience with its various imaging techniques will herald a revolutionary educational system. In fact, "new insights from many different fields are converging to create a new science of learning that may transform educational practices" (Meltzoff et al. 2009, p. 284). With such a picture in view, and through making an analogy between the developmental trend of assessment and that of language teaching methods, this study tries to accumulate compelling evidence about the inevitability of a methodism resurgence. And as such, it is suggested that, unlike the postmethod's prognostication, the quest for newer methods is inevitable and should not be deterred. If the likelihood of such a prospect is strong, then it is worth consideration.

II. The Emergence of Postmethod

"Unfortunately, no complete monograph on the history of language teaching methods is yet available" (Titone, 1968, p. 2). From the mid-1880s to the mid-1980s the language teaching profession got involved in a search for a single, ideal method that can be generalizable across different contexts (Brown, 2002). Yet this trend changed in the last decades of the 20th century as there appeared to be an evolving recognition of the constraints imposed by the concept of method (Stern, 1983); a recognition which paved the way for the emergence of a postmethod era. A primitive form of postmethod has its roots in eclecticism (Akbari, 2008). This is what was later referred to as "beyond methods" (Richards, 1990, p. 35). The term postmethod was coined by Kumaravadivelu (1994), yet conceptually it owes a lot to ideas put forward by Pennycook (1989), Prabhu (1990), and Stern (1983). Each of these scholars tried to debunk what they considered as "the myth[s] surrounding the concept of method" (Kumaravadivelu, 2006b, p. 163). They were expressing or implying that the search for methods is futile. Several reasons were consequently mentioned for saying farewell to methododism and welcoming postmethodism. Some of these reasons have been dealt with in the following along with explanations proposing their fallacious nature *in the status quo*, suggesting that the search for methods is inevitable and should not be deterred.

III. The Paradox of the Best Method: One-size-fits-all Reconsidered

Prabhu's (1990) main argument is that the search for methods is futile, and it should be terminated since "there is no best method" (p. 161); implying that there is no one-size-fits-all solution to language teaching. Later, many scholars followed suit and tried to debunk the concept of method by equating it with a one-size-fits-all solution (Bell, 2003; Brown, 2002; Kumaravadivelu, 2012). Three questions are raised here which would challenge Prabhu's (1990) idea: first, is it correct to equate the concept of method necessarily with a one-size-fits-all solution?, second, is it possible to have *one* entity which is fits-all, and third, is it possible for the future methods to have a fits-all nature? (I have deliberately omitted 'one-size' from the expression 'one-size-fits-all' for reasons which will be explained later).

All these questions address the same issue: the possibility of considering one entity as being dynamic rather than regarding it as static. As held by many scholars such as Hegel (Dunning, 1992) and Vygotsky (1986) concepts are dynamic, or as "Hegel reminds us … they are born, they develop, and they die, often to be reborn as aspects of larger concepts" (Dunning, 1992, p. 147). So, conceptually, methods can be dynamic. But what about in practice? It is argued here that the answer to this question is positive on two accounts: first, by drawing an analogy between the developmental trend of assessment and that of methods, and second, by considering the rapid advancements of science, especially ICALL.

IV. Developmental Trend of Assessment Versus That of Methods

There is a growing recognition of the dynamicity of many concepts in language teaching which used to be considered as being static traits, e.g., aptitude, learning styles, learning strategies, anxiety, and motivation (Dörnyei & Ryan, 2015). "This dynamic conception of contextually grounded and mutually interacting" (Dörnyei & Ryan, 2015, p. 11) concepts are due to "abilities [which] are malleable and flexible rather than fixed. Hence a [new] form of measurement is needed for abilities that takes their malleability and flexibility into account" (Sternberg & Grigorenko, 2002, p. 1). Dynamic assessment (DA), developed based on Vygotsky's zone of proximal development (ZPD) (Poehner, 2008), is one of such measurement options. So, in the developmental trend of assessment we see a movement away from classic, static, norm-referenced, product-oriented, summative, context-independent assessments towards espousing modern, dynamic, criterion-referenced, process-oriented, formative, context-dependent, individualized assessments (see also Hamidi, 2010). These new assessments are more challenging than the classic ones. For example, there are some challenges facing DA itself (Haywood & Tzuriel, 2002), and some facing teachers employing it (McNeil, 2018). But these challenges did not hinder the assessment profession from moving forward and getting past static assessments, yet similar challenges made language teaching methods development come to a standstill. In fact, it can be argued that one of the indirect factors that made postmethod welcome, and made it powerful enough to announce the futility of methodism continuation is perhaps the inherent difficulty involved in devising dynamic methods (DMs)[2]. It seems that the idea of developing such methods has been considered so far-fetched that (to my knowledge) it has not appeared in the literature. So, one of the advantages of the assessment trend over that of methods is that while those involved in the assessment profession have been moving forward toward espousing more dynamic modes of assessment and embracing the involved difficulty, those involved in the language teaching attached a static label to methods for good, and then criticized them for what they *themselves* had put on them.

The second point which should be admired in the developmental trend of assessment is that it was not petrified by the colonial and hegemonic potentials inherent in assessment. True, both assessment (e.g., standardized tests) and methods can have a hegemonic nature (Kumaravadivelu, 2016).Yet neither the hegemonic nature of assessment nor the recognition of the dynamicity of concepts and the subsequent difficulty involved in constructing assessment frameworks tapping this dynamicity resulted in the abandonment of the concept of assessment and the germination of the idea of a *post-assessment* era. Rather, such recognitions made the assessment profession take the initiative to develop better frameworks while at the same time acknowledging the involved difficulty (Lin, 2013). The question raised is why the same trend did not emerge for methods.

The ongoing quest for better assessment frameworks ushered in DA, and diagnostic assessment. This steadfastness later resulted in the development of stealth assessment (Shute et al. 2009). Broadly speaking, stealth assessments are game-embedded assessments to unobtrusively, accurately, and dynamically measure how players are making improvement relative to targeted competencies (Shute et al. 2009; Shute, 2011). It "involves embedding formative assessment into the learning environment such that it is invisible and hence does not disrupt learning and engagement" (Shute & Kim, 2014, p. 312). In stealth assessment, therefore, we observe a growth of deeper insights into assessment in that not only it meets the objectives of both DA and diagnostic assessment, but also it is carried out in a fun-engaging manner (Shute & Kim, 2014), therefore, it is rather stress-free. Moreover, as assessment is invisible and does not disrupt learning, it meets one of the important objectives of DA which is assessment being made at the service of learning, because DA is "a pro-learning form of assessment" (Leung, 2007, p. 257).

The evolution of assessment can also be traced in the development of individualized assessment. The growing recognition of the intricacy of language, the availability of new technologies, and concerns for the democratization of education resulted in interests in individualized assessment (de Jong & Stevenson, 1990). Also, the development of item response theory (IRT) "opened up exciting new approaches to individualized language assessment" (Masters, 1990, p. 58). One of the achievements in this field is computerized adaptive testing (CAT).

Developed based on IRT "CAT involves the delivery to testees of items which are gradually tailored to the apparent ability level of the testee" (Alderson, 1990, p. 21). CAT can be considered as a form of individualized assessment because it "provides students with an individualized assessment environment individualized for them to see their competences" (Ozyurt et al. 2012, p. 3191). So, as a result of steadfastness in the field of assessment we are witnessing a continuous evolution towards deeper insights into assessment so that now we can see the emergence of dynamic CATs capable of assessing students' ZPDs (Navarro & Mourgues-Codern, 2018).

Later on, with the development of DiscoTest (Stein et al. 2010), as a more advanced measurement tool, many of our longtime desired objectives were realized. DiscoTest is an online assessment tool developed based on 'Dynamic Skill Scale', a developmental scale devised by cognitive scientist Kurt W. Fischer. Unlike some standardized tests which measure discrete memorizable facts, Fischer's scales measures depth of understanding of a concept. Fischer's findings are also supported by neuroscientific evidence, because he found a correspondence between the levels in his scale and an increased connection in the brain (Lectica n.d.). Although as a "general approach to test design" (Stein et al. 2010, p. 208), DiscoTest has not yet been used for language testing, it can be considered as a more mature version of assessment in that it "provides all the benefits of embedded, formative tests, with the kind objectivity and validity that are desirable in standardized tests" (Stein et al. 2010, p. 208). Moreover, it tests sophisticated understanding of concepts. It is also diagnostic, and by providing continuous feedback it helps both learning and teaching (Stein et al. 2010).

Aside from possible future discussions about merits and demerits of assessment tools such as DiscoTests, such initiatives show that the assessment evolution is proceeding continuously in the right direction; we have set achievable objectives and tried to meet them. Dynamicity, contextuality, validity, reliability, practicality and objectivity are just some of such objectives. No matter how successful we have been in reaching them, the important point is that we are on the right track; getting continuously closer to our objectives. We might have swayed at times, but we are not lost in the barrens. The question is why the same trend did not emerge for methods and if DA is feasible, would DMs also be feasible.

V. The Feasibility of Developing DMs

A. Theoretical Aspects

1. DMs inspired by complex dynamic systems theory (CDST)

The dynamicity of language and its malleability by use has been referred to by many scholars. Larsen-Freeman (2003) has used the terms *grammaring* and "organic dynamism" (p. 30) to refer to this phenomenon. According to Larsen-Freeman (1997), language grows and arranges itself from the bottom up organically, and the changes observed are unpredictable and emergent, not rule-governed. Therefore, there is no target language as the target is always moving because of the collaborative use of language by all its speakers.

Following this perspective it can be argued that language cannot be effectively taught by static methods and one teacher. Rather its teaching should be based on the *collaborative effort of all its speakers* (including even those who are learning it). Therefore, to teach a language based on a "dynamic model of performance … which relates individual use to systemic change" (Larsen-Freeman, 1997, p. 149), we have to teach it by DMs whose dynamicity allows for the dynamicity of language. Such methods should take into account various variables simultaneously, and be malleable by "interaction between the teacher, the learners, and the instructional tasks and activities over time" (in line with Richards, 1990, p. 37). CDST as one of the "theories [which] view language as a dynamic system that is constantly being transformed through use" (Larsen-Freeman, 2018, p. 58) can inspire AI-based methods to make such goals achievable; an issue discussed further in the following.

2. Dynamic AI-based methods inspired by CDST

Right now "we have the technology to build a superior assessment system — one based on … AI [It] would provide a fairer, richer assessment system that would evaluate students across a longer period of time and from an evidence-based, value-added perspective" (Luckin, 2017, p. 1-3). The assessment provided by AI is precise, objective,

individualized, longitudinal, dynamic, and diagnostic. It improves students' metacognition, and teachers' reflective teaching. It provides simultaneous assessment of affective and cognitive constructs. Test fairness and social equality are observed in this type of assessment. Furthermore, as "the assessment would be happening 'in the background' over time, without necessarily being obvious to the student … [and as it] can deliver a new generation of exam-free assessment" (Luckin, 2017, p. 3), it would be rather stress-free. Concrete examples of these features are Discotest and stealth assessment. These assessments methods have been both developed based on AI because Discotest has been developed based on *The Lectical Assessment System* (Stein et al. 2010) which uses CLAS; an AI computer program for scoring Lectical assessments (Reams, 2017), and stealth assessment also utilizes AI (Shute & Spector, p. 2008).

Since its invention, AI has been growing "exponentially" (Kurzweil, 2004, p. 382). "It is a powerful force that is reshaping daily practices, personal and professional interactions, and environments" (Taddeo & Floridi, 2018, p. 751). In particular, AI, through its descendants, i.e., machine learning, ANNs, and recently deep learning (Bini, 2018) can have the potentials to transform education, causing real Kuhnian (1970) paradigm shifts.

A glance at the definitions of these terms will help clarify their relevance to issues raised in this paper. Basically, "AI is computational processing that mimics the thinking of humans" (Kessler, 2018, p. 212). Machine learning refers to a type of AI "that provides computers with the ability to learn without being explicitly programmed by exposing them to the vast amount of data" (Raeesi Vanani & Amirhosseini, 2019, p. 43). Later, machine learning constraints led scientists to develop ANNs and deep learning algorithms through biomimicry (Bini, 2018). "A **neural network** (NN) is an abstract computer model of the human brain" (Munakata, 2008, p. 7, emphasis in the original). "Similar to the brain … [it] is composed of artificial neurons (or units) and interconnections" (Munakata, 2008, p. 7) which can learn autonomously. And finally, "deep learning refers to neural networks with lots of layers" (Eckroth, 2018, p. 104). Looking at these definitions we can see that AI can provide a suitable venue for using usage-based approaches to second language acquisition. Because "[u]sage-based theories hold that the acquisition of language is exemplar based. It is the piecemeal learning of many thousands of constructions and the frequency-biased abstraction of regularities within them" (Ellis, 2002, p. 143). The same holds true for machine learning because "[m]ost methods in this area are based on learning by examples" (Bardis, 2009, p. 92). Moreover, like usage-based approaches to language learning, learning in AI is data-dependent as "AI solutions are data hungry. The more data there is and the more varied it is, the better the AI outcomes" (Mohanty & Vyas, 2018, p. 52).

AI technology enables the system to learn continually from its own experience and optimize itself (Bini, 2018), i.e., it provides the system with adaptive learning and self-modification. Recall that one of the criticisms leveled against methods was that "teaching is not static or fixed in time but is a dynamic, interactional process in which the teacher's 'method' results from the processes of interaction between the teacher, the learners, and the instructional tasks and activities over time" (Richards, 1990, p. 37). "[D]ata is to AI what food is to humans"[3] (Purdy & Daugherty, 2016, p. 11). So it can be argued that AI can provide us with CDST-inspired DMs which evolve from interactional processes. That is, since AI is not static and it can be fed by language (from teachers and learners), it can provide adaptability, i.e., dynamicity as conveyed by the second sense of CDST. And while "an interactionist approach to DA is labor-intensive, time-consuming, and, perhaps, difficult to carry out in large programs" (Antón, 2009, p. 592), AI can overcome all such difficulties. So AI-based methods inspired by CDST have the potentials to allow for the second sense of dynamicity as conveyed by this theory, i.e., diachronic and synchronic changes (Larsen-Freeman, 1997).

Also, recall that the other criticism levelled against the concept of method was the impossibility of formation and implementation of a method while taking into account many variables (Kumaravadivelu, 2006b). Again, this does not apply to future DMs because "while tracking so many variables is challenging for people … it is something that computers are particularly adept at" (Bini, 2018, p. 2359). Therefore, the first sense of dynamicity as conveyed by CDST can also be met in DMs through using AI.

3. Dynamic AI-based methods inspired by Vygotsky's ZPD

There are many AI tools which implement Vygotsky's ZPD (Holmes et al. 2019). Scaffolding, as the tutorial assistance given within the ZPD (Wood et al. 1976), can be successfully employed by technology (Luckin, 2008). "For technology to provide software scaffolding the system needs to maintain a model of its learners. Systems that do precisely this have been developed and provide one way to use the ZPD to inform educational software design" (Luckin, 2008, p. 450).

B. Historical Aspects

The historical picture depicted in this study shows that while the developmental trend of assessment has been upward and positive, that of methods has been a straight line; indicating the "demise of methods" (Bell, 2003, p. 328). It can be argued that methods development is lagging behind just because postmethod cannot think of methods as having the ability to grow beyond a static mold. Such reasoning is strengthened by the fact that the concept of postmethod has been quite influential, changing "the profession's collective thought and action" (Kumaravadivelu, 2006a, p. 59). It is further strengthened by introducing postmethod era as "the laudable transition from awareness to awakening" (Kumaravadivelu, 2006a, p. 76) in that using words such as "laudable" and "awakening" has intensified postmethod's deterrent effect on methods development.

Of course, ironically attributing such terms to postmethod, and considering methods as "limited and limiting" (Kumaravadivelu, 2003, p. 1) is both true and false, and it is not contradictory! It all depends on the context. Such ideas

can be mooted about *static* methods but not DMs. But no matter whatever the deterrent force has been, hardly can any force be strong enough to deter the influence of the exponential growth of AI (Kurzweil, 2004). In fact, "many sets of tasks that are currently placed at the core of teaching practice in higher education will be replaced by AI software" (Popenici & Kerr, 2017, p. 11). And "there is consistent evidence …that AI solutions open a new horizon of possibilities for teaching and learning" (Popenici & Kerr, 2017, p. 3) creating "a tsunami of change" (Popenici & Kerr, 2017, p. 8). AI-based dynamic language teaching methods could be one of the future possibilities, a prognostication further supported in the following.

1. Blurring method/assessment dichotomy

For those who are still dubious about a methodism resurgence there is still another way of removing their doubt. Aside from the data derived from the comparison of assessment and methods developmental trends, the issue of blurring the boundaries between assessment and instruction can be used to support an opposite movement; a movement other than the one currently prescribed by postmethodism.

DA as a pro-learning form of assessment is designed to promote learning (Leung, 2007). This goal is so important that it has led to the blurring of the boundaries between assessment and instruction in DA (Quellmalz et al. 2011). In the evolution of assessment trend, as documented in this study, we see that as we have been moving further away from static assessment towards more advanced forms of DA, the merger between assessment and instruction has been increasing to the extent that, observing this trend, we can predict, rather confidently, that in the near future the boundary between these two would be indiscernible. Therefore, soon "we will see more blending of the methods from both the fields of educational measurement and of intelligent tutoring[4] to form a hybrid system in which learning and assessment are blended in such a way that they are indistinguishable" (Quellmalz et al. 2011, p. 84). This trend of indistinguishability can be documented in the development of stealth assessment as it "involves embedding formative assessment into the learning environment such that it is invisible and hence does not disrupt learning" (Shute & Kim, 2014, p. 312), and in AI-based assessment "because [in that] the assessment would be happening 'in the background' over time, without necessarily being obvious to the student" (Luckin, 2017, p. 3). This merging of assessment and instruction right now can be seen in "Duolingo, a language learning platform based on AI and voice recognition … [which] can track students' progress and provide personalized feedback and practice" (Karsenti, 2019, p. 108). So, for those who are still skeptical, this prospect of assessment and instruction boundaries blur would be sufficient enough to remove their doubts about the inevitability of methods resurgence, *no matter* whether they are called dynamic *assessment* methods or dynamic *teaching* methods. So right now earlier prototypes of DMs are in existence in advanced versions of DA.

2. Mediamorphosis and inevitable language teaching metamorphosis

The inevitability of the emergence of DMs can also be backed up in another way. Recent revolutionary information achievements like 5D optical data storage, quantum teleportation in space, and time crystals can usher in an information overload and increased complexity. If following Logan (1997, August), we accept that each time there is an information overload and increased complexity, it would lead to a chaos which itself would trigger the emergence of a new level of order or a new language, then such breakthroughs, which sound like science fiction, could have the potentials to bring about a new language. Logan (1997, August) has predicted expert systems (a kind of AI) to be the emerging language.

Such revolutionary media can bring about a media metamorphosis, or in Fidler's (1997) words, a 'mediamorphosis'. Fidler (1997) based his 'mediamorphosis theory' on six fundamental principles, the sixth of which 'delayed adoption' holds that "[n]*ew media* technologies always take longer than expected to become commercial successes. They tend to require *at least* one human generation (20–30 years) to progress from proof of concept to widespread adoption" (p. 29, italics in original). Yet with mentioned information innovations in view, it can be anticipated that this delayed adoption time will decrease. In fact, it seems that, contrary to the Fidler's principle, the delayed adoption time will not necessarily be *always* at least 20-30 years. For instance, compact disks and USB flash drives took much shorter delayed adoption time than that anticipated by the Fidler's principle. Therefore, Fidler's principle should be ruled out as: a) the delayed adoption time is not necessarily always at least 20-30 years, and b) it depends on many factors such as need, cost, ease of production, advertisement, and even the extent to which a new technology can come into vogue among many other factors.

What Fidler (1997) is proposing in his delayed adoption is based on a linear growth. True, thinking linearly it might take 20-30 years. But the point is that media are growing "exponential[ly] … [and] we find not just simple exponential growth, but 'double' exponential growth, meaning that the rate of exponential growth is itself growing exponentially" (Kurzweil, 2004, p. 382). Consequently, it follows that the delayed time will get an exponentially decreasing pattern. Moreover, it can be argued that if something has an exponential growth, then mathematically there is the possibility of the delayed time to get even close to zero. As regards our discussion, it can be said that AI-based media have the potentials to bring about language teaching methods metamorphosis, and as they are growing exponentially, they will have an exponentially plummeting delayed adoption time. Therefore, we will soon see their prevalence.

3. Present incapability does not mean future impossibility

For those who still consider the idea of DMs as being far-fetched, one question might be helpful: "Does the present incapability necessarily connote future impossibility?" The history of science has provided us with many anecdotes, proving a negative answer. We have witnessed many significant achievements based on ideas once too far-fetched.

Motion pictures were inconceivable to the people of the Middle Ages, as were static pictures to primitive men. Televisions, the first trip to the moon, and space shuttles were all once far-fetched. Yet no matter how far-fetched they sounded, man tried to achieve them. In the same vein, DMs might seem implausible now. But no present implausibility is necessarily continuous. In fact, implausibility is timebound, as time has rendered many highly implausible plausible.

DMs are plausible and, contrary to the Prabhu's (1990) claim, such methods can be fits-all. I avoid using the term one-size as it might be misleading. In fact, such DMs, although they won't be one-size, can fit all as they can accommodate themselves to different individual differences (ID). That is, they would be *one* package yet with *stretchable sizes*, hence I avoid using the term one-size. While postmethod is trying to instill the idea that there is *nothing new* to be discovered in the fields of methods, the AI advances are convincing us to move in the opposite direction. The following analogy in the history of science might help understand the static status quo brought about by postmethodism.

The Nobel laureate Max Planck upon choosing physics as his major was advised by the physicist Philipp von Jolly to choose another major because in his view physics by then had reached its maturity and there was nothing new to be discovered (Sanghera, 2011). Yet "the decades to come, which saw the revolutions of relativity and quantum mechanics, proved the prognostication to be misguided" (Wells, 2016, p. 61). Note that von Jolly had an illustrious career endowing him knighthood (Wells, 2016). So, "even knighted, respected scholars can be wrong, especially when prophesying that the future (no new science) will be fundamentally different" (Wells, 2016, p. 61). Yet Planck, not getting persuaded, continued his quest for physics; a quest which brought him Nobel Prize in 1918 for his discovery that is now regarded as the start of the modern physics (Sanghera, 2011). So we see that neither did the quest for physics come to a halt after a wrong prediction, nor did the physics circle prescribe a *post-physics* era. Rather, the continuation of the quest for physics ushered in a paradigm shift and a new chapter in physics. Yet the prescriptive tone adopted by postmethod forbidding methods quest is counterproductive, especially in view of the envisaged DMs in this paper which can signify the emergence of a paradigm shift in language teaching.

VI. AI-based DMS: From Feasibility to Realization

"Teachers who opt for post-method practices have to be aware of the fact that methods are not dead. They survive in one way or another in coursebooks" (De Florio-Hansen, 2018, p. 86)[5]. The fact that the concept of method, even to those who have levelled many criticisms against it, is still felt needed, at least for helping practitioners develop their personal approach to teaching (Droz´dział-Szelest, 2013) shows that there is no way to shy away from methods. Rather than abandoning them because of their shortcomings this study argues that measures can be taken to improve them. After discussions on the inevitability of the emergence of DMs, and the AI potentials for developing such methods, the question raised is how these methods would be built.

There is a consensus that ID affects to a large extent the rate of second/foreign language acquisition and the ultimate level of attainment (Pawlak, 2012). So either we are an advocate of methods or postmethod we can attain more favorable results if we make our teaching ID-based or individualized. Yet "recent trends tend to see ID as dynamic entities that change over time and may affect development differentially at different times" (Lowie & Verspoor, 2019, p. 185). Following an ID-based approach to teaching is difficult by itself let alone taking care of their dynamicity. Yet, while this task is difficult for human it can be easily accomplished by the AI. Nowadays there are adaptive and intelligent learning systems in existence to deal with the issue of learning personalization (Slavuj et al. 2017). Also now such systems even allow for the dynamicity of ID (e.g., Lo et al. 2012). The improvement in this field is rocketing to the extent that now not only are such systems capable of emotion recognition (see Petrovica et al. 2017) but also they are capable of measuring complex and multifaceted internal variables such as motivation. For example, acknowledging the dynamic and sequential nature of motivation, and hence considering the impact of student's previous motivational state, Naghizadeh and Moradi (2015, May) proposed a model for motivation assessment in ITs based on the ARCS Model (Keller, 1987). To operationalize motivation in their proposed model, they assigned new roles to the main components of ITs; the most important issue being the allocation of a Motivation Assessment Unit to the student model. They concluded that to assess motivation in their proposed model they should use seven features of: task time, grade, task difficulty, student's interest in the subject, accordance between content presentation and student's learning style, skill level, and previous motivational state.

It can be argued that concerns for ID and individualization in the field of assessment have resulted in the development of DA (at least in part) and in the field of teaching in adaptive technology-assisted systems. Such systems when used for language teaching are the main concern of "Intelligent Computer Assisted Language Learning (ICALL) [which] is a field within … (CALL) that applies concepts, techniques, algorithms, and technologies from artificial intelligence to CALL" (Heift, 2017, p. 290). ICALL can provide the medium where DMs can grow. Of course, there is a catch.

As mentioned by Slavuj et al. (2017), adaptive "systems are mostly developed for well-defined domains that have a rather straightforward acquisition order, such as mathematics or computer programming … [and in case of] ill-defined domains [such as] [n]atural language learning … developing … [such] systems … is notoriously complex and challenging" (p. 64). While Slavuj et al. (2017) have attributed this difficulty "to the nature of language systems" (p. 64), it can be argued that this problem stems from other issues. Because first of all "the notion of an ill-defined domain is

vague … [and] there are no clear boundaries between ill-defined and well-defined domains. Rather, there is a continuum ranging from well-defined to ill-defined" (Fournier-Viger et al. 2010, p. 82), and second, "[with clarifying] the definition of an 'ill-defined domain,' … [we can] offer various solutions for building tutoring systems for these domains" (Fournier-Viger et al. 2010, p. 81).

So it can be argued that the failure of adaptive technology-assisted language teaching systems stems from the lack of a comprehensive definition of language. And since "[d]efinitions are theory-laden" (Zins, 2007, p. 488), the problem can be attributed to the atheoretical nature of language in such systems. Two leading theories in this regard are the CDST and ZPD.

CDST can be used to inform adaptive systems such as the Mocha project (Schulze, 2008). Also since corrective feedback (CF) provided in a graduated fashion can promote learning in a dialogically and collaboratively constructed ZPD (Aljaafreh & Lantolf, 1994), "ZPD can be created between the ICALL system and the learner by developing computer algorithms that provide graduated CF" (Ai, 2017, p. 316). Luckin and du Boulay (2016), for instance, have referred to the Ecolab, an Interactive Learning Environment, which is an implementation of the Vygotsky's ZPD. For developing DMs we need adaptive systems informed by both CDST and ZPD.

The next question raised is how we can allow for the coexistence of individualization and a method because individualization favors freedom but methods boundaries. Adaptive AI-based systems can enable us to allow for both the variability of ID and the boundaries of a method. In Garrett's (1991) words, in such an environment "[s]tudents can move through the material at their own pace and can repeat or sometimes skip segments of lessons according to their perception of their own need, *but the material contained in the lesson, the way it is presented, the analysis of the students' performance, is the same for all*" (p. 715, emphasis added). "[T]*he use of the computer does not constitute a method.* The computer is rather a medium or an environment in which a wide variety of *methods, approaches, or pedagogical philosophies may be implemented*" (Garrett, 1991, p. 698, the first emphasis in the original, the second added). It can, therefore, be argued that computers along with the AI can provide a medium for thriving DMs.

This need for method and technology integration, which is the backbone of DMs, can be instantiated by "technology-mediated TBLT" a framework developed for investigating how principles of task-based language teaching can be integrated into technology (González-Lloret & Ortega, 2014). Ironically, Kumaravadivelu's (2006b) three operating principles of particularity, practicality, and possibility, which shape his postmethod pedagogy can be met following such a framework (Motteram & Thomas, 2010).

So far, we saw that through integrating technology our methods can be *dynamic* (as conveyed by the ZPD and the first sense of dynamicity in CDST). The question raised is how this integration can make methods *dynamic* in the second sense of dynamicity in CDST.

The second sense of dynamicity in the CDST is based on the dynamicity of language. DMs can be dynamic in this sense through implementing open learner models (OLMs). OLMs "are learner models that can be viewed or accessed in some way by the learner, or by other users (e.g. teachers, peers, parents)" (Bull & Kay, 2010, p. 301). In such modeling "learners can *inspect*, *discuss* and *alter* the learner model that has been jointly constructed by themselves and the system" (Dimitrova & Brna, 2016, p. 332, emphasis in the original). Using OLMs is in line with dynamic views of language which "view language as a dynamic system that is constantly being transformed through use" (Larsen-Freeman, 2018, p. 58). It allows for a "dynamic model of performance … which relates individual use to systemic change" (Larsen-Freeman, 1997, p. 149). Because teaching here is not static rather it is malleable by "interaction between the teacher, the learners, and the instructional tasks and activities over time" (in line with Richards, 1990, p. 37); a malleability which will result in synchronic and eventually diachronic changes in language. Also, ironically, following OLMs we can have dynamic *methods* that, contrary to Prabhu's claim (Pang, 2019; Prabhu, 1990) allow for a teacher's sense of plausibility. Because utilizing *editable* OLMs allows not only learners, but also teachers, or others to change or edit the contents (Bull & Kay, 2010)[6]. Therefore, in such a context, teachers can have their say and teaching will no longer become what Prabhu considers "more or less an occupational routine" (Pang, 2019, p. 355). Following OLMs we see a movement away from ITs to Intelligent mentoring (or mentor-like ITs) which is reminiscent of the shift from teacher-centered to learner-centered approaches, and from perennialism to progressivism.

The next question is where methods reside in such systems. According to Matthews (1993), we can conceive of an ICALL system in terms of the classical ITs architecture composed of the *Expert module* containing the knowledge that is to be tutored, the *Student module*[7] consisting of a model of what the student knows about that domain (in addition to relevant details such as learning preferences) and the *Tutor module* determining what should be taught and how. So methods *mostly* could reside in the Tutor module. Decisions such as the purpose of learning, the type of syllabus, teachers' and students' roles, etc. (see Larsen-Freeman & Anderson, 2011) can be made in this domain. Although it does not mean that other modules should be method-less. Rather they should be in line with the utilized method, e.g., "different [learner] modeling techniques correspond to different approaches in SLA" (Schulze, 2008, p. 149).

True, learning a language requires AI facilities more advanced than ITs. But DMs have a promising future because unlike ITs "which often focus on a subset of learner errors and/or restrict learner input to the sentence level … spell checkers, grammar checkers, and systems for automatic essay scoring evaluate L2 learners' production of entire texts" (Heift, 2017, p. 290). So soon we will see AI-based DMs advanced enough for teaching the whole language. Individualized and dynamic teaching and assessment, the provision of continuous diagnostic feedback, and the

consideration of myriad variables simultaneously are some of the advantages of the future DMs. Moreover, since these methods utilize OLMs "they can help raise awareness of knowledge, prompting metacognitive activities such as reflection, self-evaluation and planning" (Bull et al. 2008, p. 62). What makes such DMs even more significant is that since they provide individualized teaching and assessment, they espouse egalitarian philosophy, and they are in accord with principles of democratization of education, and consequently, more humanistic.

VII. Conclusion

Ever since the advent of postmethod, language teaching methods development has been on the wane. Being an influential movement, postmethod has deterred methods development by inculcating those involved in language teaching with a view to see staticity as the only possible connotation of the term method. Consequently, refuting "a static view of teaching" (Richards, 1990, p. 37), postmethod advocates consider the continuation of methodism as being futile. To them it is only the concept of method which should be to blame and abandoned. As another solution, however, this study has investigated the possibility of maintaining methods but making them dynamic[8].

Postmethod has nipped the idea of such methods in the bud. Analogically speaking, it can be argued that, following Foucault (1977), postmethodism has created a panopticism where those willing to develop new methods, though not necessarily consciously aware, constantly find themselves under surveillance to make sure they won't trespass the law of the futility of methods quest. Attaching "futility" and "awakening" (Kumaravadivelu, 2006a, p. 76) labels to this quest and the era terminating it respectively, especially by members of the elite, has intensified this deterrent force. Of course, it should be noted that this study is trying to present evidence about the inevitability of the elevation of methodism from staticity to dynamicity, and not rejecting all postmethodism's valuable awakenings. Postmethod brought us awakening when language teaching was dominated by static methods and teachers were more powerful to control numerous variables and they could "overcome limitations posed by methods-based pedagogy" (Burke, 2007, p. 442). But in the future, dynamic AI-based methods can help teachers to take control of many variables simultaneously. And this help should not necessarily be considered as depowering teachers, rather if like McLuhan (1994) we consider technology as 'the extensions of man', then dynamic AI-based methods are empowering teachers. Recall that computers did not depower librarians, engineers, physicians, or teachers. Used correctly, AI will not either.

The innovative "designer methods" of the 19th century were based on learning theories (Richards & Rodgers, 2014, p. 383). Yet what distinguishes these methods from future DMs is that while the former were simply based on some *partial* or *general* learning theories, DMs will be based on *more scientifically-based* theories, or to look more optimistically, they will be based on learning facts. There are many theories which are now facts. Geocentrism and heliocentrism were both once theories, yet the advancement of knowledge rendered the former a myth and the latter a fact. The advancement of knowledge and technology can expedite theories' transitional phase from a theoretical to a factual state, or if we are not that much lucky, it can strengthen our theories by providing more pieces of evidence.

Technology can provide us with instruments for collecting such evidence. Various neuroimaging techniques, for instance, are providing us with new pieces of evidence every day; helping us to solve more pieces of the learning theory puzzle. Learning is not a product it is a *process*; it is not static it is *dynamic*. In the same vein, we can observe a growth of neuroimaging techniques from capturing *staticity* to *dynamicity*- a growth observed in the improvement of magnetic resonance imaging (MRI) scanners capturing *static* neuroimages to *functional* MRI (fMRI) scanners capturing *dynamic* images. Right now we have access to many *functional* neuroimaging techniques such as event-related potential, positron-emission tomography, magnetoencephalography, and fMRI (Hanson & Hanson, 2005) which can provide us with *dynamic* pieces of evidence to help us solve the *dynamic* theory of learning. "By adopting the tools of neuroscience, cognitive psychologists are now able to directly (or as directly as feasible) observe the brain *as it works* on various cognitive tasks" (Hanson & Hanson, 2005, p. 121, emphasis added). These technologically-rendered evidence provide us with more and more learning facts, expediting the transitional phase of our learning theories to a factual state to the extent that now "cognitive neuroscientists have come very close to looking inside the black box" (Hanson & Hanson, 2005, p. 121). Moreover, while fMRI "reveals changes in blood-oxygen levels in different parts of the brain, … [and] the data show nothing about what is actually happening in and between brain cells" (Venere, 2017, p. 1), new neuroimaging techniques can enable us to have access to microscopic fMRI of *individual* neurons; a goal now achieved through combining MRI and optical microscopy (Venere, 2017).

All these pieces of evidence, collected in an interdisciplinary fashion in this study, herald the rocketing development of more coherent language learning theories and the inevitability of a methodism resurgence. In the codex era we could not eradicate methods as they continued to survive lurking in textbooks (Akbari, 2008). In the same vein, upon taking our journey from "codex to hypertext"[9], methods still continue their survival, now lurking in cyberspaces. It is just the medium which has changed. And being a much more powerful medium, not only has this new medium not blurred the concept of method, but also it has deepened its roots even further.

While postmethod teachers, as decision-makers, play a focal role in language teaching, with teachers getting distant (Slavuj et al. 2017) in the digital era, the postmethod legacy won't be enduring anyway. The collected evidence in this study indicates the emergence of scientifically-based DMs developed interdisciplinarily. We are living in an era where "interdisciplinarity is both desirable and inevitable" (Chettiparamb, 2007, p. 1). The boundaries established between different disciplines were basically set to be used as mental scaffolding, yet they mostly remained there permanently.

Originally coined by Wood et al. (1976) and further developed by Bruner (1983), scaffolding "describes a system of *temporary* guidance offered to the learner by the teacher, jointly co-constructed, and then *removed* when the learner no longer needs it" (Boblett, 2012, p. 1, emphasis added). Yet this removal phase or the "handover principle", as Bruner (1983) calls it, has usually been neglected in many mono-disciplinary studies. Originally, we "imposed boundaries of knowledge … for better apprehension of the world, [yet it] has had the negative repercussion of forgetting their very hypothetical [and transient] nature" (Maftoon & Taie, 2016, p. 41). Interdisciplinarity helps us to see more vividly this hypothetical and transient nature of discipline boundaries and to dismantle them whenever we can. It helps us to see how language teaching is closely linked to other, apparently irrelevant, disciplines. Through it we can see a movement away from singularity to plurality, and from staticity to dynamicity. "We are heading towards an era where concepts are conferred with the metaphor of a 'living organism' to embody their complexity, dynamicity, and interconnectedness" (Maftoon & Taie, 2016, p. 48). The question which is raised is that by inculcating those involved in language teaching with a view to see staticity as the only possible connotation of the concept of method hasn't postmethod (notwithstanding many of its valuable awakenings) been ossifying our very dynamic nature.

NOTES

1. These examples are very important and have been selected carefully to exemplify a future information revolution. They sound like science fiction and the two latter are so complicated that they are difficult to define. Readers are kindly recommended to search some of the websites attempting to define them to develop an idea about their definition and significance.
2. The term 'dynamic' when referring to DMs in this study has two meanings. The first one is similar to the one conveyed by DA, i.e., it is based on the ZPD. And its second meaning stems from a dynamic view of language as proposed by the Complex Dynamic Systems Theory. In this category, dynamicity conveys a) simultaneous consideration of many Individual Differences, and b) allowing for synchronic and diachronic changes of language.
3. As told by Barry Smyth, a professor of computer science.
4. "Those systems used in SLA that contain parsers are referred to as Intelligent Tutoring Systems [ITs], or specimens of … (ICALL)" (Dodigovic, 2007, p. 100).
5. Of course, this issue was first raised by Akbari (2008).
6. For information on different levels of interactivity and control in such models see Bull and Kay (2010).
7. Another name for learner model
8. This article draws much of its inspiration from the seminal academic writings of Professor Larsen-Freeman, especially her influential writings on the dynamism of language and CDST, and from the seminal works of Professor Nick Ellis on emergentism.
9. This is also the name of a book written by Lang (2012).

ACKNOWLEDGEMENTS

No words can express my heartfelt gratitude to Professor Diane Larsen-Freeman for the precious time that she kindly spent on this article and for providing constructive feedback on its initial draft. I am also profoundly grateful to Professor Mahmood Reza Atai for his constant and valuable support and comments.

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