FOLIA ORIENTALIA
VOL. LIV — 2017

A r t i c l e s

Literature and Linguistics

Alexander Andrason
University of Stellenbosch

Against binarism, simplicity, neatness and stasis. A theoretical prolegomenon to the reality of verbal grams in Biblical Hebrew: From the complexity of semantic maps to the uncomplicatedness of psychological conceptualizations

Abstract

Developed within the frame of cognitive linguistics and cognitive science, the present paper argues that the wave-stream model is a more adequate manner of representing verbal grams in Biblical Hebrew than neat models built on discrete, binary and static categories. Taking as examples two Biblical Hebrew verbal grams (WAYYIQTOL and QATAL) and building on the empirical evidence concerning the senses conveyed by these two forms in the book of Genesis, the author demonstrates the following: a) Neat, binary, discrete and static models correspond to "folk" representations of reality; b) A more adequate representation, which preserves the complex nature of language and its components, is provided by the wave-stream model; c) The wave-stream model additionally suggests the psychological reality of the grams or their conceptualizations by speakers. As a result, the wave-stream model has both etic (language centric) and emic (psychological or human centric) dimensions, the latter being derived in a principled manner.

Keywords

Biblical Hebrew, verbal system, TAM, semantic maps, modeling, cognition.

1. Introduction

Developed within the frame of cognitive linguistics and cognitive science, the present paper argues that the complexity model of waves and streams (Andrason 2015, 2016a, 2016b, 2016c) is a more adequate manner of representing verbal grams in Biblical Hebrew (BH) than excessively neat models built on discrete, binary and static categories. It gives access both into the nature of the grammatical object as a part of a real-world complex system, and to its perception and psychological conceptualization by speakers.

The article will be organized in the following manner: First, in Section 2, I will introduce the issue of complexity of the real world and possible folk and scientific solutions to it. Next, in Section 3, I will discuss the complexity of Biblical Hebrew – taking as a case study two verbal grams, i.e. WAYYIQTOL and QATAL – as well as its treatment in folk and scientific models. In the final section, main conclusions will be drawn.

2. Reality and its representation

2.1. Complexity of reality

All real-world systems – any part of reality, including language[1] – are complex in the technical sense of complexity theory. They are open (they exchange material, energy and information with the environment), fuzzy (boundary-free), situated (highly environment-dependent), and unstable – as far as their individuality is concerned (a system constitutes a hierarchy of individuals).[2] They are also infinitely (or uncontrollably) cardinal with respect to their components and the relations that couple them. Complex systems are connected to everything, consisting of and contributing in some manner to any other element of the real world. Moreover, they are inherently dynamic and adaptive – they fluctuate and emerge in response to their own properties and the properties of other systems and parts of reality. This response is path-dependent and highly sensitive to initial conditions. In fact, the sensitivity is nonlinear, exponentially amplifiable and, at least in some regions, chaotic. Structurally, such systems are non-additive, non-modularizable, and irreducible. Rather, they are organizationally intricate – they exhibit emergent properties and are driven not only by bottom-up causation but also by top-bottom causation

[1] Language is viewed as an exemplary real-world complex system. Accordingly, it exhibits all the characteristics typical of realistic complex systems (Bastardas-Boada 1999, 2013a, 2013b, Massip-Bonet 2013, Munné 2013, Mufwene 2013, and Andrason 2016a).

[2] On the one hand, an individual may be a system of more microscopic individuals. On the other hand, it may be a component of another individual at a more macroscopic level.

(Cilliers 1998 and 2005, Hooker 2011a, 2011b, Bishop 2011, Cilliers et al. 2013, Andrason 2016a).[3]

The complexity of any real-world system is overwhelming. The components of real-world systems, their relations, dynamic configurations and organizational elaborateness are incalculable. In general, the total information included in any real-world complex system is infinite. Therefore, should the description of such a system be complete, the series that represent it would have to be infinite (Wagensberg 2007). As humans – both as laymen and scientists – we cannot deal with this complexity in its crude form. The solution is to simplify it to manageable dimensions and represent it in a manner that can be more easily assimilated. These representations are referred to as models.

2.2. Solutions to the complexity of reality

2.2.1. A folk solution to the complexity of reality

A popular solution to complexity – typical of humans – consists of constructing distorted folk models of reality. I will explain this by taking as an example our perception, the most evident and easily comprehensible manner of interacting with complex reality.[4]

Despite our intuition, we do not perceive reality as it is. Not even as it is presented to us by our eyes. Reality is nothing more than a model – it is a neuronal map reconstructed in our brain. Neurons receive the information from different sensory systems (in this case, a visual system) and build a simulation of the external world. This simulation is the only reality we can interact with. We do not see reality as it is – we see a film played to us by our neurons (Macnick & Martinez-Conde 2010, Martinez-Conde 2012, Macnick 2012).

When reconstructing reality in the brain, neurons distort it. The distortion principally stems from a limited (albeit immense) number of neurons that must cope with nearly unlimited reality. Being, in a manner, scarce and overused, neurons take shortcuts when reconstructing the external world – they create an illusionary image of the world.[5] This phenomenon is referred to as neural deception, i.e. a subjective perception that does not match the real world. Surprisingly, most of what we perceive is, at least partially, illusory (Martinez-Conde 2012).

There are three main types of shortcuts that occur when neurons (re) construct our visual experience of the world:

a) Neurons add information that is not there (i.e. we see things that do not exist);

---

[3] For a detailed explanation of the properties of complex systems see Andrason (2016a).

[4] The discussion in this section draws from Macnick & Martinez-Conde (2010) and Martinez-Conde (2012).

[5] Distortions also have their roots in the fact that neurons mix the input information received from sensory systems with our cognition and experiences.

b) Neurons remove information that is there (we do not see things that exist);
c) Neurons improve the information received (we see things in a different manner, usually more regular or ordered, than they realistically).[6]

I will illustrate these three mechanisms by three well-known visual illusions. The most evident example of adding new information as far as perception is concerned, is the phenomenon of a blind spot. If one considers Figure 1, closes his or her left eye and looks with the right eye on the black circle, the grey circle will be substituted by the black line. That is, the black line will become continuous and uninterrupted. This happens because of the blind spot in the retina and the filling-in phenomenon. The blind spot is a field where the eye lacks photoreceptors such that no part of reality that falls on this area can be detected. In other words, there is always a fragment of reality that is missing in our vision. As neurons receive information with an unexpected gap, they "assume" that the image must be coherent, i.e. uninterrupted. Therefore, they take the properties of the surrounding areas (e.g. color and texture) and use it to reconstruct the part of reality physically invisible. During this reconstruction, they add new information, which in this case is incorrect.[7]

Figure 1. Blind-spot illusion

An example of removing information extant in reality is the phenomenon of an out-of-focus image.[8] If we look at the center of such an image for a period of thirty seconds, the image fades out and what we perceive is the accompanying background, e.g. the white color of the surrounding page. This happens because the neurons treat the colors that are out of focus as noise or random disturbances, common for instance in extremely bright sunlight. Thus, even though our vision relays correct information to us, neurons do not "believe" it and, as a result, eliminate the objects that exist in reality.

---

[6] The three mechanisms apply not only to perception but also to all the other manners of interacting with the external world.

[7] An example of cognitive filling (not only visual) is the so-called Guardini and Gamberini's illusion. In this image, six lines and three packmen are understood as limited information and reinterpreted as two tringles or pyramids. In other words, angled lines and notched circles make our brain think that some information is missing and therefore should be restored, even though it has never been there. By filling in blanks, the brain creates a picture that is more complex that it is in reality (Martinez-Conde 2012; for a visual demonstration of this illusion, see www.colorcube.com /illusions /triangles.htm).

[8] For an example of an out-of-focus image, consult www.moillusions.com/disappearing-optical-illusion.

The healing grid illusion illustrates the phenomenon of improving information received by neurons. Improving means that by seeking structure and patterns in the external world, our neurons impose order on parts of reality that are not completely regular. If one looks at the center of a healing grid image for thirty seconds, the grid that is irregular in the peripheral areas (e.g. in the right and left sides of the image) becomes perfectly regular.[9] One should note that in healing grids, more than 70% of the grid is usually not regular. This means that our neurons impose the order of the less than 30% of the grid – placed in the center of the picture – over the remaining irregular areas. As a result, the (quantitatively dominant) irregularity is reshaped in accordance to the (quantitatively smaller) regular pattern.[10]

The three mechanisms discussed above are arguably governed by a single principle – we seek to make sense of the world. We assume that reality is coherent, regular, and with no random elements involved. As we expect reality to behave in that manner, our neurons feed us with a less inconsistent, less disordered, and less random version of what they receive. *This however does not imply that reality itself is as our neurons make us believe it to be*. Irrespective of what types of maps our neurons reconstruct for us in our cortex, reality remains what it is. No matter how the neuronal map distorts the external world, by adding, removing and improving information, the external world does not permute. Whatever we perceive, the actual object of perception remains the same – the grey point in Figure 1 exists, the diffused colors in the out-of-focus image exist, and the irregularities in the healing-grid image exist.

The acknowledgment of processes that lead to the misrepresentation of reality is crucial. The knowledge about them not only gives us insight into the psychology of human interaction with reality (i.e. how humans comprehend the external world), but also enables us to (re)discover what the unaltered reality may be. That is, by being aware of inevitable distortions, and by understanding what mechanisms underlie them (i.e. how the information is transformed from sensorial inputs into neuronal maps), we can reconstruct a more adequate image of reality, even though the neuronal map is itself inaccurate. In this manner, we can minimize the damage caused by our neurons constantly altering the external world. The fictitious matrix can, to an extent, be controlled, so that we

[9] For an example of a healing-grid image visit http://www.illusionspoint.com/visual-optical-illusions/healing-grid-illusion.

[10] The mechanism of correcting reality is extremely common, being especially evident in the phenomenon of "improving narratives". This phenomenon is highly pervasive in our lives and leads to choice blindness. Choice blindness means that we are "blind" to our own decisions. In particular, in order to make sense of the world and maintain its order, we improve the narrative of our own experience (Martinez-Conde 2012). Choice blindness demonstrates how neurons manipulate the perception of our own choices making us believe that we choose what we actually did not (on choice blindness, see Johansson et al. 2014).

may approximately guess which properties are real and which are non-real. As a result, knowing what humans (or their neurons) do with the external world, we can better understand ourselves and the reality in which we exist.

2.2.2. A modern scientific solution to the complexity of reality

Folk models are typical of humans. They are in fact necessary for human existence, having possibly played an important role in our evolution. However, science cannot rely on them nor can it take them for trustful and adequate representations of reality. The necessity of simplifications and distortions to our survival, and the persistence of neuronal and cognitive deception in humans and animals, do not imply that the external world is identical to what we perceive. In general, folk models are overly simplistic and excessively distort reality. They are also to a degree unconscious – that is, distortion occurs at a neural level without our deliberate participation. Science must develop its own models, which would be less simplistic and less distorted. In cases where the simplifications and distortions are unavoidable, these must be consciously controlled.

In the 19th and 20th century, science mainly dealt with simplicity. It either envisaged problems that involved a few variables or sought to represent real-world systems with simple and a-temporal formulas. The ideal of simple and a-temporal (reversible) models was typical of modernism and structuralism in all their facets. However, while looking for simplicity and invariability, scientists gradually realized that the universe is infinitively complex and necessarily temporal (Prigogine 2009: 156). In the second half of the 20th century, scholars became increasingly interested in problems that comprised of hundreds or thousands of variables, and commenced to deal with organized and disorganized complexities (see already Weaver 1947: 154). This triggered a genuine transformation of science in last decades of the 20th century, reversing its classical paradigm. It is complex, dynamic and irreversible systems that are seen as natural, rightfully receiving the attention of researchers (Hooker 2011a: 5–6 and 2011b: 864–865). In contrast, simple and reversible formulas and models became synonymous to artificiality and exceptions (Wagensberg 2007, Prigogine 2009: 175, Hooker 2011a: 64–67, 2011b: 862–863).

Dealing with complexities of various types, scholars realized that these could not be approached with modernistic methods. Such modernistic methods emphasize what is common and a-temporal (static). They ignore the diversity of data, their situatedness and dynamics – by doing this, they drastically simplify and immobilize the universe. Neat and excessively regular models with a few discrete and static components, and a handful of relations that connect them, were inoperative for realistic systems. A new class of models had to be developed – complexity models, which in contrast to non-complex models focus on variability of data and their specific environmental dynamics (Hooker 2011b: 864). This means that complex models are specifically designed to deal with dynamic systems compounded of a large or infinite number of closely interconnected variables. Since the mid-20th century, these models have proliferated, proving their utility in natural and social sciences, including linguistics (Hooker 2011c).[11] Overall, complex models of real world systems have bestowed scholars with the possibility of comprehending reality without negating its inherent complexity and dynamics, and without reducing it to a system of a few static components or relations.

In general terms, complex models preserve all or, at least, most properties typical of complex systems. They are dynamic even though they concern the state of a system at a precise point in time. They operate both at a composite macro-scale and at a micro-scale – they respectively solve for the behavior of the system as a whole and for the behavior of a large (or even infinite) number of constituents, coupling them one to another. They make explicit reference to the situatedness and openness of modelled systems. They build on extreme cardinality both with respect to constituents and relations. They analyze such relations in terms of non-linearity and path-dependence. By giving access to multiple scales of analysis, they demonstrate the individual instability of the system's components, as well as their categorial fuzziness. Furthermore, they are characterized by two types of causation flow: bottom-up causation and top-down causation.[12] This allows for emergent traits to appear and be explained (for a comprehensive exposition of complex models consult Auyang 1998, Hooker 2011b, Andrason 2016a). There are three types of complex models that are currently common in science: many-body models, organic models and cybernetic models (Auyang 1998). The key word in all of them is: dynamic network.

There is no minimal threshold of complexity for a model to be called complex. Generally, the accessibility of complex models to the complexity of reality may vary. Models can range from more resultant, isolated, settled for equilibrium, with fixed boundaries or external world relegated to exogenous parameters, and with endogenous variables externalized or regarded as given and fixed, to more emergent, open, relational, fine-grained (more precise), endogenous and dynamic (Andrason 2016a). The more properties that are exemplary of realistic complex systems, a given complex model is able to preserve – being at the same manageable and transparent enough – the "better" it is (Andrason 2016a, cf. Hooker 2011b and 2011c: 864, Cilliers et al. 2013).[13]

---

[11] For application of complexity models in various branches of science see Auyang (1998), Lewin (2002), Kaufmann (2000), Prigogine (2009) and Schneider & Sagan (2009) and Hooker (2011a) and (2011c).

[12] The former ascends from micro-levels to macro-levels as atomic components combine and condition the behavior of more complex entities and, then, the global system. The latter operates downwards from macro-levels to micro-levels whereby the holistic system and its more complex compositions condition the properties of atomic elements.

[13] In all such cases, rather than being dictated by the system itself, the exact shape of a representation (e.g. the determination of the limits of the model and the extent of its complexity)

Although complex models offer a manner of representing reality by acknowledging its inherent complexity, they are not flawless. In order to make sense of the external world, they must alter it through removing, adding and improving captured information. Like human neurons cannot conceive reality as it is, complex models are incapable of analyzing the world in its total and crude complexity (Auyang 1998: 321). Even the most complex models of complexity are not reality but rather manners of harnessing reality – they only approximate it to a certain degree (Auyang 1998: 69, 341). Similar to any other empirical model, all complex models control the overwhelming complexity of reality by necessarily making it simpler and by decreasing the system's entropy (Auyang 1998: 321). The system becomes abstract, idealized and fictionalized, and therefore conceptually manageable (Auyang 1998: 70, 341, 344).[14]

Even though there is no escape from at least partial distortion, complex models falsify reality to a much lesser extent than traditional models; their idealization and fictionalization are conscious, and can be to a great extent counterbalanced. That is, both idealization and fictionalization can be controlled if the results yielded by the complex models are de-idealized and de-fictionalized once these models are applied to reality (Smith 1998: 127). Even though the input

---

is conditioned by the observer's position and model constructor's objectives (e.g. the aimed statistical treatment, generalizations to be discovered and the required precision in controlling causal factors in the system). As a result, each complex system can be mapped onto many complex models. Each such model unveils different macro-truths and their relation to micro-states, solves for distinct fragments of the target real-world system, and distinguishes diverse patters and facets of its organizational structures (Auyang 1998, Prigogine 2009, Hooker 2011a, 2011b, Cilliers et al. 2013, Andrason 2016a).

[14] There are various types of idealizations, of which the most common seem to be the following. In complex models, the system cannot be totally open. The system that is modelled must be isolated from some part of reality, which is then treated as random noise. The system's boundaries must be established (Auyung 1998: 61, 69, 321). Complex models are not complete. They cannot explore the entire system that is being modelled and their descriptive series cannot be infinite (Auyung 1998: 68). All the relation and variables cannot be made endogenous. Some must be fixed and externalized as exodonous parameters. The influence of the rest of reality that has been isolated from the modelled system is packaged in such exogenous parameters and viewed as unaffected by the dynamics of the system (Auyang 1998: 61). All the aspects of the modelled system and especially all its details cannot be preserved. Many (if not most of them) must be ignored as the model focuses on most essential and relevant features and their coherence (it should be recalled that the relevance is tied to the model itself and not to the realistic system that is being modelled). The model principally concerns macro-variables, macro-relations, macro-patterns and most relevant causal factors. In a complexity model, the system must also be divided into relatively autonomous modules of "weakly interacting individualized parts" (Auyung 1998: 341) thus yielding, at least, some properties that are resultant. Furthermore, not all the features of the modelled system can be dynamic. Some parts are static and various models in fact settle for equilibrium (Auyang 1998: 342). Lastly, as any empirical model, complex models fictionalize by having "surplus content". That is, they employ precise real numbers to represent quantities that are coarse-grained, imprecise and fuzzy (Smith 1998: 127). This, in turn, yields solutions that are overspecified and unrealistic.

over-precision, assumed rounding and abstractions are fictional, the model can be relatively realistic if it is fuzzified once the solution is obtained. The fuzzification counterbalances the idealized model and renders it credible. In contrast, the idealizations, simplifications and falsifications presented by non-complex models of complexity are dangerous because they distort reality to a point where reality does not resemble what it is – a complex dynamic system. At this distortion level, any fuzzification is futile because the breach between the model and the modelled system becomes impossible to overcome.

3. The Biblical Hebrew language system and its representation

As any language, Biblical Hebrew is (or was) a real-world complex system. It is impossible to discuss its entire complexity, especially in an academic paper. Therefore, I will illustrate the phenomenon of complexity – and solutions to it proposed in models – on an example of two verbal grams, WAYYIQTOL and QATAL, and their semantics.

3.1. Complexity of language

The complexity of WAYYIQTOL and QATAL (and the complexity of their relationship) is a well-known fact that has given rise to multiple interpretations, translation options and systemic explanations (for a comprehensive review, see Andrason 2016b). This complexity is clearly visible at an empirical micro-level, where one is exposed to an array of senses the two grams may express (or the contexts in which they may be found) and the frequency with which it is done so. To be exact, previous studies (Andrason & van der Merwe 2015, Andrason 2016b) demonstrated that at this micro-scale of analysis, the semantic behavior of WAYYIQTOL and QATAL is highly complicated.[15] Each form can convey many senses, sometimes of a highly dissimilar semantic character and intricate frequency pattern (or distribution). The qualitative and quantitative composition of the semantic potential of the two grams is further complicated by the parameter of a text type. That is, both qualitative and quantitative values vary depending whether they are analyzed for the holistic grams, or separately in narrative, discourse, and narrative discourse and comment. Table 1 summarizes this semantic behavior of WAYYIQTOL and QATAL.[16]

[15] These studies analyzed the semantic properties of WAYYIQTOL and QATAL in the book of Genesis.

[16] The data in Table 1 are reproduced from Andrason & van der Merwe (2015) and Andrason (2016b). For the definitions of the semantic categories used in this table, consult these two publications.

Table 1. Semantic potential of WAYYIQTOL and QATAL[17]

	Discourse		Narrative		Narrative discourse and comment		Total	
	WAY	QAT	WAY	QAT	WAY	QAT	WAY	QAT
Perfect[a]	82	73.1	0	0	46	21.6	3.6	36
Pluperfect	0	1.9	0.5	35.9	0	21.6	0.4	18.9
Perfective past	6	3.7	93.5	48.3	51	45.9	89.7	26.7
Present[b]	6	12	0	0	0	0	0.15	5.7
Performative	2	4	0	0	0	0	0.05	1.9
Future	0	2.3[c]	0	0	0	0	0	1.1
Modal	2	1.7	0	0	0	1.3	0.05	0.9
Non-perfective past	2	0.9	6	15.4	3	9.4	6	8.2
Gnomic	0	0	0	0.2	0	0	0	0.1

[a] In this paper, for the sake of simplicity, the various types of perfects (inclusive, resultative and experiential present perfects, as well as indefinite perfect) are grouped into a single category.

[b] The category of a present has been simplified and includes the following subcategories: resultative stative present, stative present and simple present.

[c] The class of a future contains two more specific senses: future perfect and simple future. In the case of QATAL, the former constitutes 1.2% in discourse and 0.6% in all text types jointly. The latter, amounts to 1.1% in discourse and 0.5% for all types of texts.

It is evident that at this relatively fragmentized, empirical micro-level, both the individual complexity of WAYYIQTOL and QATAL and the complexity of their mutual relationship are impressive. In fact, the two types of complexity are unmistakable, even though the real world has already been idealized and fictionalized to an important degree: a) the meaning of the WAYYIQTOL and QATAL grams have been packaged into preconceived categories (i.e. senses that,

[17] According to Andrason (2016b), there are no examples of a resultative proper sense. However, as demonstrated by the data from Samuel 2, this sense may constitute up to 3% of all occurrences of QATAL (cf. Andrason 2015). In fact, in my earlier analysis of Genesis, I might have analyzed some resultative proper senses as resultative perfects. Therefore, in the following discussion, I will *estimate* that at the most global level the perfect values ascend to 33% while the resultative proper sense approximates 3%. It should also be noted that the overall frequency of the three classes of text types is not identical in the two grams. That is, 94,5% of WAYYIQTOL forms appear in narrative while only 2.5% in discourse, and 3.2% in narrative discourse and comment. For QATAL, 48% of its uses are found in discourse, 47.5% in narrative, and 4,4% in narrative discourse and comment (Andrason 2016b).

albeit not identical, have been regarded as members of the same class and thus undistinguishable); b) the grams have been isolated from all the remaining parts of the verbal system and the BH language; and c) their semantic behaviors have been disconnected from other factors that also play an important role in meaning (e.g. syntax, information structure, root morphology, etc.).[18] If one wants to include other parameters and variables, the complexity of WAYYIQTOL and QATAL becomes overwhelming and almost untreatable.[19]

A further aspect that renders the complexity of WAYYIQTOL and QATAL even more intricate is that both grams are necessarily dynamic. In other words, as any real-world complex system, Biblical Hebrew and thus the framed systems of WAYYIQTOL and QATAL are inherently temporal at a synchronic level of analysis. That is, even if one considers the corpus underlying the empirical study as representing a precise point in time (which can in fact be easily challenged), the WAYYIQTOL-QATAL system must have been governed by some evolutionary rules, in the same way as any today's newspaper reflects developmental principles operating in the language in which it is written. These dynamics underlying the two grams further increase their complex nature.

3.2. Solutions to the complexity of language

3.2.1. A folk solution to the complexity of language

Speakers solve the complexity of grammatical forms, such as WAYYIQTOL and QATAL, by applying the cognitive mechanisms discussed in the Section 3.1.1. These mechanisms give rise to folk conceptualizations of grams. First, speakers remove information that is there – they ignore cases that invalidate the rule, especially those that are subject to highly specific and limited contexts and those that belong to domains perceived as incompatible with the value associated with the form. Second, speakers add information that is not there – they rationalize exceptions by manipulating them so that they look as if they were quasi-normal (in other words, they seek to derive them conceptually from the value associated with the form). Third, speakers improve the information received from the external world – they seek perfect regularity, inventing systems of binary oppositions and crisp discreet boundaries and categories. Furthermore, they pursue stasis and conceptualize a form as an object in equilibrium, i.e.

[18] The ignored material is not irrelevant. However, as any complex model of a real-world system, the complex model of the BH verbal system must idealize. The absolutely inevitable type of idealization is framing. In our case, the analysis has been framed to pure semantics and to a set of preconceived categories. For the rationale of the categorization and framing mechanisms adopted in the empirical studies from which the evidence is drawn, see Andrason & van der Merwe (2015) and Andrason (2016b).

[19] Of course, there are many other well-known weaknesses of such an elementary empirical picture, if it is limited to a purely descriptive and taxonomical level of analysis.

as an invariable individual. As a result, speakers formulate and operate with excessively neat models of discrete, binary and static categories.

These cognitive phenomena are pervasive in all languages as speakers try to make sense of the linguistic world in which they live. For instance, in Polish, all the informants interviewed by me, defined the gram of the type *zrobił* (the prefixed L-gram) as a perfective (completed) past and located it in opposition to the type *robił* (the non-prefixed L-gram) viewed as an imperfective (non-completed) past. When asked if the prefixed L-gram could convey the sense of futurity or refer to actions that should or must happen in future, all the informants responded that such a use was impossible. Furthermore, when asked if the non-prefixed L-gram could express perfective (completed) events, and thus fail to be opposed to the prefixed L-gram, all of them argued that this was likewise impossible. Of course, the prefixed L-gram can be used in a non-past time frame, for instance to express future obligation (*Zrobił mi to jutro!* 'You must do it for me tomorrow!'), and the non-prefixed L-gram may sometimes convey a past perfective (completed) sense, being used instead of the prefixed-L gram (*Widziałem już cały ten film dziesięć lat temu* 'I saw this entire movie already ten years ago'). Similar simplifications are found among Xhosa speakers (Nguni, Bantu; Andrason & Matutu forthcoming).[20]

[20] When exposed to these facts, speakers immediately try to make sense of such inconsistencies, seeking a possible conceptual connection between the uses judged as irregular and the value associated with the form. These explanations have little to do with linguistic reality but help the speakers to defend their folk model of the language and preserve its neatness, discreteness and binarism. This behavior resembles the phenomenon of self-deception (keeping truth from your conscious mind; Trivers 2011) a common response to cognitive dissonance (discomfort when two cognitions contradict each other; Tavris & Aronson 2007: 13–14, Cooper 2007, Wade & Tavris 2012: 235–237). Self-deception is a general and largely unconscious feature of our lives. As we want to maintain our system of beliefs or opinions (in this case, our psychological model of a verbal gram), we typically dismiss the evidence presented to us. We rather formulate additional rules (explanations) to hold that system intact. Dissonance is uncomfortable and we want to reduce it (Tavris & Aronson 2007). We have two options: either to correct our view by accepting its shortcomings and modifying our cognition at the end, or to expand on post-facto justifications and dismiss the evidence. In folk solutions to reality, the latter option is by far more frequent (for details see Tavris & Aronson 2007, Cooper 2007, Wade & Tavris 2012, and Trivers 2011).
My own experience provides a highly instructive example of cognitive dissonance and self-deception. During a talk I delivered at Stellenbosch University in 2014, a professor argued against my paper. When confronted with empirical data concerning the uses of a gram in his mother tongue and their cognitive reality, which exposed the inadequacy of his model, rather than accept it, he dismissed the evidence and concluded: "This explanation (i.e. the folk explanation defended by him) works for me!". Indeed, each human being daily operates with folk models that work for him or her. These models do not necessitate being validated by others. They do not even have to comply with reality. It is sufficient if they satisfy the author of the model. While the mechanism of self-deception is typical of an individual and possibly necessary to his or her self-coherence, it has little or no use in the scientific enterprise. Dictators and serial killers sleep peacefully because they can rationalize their acts in a manner that calms their conscience. This, however, does not mean that their acts are good (Tavris & Aronson 2007: 9).

Certainly we do not have access to the speakers of Biblical Hebrew and cannot verify how they conceptualized WAYYIQTOL and QATAL. However, given the mechanisms operating during the psychological structuration of grammar, it is highly plausible that BH speakers might have conceptualized these grams as discrete and static objects contrasted with each other by means of a neat and binary opposition. As will be argued further below, WAYYIQTOL was likely conceptualized as a narrative perfective past gram, while QATAL was associated with the category of a perfect (present and past perfect) and a discursive (typical of dialogues) perfective past (cf. Andrason & van der Merwe 2015).[21]

Folk solutions to the problem of complexity should be acknowledged because language is creatively manipulated by speakers. Therefore, their perception of linguistic reality and the emic dimension of language that emerges from it play a relevant role in language use and language development. However, beside the emic dimension, language has another dimension. This dimension, referred to as etic, is unaffected by the speakers' psychological conceptualizations. In this dimension, language is an external physical-sociological object that can been accessed empirically and objectively in nature – it is a system that emerges from linguistic production.

Like the real world is not what neurons reconstruct in the human cortex, the language we speak is not identical to what we think about it. The emic model, which speakers actively reconstruct in their mind, does not match the etic reality. Indeed, even though neat, discrete, binary and static models may suggest the speakers' psychological conceptualization of verbal grams, they are not satisfactory models of reality. Therefore, they should not constitute the aim of science. In a manner analogous to human perception and neural deception typical of it, such models add, remove and improve information that exists in reality to an excessive extent. While such manipulations and simplifications are regular of humans – being, in fact, necessary to their existence – they should be minimized in scientific representations of reality.

Unfortunately, most descriptions of the BH verbal system have been developed in a manner profoundly resembling folk models; namely, seeking excessive neatness, discreteness, binarism and stasis. In these models, scholars define WAYYIQTOL and QATAL in manners analogous to folk conceptualizations, i.e. as discrete categories (typically formulated in terms of an invariant or meta/abstract meaning), definable by neat short descriptive series (i.e. as a type of aspect or tense), located in opposition to another form (usually WAYYIQTOL and

---

As noted by Tavris & Aronson (2007: 42), "dissonance theory is a theory of blind spots" – in both cases, parts of reality become invisible to us.

[21] For a further, more principled, discussion of the psychological conceptualization of WAYYIQTOL and QATAL see Section 3.2.2.

QATAL have been viewed as aspectually, temporally or syntactically opposed) and in equilibrium (even though dynamics are recognized from a diachronic perspective they are regularly ignored at a synchronic level). This gives rise to an almost eternal (and futile) debate in BH studies whether WAYYIQTOL and QATAL are tenses, aspects, taxis expressions, and whether, and how, they are opposed to each other (for a comprehensive and critical review of this debate see Andrason 2016b: 1–11).[22] Recently, this type of analysis has been advocated by Korchin (2008, 2015) who explicitly defends binarism and thus neatness and discreteness.[23] Korchin (2015: 6) argues that binarism offers "productive descriptive analyses of language" because it (i.e. binarism) may serve as an explanation "for language origins and usage". The importance of binarism in human evolution and existence is unmistakable, as is the relevance of the three mechanisms in perceiving and reinterpreting reality explained in Section 3.1.1 (i.e. of eliminating, adding and improving information). A range of simplifications are necessary to us (and to, probably, any other living creature) to successfully operate in the world and ultimately to survive. This however, does not mean that an oversimplified model of reality is reality. In other words, reality remains unaffected by the fact that various simplifications (e.g. neatness, discreteness, binarism and stasis) are typical of humans and their conceptualization of reality. Whatever the degree of simplification human conceptualization operates with, reality is what it is – complex and dynamic.

To conclude, linguistic models developed within a frame of neatness, discreteness and binarism as well as those settled for rigid equilibrium simplify reality to such a degree that the modelled language system ceases to be what it is – a real-world complex dynamic system. The modelled system rather becomes unrealistic caricature of the phenomenon it depicts. As explained above, this is fully acceptable in folk models spontaneously formulated by speakers. However, it cannot be accepted in science.

3.2.2. A modern scientific solution to the complexity of language

The model that preserves the complexity of WAYYIQTOL and QATAL to the highest degree – while still being conceptually or operationally manageable – is the model of waves and streams (Andrason 2015, 2016a, 2016b, 2016c, Andrason & Locatell 2016). In this model, grams are defined as dynamic two-dimensional (qualitative and quantitative) networked waves propagating along streams that lead across semantic domains available crosslinguistically. As this representation respects the complex dynamic nature of verbal grams, and enables

[22] Certainly, such neat, binary and discrete models can be useful for pedagogical purposes as second language learners (especially beginners) operate with folk models.

[23] Although Korchin (2015) recognizes the relevance of diachrony in language even at a synchronic level of analysis, he does not overly incorporate evolutionary dynamics to his synchronic model.

one to recover all the properties typical of complex systems, it offers a more adequate manner of representing linguistic reality. In general terms, in this model, WAYYIQTOL and QATAL are defined as a pair of two-dimensional networks or waves spreading along the anterior stream;[24] WAYYIQTOL is a more advanced wave, while QATAL is a less advanced wave (Andrason 2015, 2016b).

The wave-stream model builds on advances in cognitive linguistics (for a recent summary of these advances consult Janda 2015), also drawing from the progress in linguistic typology and grammaticalization theory. The core concept is a dynamic semantic network (better known by the term 'map'). The map is a cognitively plausible network of senses (or properties) exhibited by a form at a given point in time. The coherence of this network is granted by a diachronic path along which the gram has been evolving and which shows the conceptual relation between components of the map. Even though all the recorded senses are possible synchronically, each sense of a gram corresponds to a distinct stage where the possibility to employ that particular sense was granted. Thus, the conceptual coherence of the semantics of a form treated in its totality lies in the path, even though this path (and thus this type of coherence) may be unrecoverable for speakers synchronically. The network is directional and inherently dynamic, forming a grid of vectors (cf. Haspelmath 2003, Andrason 2010, 2016a, 2016c, Janda 2015). Additionally, each sense of the network is correlated with a degree of its prototypicality. Prototypicality is a complex concept and can be measured by combining (or computing) several values. Nevertheless, in corpus studies, the most evident indicator of prototypicality is frequency.[25] If the qualitative network is imagined as being organized along horizontal x axes, the values of prototypicality can be represented on the vertical y axis. Accordingly, the flat network can be raised as far as the degree of prototypicality allows for it. If the network is simplified to a vector (or if only a fragment of a network is analyzed), the dynamic surface that is elevated in more prototypical regions adopts the shape of a wave (Andrason 2016a, 2016c).[26]

Given the composition of its semantic potential, WAYYIQTOL has been mapped by means of the anterior path[27] and a few other paths related to that

[24] For the explanation of the terms 'anterior' and 'stream' see further below.

[25] Frequency is only one parameter. Other important features are productivity and saliency. Moreover, frequency can be crude (total) or nuanced (analyzed separately in different linguistic, sociological or literary contexts).

[26] The direction of the wave stems from the direction of the path(s) along which the semantic network is organized.

[27] The anterior path is an evolutionary template whereby the sense of a resultative proper gives rise to a set of perfectal values (inclusive, resultative, experiential and indefinite present perfect), which in turn trigger the use of a gram with the meaning of a past tense, first the perfective and later non-perfective.

evolutionary template (Andrason 2015, 2016b).[28] If only the most common values are taken into consideration, the complex network can be simplified to a vector based exclusively on the anterior path. The evidence shows that the gram spans almost the entire length of this evolutionary pattern, offering senses of a perfect (taxis), perfective past, and non-perfective past. In contrast, the resultative proper sense seems to be absent. The contribution of the components of the semantic potential of WAYYIQTOL to the meaning of the gram is very dissimilar. If the global frequency is considered (i.e. frequency that simultaneously holds for all the types of texts and all possible syntactic contexts), taxis (i.e. all the perfectal senses grouped into a single category) amounts to 4%, perfective past reaches 90% and non-perfective past equals 8% (Andrason 2016b).[29] The wave model of WAYYIQTOL, built on this evidence, exhibits a topology with an impressive peak at the stage of perfective past (cf. Figure 2, below). Overall, the contribution of the senses other than the perfective past to the total meaning of the gram is minimal (for details see Andrason 2016b).[30]

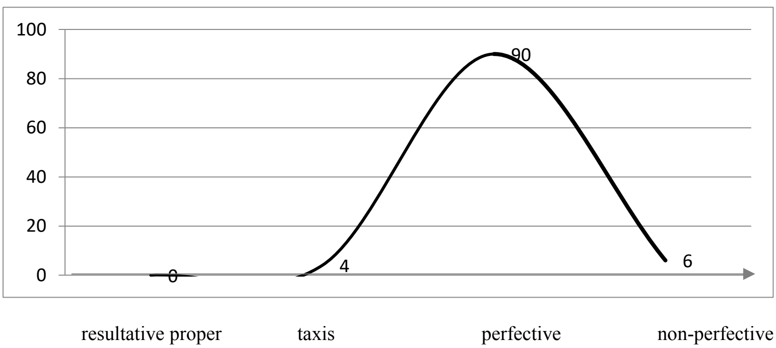

Figure 2. Wave of WAYYIQTOL[31]

[28] For WAYYIQTOL and QATAL, the present and stative senses have been modelled by means of the simultaneous path (resultative proper > resultative stative > stative present > present). Various modal values have been mapped by resorting to a modal contamination path. Future and performative senses have been related to the anterior path as its sub-branches. For the sake of simplicity, all these senses and their mappings will be ignored in this paper. It is, however, important to bear in mind that all such values have been linked to the anterior cline and can be accommodated by a wave-stream model of a more atomic granularity (Andrason 2011, 2013a, 2013c, 2013d, 2016b).

[29] A more microscopic analysis of the frequency (which distinguishes different types of texts, different syntactic environments, and distinct roots employed in this construction) may be found in Andrason (2016b).

[30] This map has been corroborated by diachronic and comparative evidence (Andersen 2000, Kouwenberg 2010, Andrason 2011a, 2013a 2016b).

[31] The number indicates the frequency of each semantic type represented as a stage on the path. The uninterrupted cline of the wave makes reference to the fact that even though the stages representing the senses are depicted as discrete (each one with its own qualitative definition and quantitative weight),

In a similar manner, this diversity of senses of QATAL has been organized into a coherent network by means of an anterior path and the paths that are connected to it. If the analysis is limited to senses available along the anterior cline (to render the comparison with WAYYIQTOL more feasible), the data indicate that QATAL is compatible with all the senses accessible on the anterior cline: resultative proper, perfect, perfective past, and non-perfective past. Accordingly, QATAL spans the entire anterior path. However, the quantitative contribution of the components of the map of the QATAL form is far from being equal. Taxis senses are the most common (nearly 53%). The perfective past value is less frequent although still well represented (27%). The sense of a non-perfective past is less numerous (8%) and that of a resultative proper is almost negligible, constituting less than 3% (Andrason 2016b). As a result, QATAL exhibits a wave topology clearly distinct from that of WAYYIQTOL. The gram exhibits two peaks: the primary peak in the stage of taxis and a secondary peak in the area of a perfective past. The sense of a resultative proper, from which the wave emerged, is barely perceptible, while the final stage of non-perfectivity, although visible, is less prominent than the senses of taxis and perfective past (cf. Figure 3). Overall, the wave of QATAL is more evenly distributed than that of WAYYIQTOL and, in further contrast to the WAYYIQTOL gram, it is principally lifted in its intermediate sections (for details see Andrason & van der Merwe 2015 and Andrason 2016b).[32]

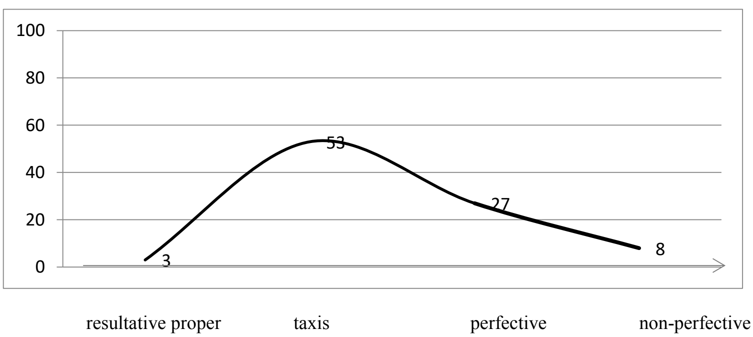

Figure 3. Wave of QATAL[33]

they form a continuum containing an infinite number of meaning extensions, which smoothly and gradually transform in one another. In this way, the stages distinguished on the grammaticalization path (and the wave) can be viewed as prototypes around which all the microscopic values are organized, as they either approach the postulated prototype or move away from it.

[32] This mapping has also been corroborated by extensive diachronic (direct and indirect) and comparative evidence (Andrason, 2012a, 2012b, 2013a, 2013b,2013c, 2013d, 2016b, Andrason & van der Merwe 2015).

[33] The remaining 9% of the frequencies correspond to the senses that are not available along the anterior path (e.g. present, stative, future, or modal).

Since WAYYIQTOL and QATAL are networked by means of a comparable path, they are products of the same evolutionary pattern. A pattern that has recursively been employed in the language, each time prompting a new gram-wave, is referred to as a stream. In other words, a stream constitutes a medium in which waves (i.e. grams' topologies) propagate (regarding the notion of a stream see Andrason & Visser 2015, Andrason 2016a, 2016b, 2016c). As the waves of WAYYIQTOL and QATAL are organized along the anterior path (being both regulated by this evolutionary principle), they can be imagined as propagating along the shared anterior stream. This can be postulated even though the two grams derived from two different original locutions and were shaped at two distinct diachronic periods (Andrason 2016b).

By locating WAYYIQTOL and QATAL on the stream, the relational properties of the two grams, or their situated dynamic states, can be estimated. First of all, the topologies of the two grams indicate that the WAYYIQTOL wave is more advanced (its peak is located at the perfective past stage), while the QATAL wave is more conservative (its peak is located at the taxis stage). Further relational traits emerge from analyzing the quantitative difference that exists between the peak of a gram and the wave of the other construction. To be exact, QATAL surpasses WAYYIQTOL in the taxis stage by 49 points (compare 53% of QATAL versus 4% of WAYYIQTOL), while WAYYIQTOL surpasses QATAL in the perfective-past stage by 63 points (compare 27% of QATAL versus 90% of WAYYIQTOL). The situatedness of QATAL in the environment conditioned by WAYYIQTOL has important bearings on QATAL's semantics. Namely, the predomination of the WAYYIQTOL wave in the perfective past section of the stream suggests that even though the value of a perfective past is quantitatively fairly relevant in the semantic potential of QATAL (it constitutes almost a third part of all the cases), it is much less prototypical from a broader perspective. Simply put, the properties of WAYYIQTOL, which is the perfective past form *par excellence* (90%), hide the QATAL's compatibility with the perfective past domain as, in this area, the QATAL wave is covered by the WAYYIQTOL's wave. Inversely, even though WAYYIQTOL can sometimes express the sense of a perfect (4%), the impressive predomination of QATAL, which surpasses WAYYIQTOL in this function by 49 points, hides this type of semantic compatibility of the gram, even further emphasizing its (i.e. WAYYIQTOL's) association with the perfective past domain (cf. Figure 4, below). As a result, the situated prototypicality of QATAL corresponds to taxis, whereas that of WAYYIQTOL corresponds to a perfective past. This implies that the systemic meaning of QATAL does not only derive from its own internal properties (the structure of the wave), but is also conditioned by the behavior of WAYYIQTOL and, in general, the structure of the stream on which QATAL travels. Inversely, the meaning of WAYYIQTOL depends both on its inherent characteristics and on the organization of the stream on which it coexists with QATAL. In both cases, the environment – in particular, the other gram on the stream – significantly influences the form's meaning by regulating its prototypicality (for a detailed discussion of this phenomenon, see Andrason 2016c).

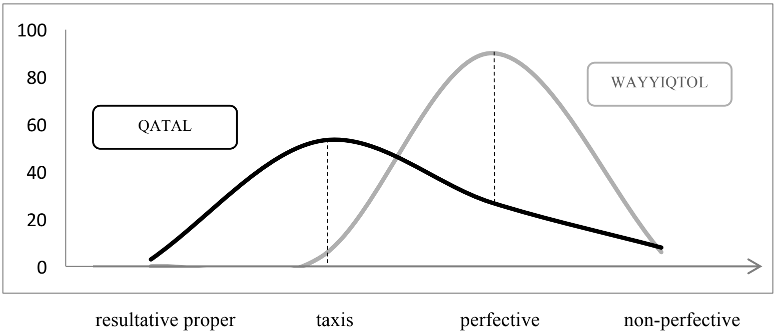

Figure 4. A dynamic WAYYIQTOL-QATAL module

The wave-stream model enables one to preserve (at least to a certain degree) properties that are typical of complex systems. The model gives access to two extreme scales (an analytic micro-scale and a synthetic macro-scale), and a variety of intermediate scales. The model is dynamic at a synchronic level as the synchronic states of grams are defined in terms of kinetic objects. Grams are categorized as waves, language modules as streams, and the entire language as an ocean (cf. Andrason 2015, 2016a). Fuzziness is overtly acknowledged. On the one hand, grams depicted as waves constitute trans-categorial objects. On the other hand, streams connect semantic domains in a gradient manner (consider, for instance, the uninterrupted shapes of the *x* axis and the wave mentioned previously). The situatedness of grams is also present and visible at various levels. For example, a sense is embedded in the wave which contributes to all individual activations of atomic values, coloring the contextually induced meaning by the total semantic potential of the gram (cf. Andrason 2010). A wave is embedded in a stream, the structure of which has significant effects on the systemic prototypicality of the gram. Accordingly, the model gives access to two-directional causation movements. The analytic (micro-)level study leads upwards to a synthetic (macro-)level and then back from the system level downwards to atomic cases. That is, just as certain properties of the wave draw from atomic senses and the structure of the stream draws from the structures of the waves (bottom-up causation), the wave's character is conditioned by the properties of the stream and a sense is to a degree conditioned by the form of the wave (top-down causation).[34] This means that emergent traits can be discovered and

[34] This interaction goes on in an interminable back and forth manner to perpetuity (like in classical complex systems) because atomic components influence the entire system in the same manner as the

accounted for. For instance, the total meaning of a verbal gram is more than a mere summation of concrete microscopic instances where the form appears. Both the direction of the gram's wave and the gram's situated prototypicality are emergent properties which cannot be deduced by micro-analyzing that gram. The model also makes reference to the openness, non-linearity and deterministic-chaotic nature of verbal grams (Andrason 2013, 2016a, 2016b).[35]

Although, thus far, the wave-stream model has mainly been used to represent the etic dimension of Biblical Hebrew, it also allows us to discover the emic dimension of this language. The important fact is that the psychological reality of grams, as possibly conceived by native speakers, can be derived from the etic dimension in a principled manner (Andrason 2016a, 2016c). This can be achieved by following the hypothesis concerning the adequacy of the situated prototypicality peaks (i.e. prototypicality peaks that are exclusive peaks on the stream) and the folk semantic maps and their centers. Even though until now the approach has mostly been applied to living languages (Andrason 2016a, 2016c), it has also been demonstrated to be suitable for extinct languages with no speakers available (Andrason & Locatel 2016). That is, the structures of the etic streams and the waves situated on them may be employed to hypothesize what the speakers' associations and what the psychological reality of the verbal grams might have been.

As far as Biblical Hebrew is concerned, the wave-stream model suggests that WAYYIQTOL was likely conceptualized as a narrative perfective past, while QATAL was associated with a perfect (taxis). This may be postulated because the situated peak of WAYYIQTOL corresponds to the sense of a perfective past, which is also the most productive value of this gram. In the case of QATAL, the gram's situated peak matches the sense of taxis (a present and past perfect). Likewise, this sense is the most productive for this form (for a similar conclusion see Andrason & van der Merwe 2015). Accordingly, the two grams might have been perceived as forming a binary opposition: taxis versus perfective; present perfect verses past; and discourse versus narrative (cf. Figure 5). Such a conceptualization of two grams in a single language is typologically plausible. It approximates the relationship that couples *passé simple* (a narrative past) and *passé composé* (a present perfect and a perfective past in discourse) in French. It is also similar to the relationship extant between the ILE gram (a present perfect and near discursive past) and the A gram (a remote past and narrative past) in Xhosa (Groenewald 2014, Andrason & Matutu forthcoming).

Additionally, the wave-stream model enables one to render the emic dimension and speakers' conceptualizations more nuanced and to postulate

---

system influences them all. There is no exact starting point of this mutual interrelation – neither the micro- nor the macro-level/properties come first (Auyang 1998).

[35] For a comprehensive explanation of how the wave-stream model preserves all the properties typical of complex systems, consult Andrason (2016a). For a more exhaustive account of the wave-stream model of WAYYIQTOL and QATAL see in Andrason (2016b).

psychological radial maps. These maps need not match the etic dynamic networks. On the one hand, the categorization of senses can differ from that developed on typological grounds and, on the other hand, the direction of the conceptual relationship between the components of the map can be different. In general terms, speakers operate with their own (or language specific) categories and the conceptual derivation is perceived as radiating from the center (the most prototypical sense) to the periphery (less prototypical senses). Extremely marginal senses are usually removed from such maps as speakers seem to be practically unaware of them (for details see Andrason 2016c).[36]

The wave-stream model yields the following psychological maps of WAYYIQTOL and QATAL (cf. Figure 5, below). The map of WAYYIQTOL radiates from its center, the sense of a perfective past (which, as explained above, corresponds to the psychological conceptualization of the form) to two highly peripheral domains: taxis and non-perfective past. It should be noted that the conceptual derivation connecting the perfective past sense and the taxis domain is opposite to that found in the etic map. In the case of QATAL, the map spreads from the central value of taxis (the prototypical sense associated with this form) to the more peripheral value of a perfective past. The distance of this sense from the center of the map is lesser than the distance between the center and the periphery in the WAYYIQTOL map. This is dictated by a higher prototypicality degree of the perfective past value in the etic map of QATAL. The extremely rare senses were most probably absent in the psychological maps of QATAL and WAYYIQTOL.

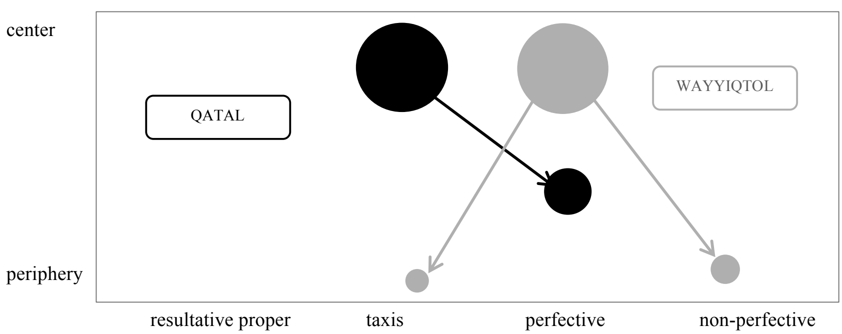

Figure 5. Folk maps and conceptualizations of WAYYIQTOL and QATAL[37]

[36] Of course, speakers still use a gram in such extremely rare senses even though they seem not to be aware of that possibility (cf. Section 3.2.1).

[37] The extent of circles indicates an approximate degree of prototypicality transferrable onto the distance from the center. The two hypothesized maps cannot be directly verified as there are no speakers of Biblical Hebrew available. However, given the link relating the etic and emic dimensions demonstrated on living languages and explained in this section (Andrason 2016c), this hypothesis is plausible.

It is important to emphasize that neither the psychological maps of QATAL and WAYYIQTOL (as posited in Figure 5) nor these forms' binary emic contrast (as possibly perceived by native speakers) are crucial for the BH language system. As explained, that system – like any language system – is complex in the sense of complexity theory, which clashes with stasis, neatness and simplicity. Psychological maps and neat binary oppositions are rather examples of folk models constructed by speakers who resort to the various types of simplifications and falsifications introduced in Section 2.

The essential fact is that apart from depicting the BH system and its parts as complex systems – which, in my view, is the true objective of a linguistic analysis – the wave-stream model also gives us access to such folk models developed by speakers. Thus, if needed, it enables us to postulate unrealistic (oversimplified and/or false) models in a systematic and methodologically sound manner. Accordingly, there is no need for purposefully static, neat, and simple models of Biblical Hebrew – which are equally unrealistic solutions to reality as folk representations. It is always possible to derive such fictitious portrayals from the wave-stream model which is significantly more representative of reality because it preserves most (if not all) complex properties of language.

4. Conclusion

The present paper demonstrated that the wave-streams model is a more adequate manner of representing verbal grams in Biblical Hebrew than neat models built on discrete, binary and static categories. The advantages of the wave-stream model principally stem from the fact that by using it, it is possible to harness the complexities of WAYYIQTOL and QATAL, and reduce them to manageable dimensions, while still preserving all the properties exemplary of complex systems. In contrast, neat, discrete, binary and static models correspond to folk representations of reality. While such models are typical of human psychology, they should be minimized in scientific representations of reality. In fact, they may be viewed as unnecessary in BH scholarship, since the wave-stream model can also be employed to postulate – in a principled manner – the psychological reality of the BH grams. As a result, the wave-stream model has both etic (language centric) and emic (psychological or human centric) dimensions, the latter being derived from the former.

References

Andersen, D. 2000. The evolution of the Hebrew verbal system. Zeitschrift fur Althebraistik 13/1. 1–66.

Andrason, A. 2011. The Biblical Hebrew *wayyiqtol* – a dynamic definition. Journal of Hebrew Scriptures 11/7. 1–50.

Andrason, A. 2012a. The gnomic *qatal*. Orientalia Suecana 61. 5–53.
Andrason, A. 2012b. Making it sound – performative *qatal* and its explanation. Journal of Hebrew Scriptures 12/8. 1–58.
Andrason, A. 2013a. El sistema verbal hebreo en su contexto semítico: una visión dinámica. Estella.
Andrason, A. 2013b. Future values of the *qatal* are "logical" – How to chain future senses of the *qatal* to the core of its semantic network? Hebrew Studies 54. 7–38.
Andrason, A. 2013c. Against floccinaucinihilipilification of the counterfactual sense of the BH suffix conjugation – or an explanation of why the "indicative" *qatal* expresses conditions, hypotheses and wishes. Old Testament Essays 26/1. 20–56.
Andrason, A. 2013d. An optative indicative? A real factual past? A cognitive-typological approach to the precative *qatal*. Journal of Hebrew Scriptures 13/4. 1–41.
Andrason, A. 2015. Toward the ocean of the Biblical Hebrew verbal system. Folia Orientalia 52. 15–36.
Andrason, A. 2016a. A complex system of complex predicates: Tense, taxis, aspect and mood in Basse Mandinka from a grammaticalization and cognitive perspective. PhD dissertation. Stellenbosch University.
Andrason, A. 2016b. The complexity of verbal semantics – An intricate relationship between QATAL and WAYYIQTOL. Journal of Hebrew Scriptures 16/4. 1–96.
Andrason, A. 2016c. From vectors to waves and streams. Semantic maps – a new generation. Stellenbosch Papers in Linguistics 45. 1–29.
Andrason, A.; C. Locatell. 2016. The perfect wave. Biblical and Ancient Greek Linguistics 5. 7–121.
Andrason, A.; N.H. Matutu. (forthcoming). Dynamic synchrony – the ILE and A grams in isiXhosa.
Andrason, A.; C.H.J. van der Merwe. 2015. The semantic potential of verbal conjugations as a polysemous set of senses. Hebrew Studies 56: 71–88.
Andrason, A.; M. Visser. 2015. Affordances perspective and grammaticalization – incorporation of language, environment and users in the model of semantic paths. Studies in Second Language Learning and Teaching 5/4. 663–698.
Auyang, S. 1998. Foundations of Complex-System Theories. Cambridge.
Bastardas-Boada, A. 1999. Lingüística general y teorías de la complejidad ecológica: algunas ideas desde una transdisciplinariedad surgente. In: J. Fernández González et al. (eds.). Lingüística para el siglo XXI. 287–294. Salamanca
Bastardas-Boada, A. 2013a. Sociolinguistics: towards a complex ecological view. In: À Massip-Bonet, A. Bastardas-Boada (eds.) Complexity Perspectives on Language, Communication and Society. 15–34. Heidelberg
Bastardas-Boada, A. 2013b. General linguistics and communication sciences: Sociocomplexity as an integrative perspective. In: À Massip-Bonet, A. Bastardas-Boada (eds.) Complexity Perspectives on Language, Communication and Society. 151–173. Heidelberg.
Bishop, R. 2011. Metaphysical and epistemological issues in complex systems. In: C. Hooker (ed.) Philosophy of Complex Systems. 105–136. Elsevier.
Cilliers, P. 1998. Complexity and Postmodernism: Understanding Complex Systems. London.
Cilliers, P. 2005. Complexity, deconstruction and relativism. Theory, Culture and Society 22/5. 255–267.
Cilliers, P. et al. 2013. Complexity, modeling, and natural Resource management. Ecology and Society 18/3. 1–12.
Cooper, J. 2007. Cognitive Dissonance Fifty Years of a Classic Theory. Los Angeles.
Groenewald, H.C. 2014. A re-evaluation of tenses in isiZulu. Literator 35/1. 1–8.
Haspelmath, M. 2003. The geometry of grammatical meaning semantic maps and cross-linguistic comparison. In: M. Tomasello (ed.) The New Psychology of Language. 211–242. Mahwah.
Hooker, C. (ed.) 2011a. Philosophy of Complex Systems. Amsterdam.

Hooker, C. 2011b. Introduction to philosophy of complex systems: A. In: C. Hooker (ed.) Philosophy of Complex Systems. 3–90. Amsterdam.
Hooker, C. 2011c. Introduction to philosophy of complex systems: B. In C. Hooker (ed.) Philosophy of Complex Systems. 841–910. Amsterdam.
Janda, L. 2015. Cognitive linguistics in the year 2015. Cognitive Semantics 1. 131–154.
Johansson, P. et al. 2014. Choice blindness and preference change: You will like this paper better if you (believe you) chose to read it! Journal of Behavioral Decision Making 27/3. 281–289.
Kauffmann, S. 2000. Investigations. Oxford.
Korchin, P. 2008. Markedness in Canaanite and Hebrew Verbs. Harvard Semitic Studies 58. Winona Lake.
Korchin, P. 2015. Suspense and authority amid Biblical Hebrew front dislocation. Journal of Hebrew Scriptures 15/1. 1–46.
Kouwenberg, N.J.S. 2010. The Akkadian Verb and its Semitic Background. Winona Lake.
Lewin, R. 2000. Complexity: Life at the Edge of Chaos. Chicago.
Macnick, S.; S. Martinez-Conde. 2010. Sleights of Minds. What the Neuroscience of Magic Reveals about our Everyday Deceptions. New York.
Macnick, S. 2012. Sleights of mind. Talk at The Great Debate: Deception, 20.10.2012, College of Liberal Arts and Sciences, Arizona State University.
Martinez-Conde, S. 2012. How does our brain deceive us? Why we experience illusions instead of the truth. Talk at The Great Debate: Deception, 20.10.2012, College of Liberal Arts and Sciences, Arizona State University.
Massip-Bonet, À. 2013. Languages as a complex adaptive system: Towards an integrative linguistics, In: À Massip-Bonet, A. Bastardas-Boada (eds.) Complexity Perspectives on Language, Communication and Society. 35–60. Heidelberg.
Massip-Bonet, À.; A. Bastardas-Boada. (eds.) 2013. Complexity Perspectives on Language, Communication and Society. Heidelberg.
Mufwene, S. 2013. The emergence of complexity in language: An evolutionary perspective. In: À Massip-Bonet, A. Bastardas-Boada (eds.) Complexity Perspectives on Language, Communication and Society. 197–218. Heidelberg.
Munné, F. 2013. The fuzzy complexity of language. In: À Massip-Bonet, A. Bastardas-Boada (eds.) Complexity Perspectives on Language, Communication and Society. 175–196. Heidelberg.
Prigogine, I. 2009. ¿Tan solo una ilusión? Barcelona.
Schneider, E.; D. Sagan. 2009. La termodinámica de la vida. Barcelona. (Into the Cool: Energy Flow, Thermodynamics, and Life, 2006, Chicago.)
Smith, P. 1998. Explaining Chaos. Cambridge.
Tavris, C.; E. Aronson. 2007. Mistakes Were Made (Nut Not by Me). Orlando.
Trivers, R 2011. The Folly of Fools. The Logic of Deceit and Self-deception in Human Life. New York.
Wade, C.; C. Tavris. 2012. Invitation to Psychology. Boston.
Wagensberg, J. 2007. Ideas sobre la complejidad del mundo. Barcelona.
Weaver, W. 1947. Science and complexity. In: K. Richardson, J. Goldstein (eds.) Classic Complexity: From the Abstract to the Concrete. 163–161. Mansfield.