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The human communication orders and the principle of natural language sustainability

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Drumming more life and diversity into communication by mixing the modalities

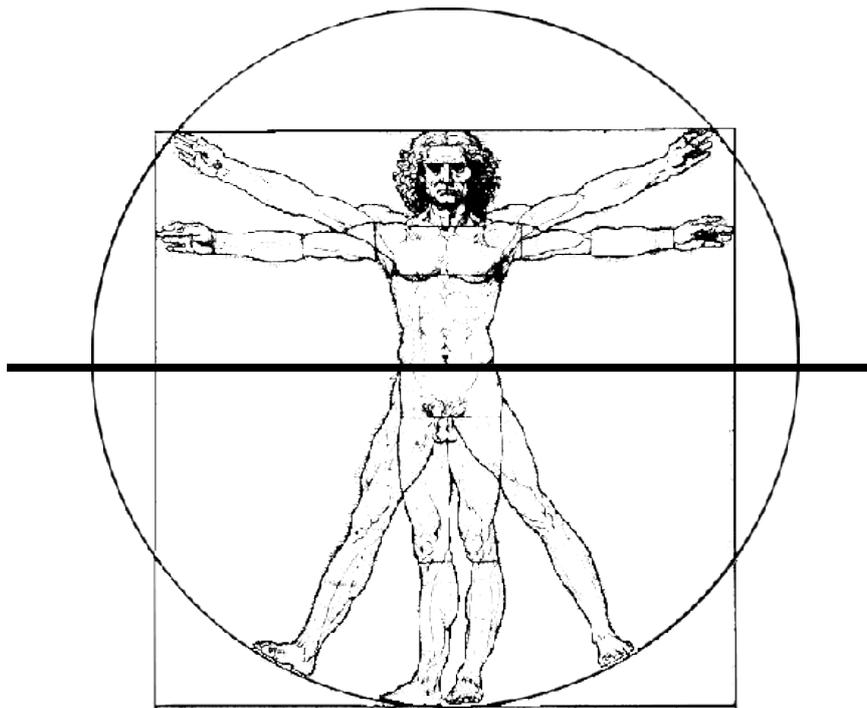


1. Introduction

As communicating agents, humans have always functioned in the predominantly bi-modal communicative design. The design's architecture includes the anatomical structures of the audio-vocal modality, referred to here as the audio-vocal subdesign (hence AVO), and the anatomical structures of the visual-tactile manual modality, referred to here as the visual-tactile manual subdesign (hence VIT), respectively. The two subdesigns have always co-occurred and cooperated closely in acts of human communication. This fact has been reported time and again in ample pertinent literature (cf. Armstrong et al., 1995; Corballis, 2002; De Ruiter, 2000; Dray and McNeill, 1990; Duranti and Goodwin, 1992; Johnson, 1987; Kendon, 1972; Kita, 2000; Levelt, 1989; Mayberry and Jaques, 2000; McNeill, 1992, 2005; Nobe, 1996, to name but a few selected sources). The evident interrelationship in the use of the two modalities does, in fact, demonstrate a close integration of the two subdesigns which has been artistically and quite inadvertently captured by Leonardo Da Vinci in his famous *Vitruvian Man*. The figure may thus be thought of as representing in the most elegant and most precise way the postulated and real synchrony of the two subdesigns in human communicative

practice. In the figure which is reproduced below (nr 1), the thick horizontal black line, inserted by the present author, separates the bimodal complex of the said subdesigns from the rest of the human body.

In the present account, the bimodal complex of the originally tool-free and thus ear-centred audio-vocal and of the visual-tactile and thus manual-centred subdesigns is assumed to constitute **the primary human communication order** based on the mouth-ear-hand coordinates. It is referred to as the **natural human communication order** (hence abbreviated as NHCO). The order has persisted from time immemorial until the occurrence of its extension by the augmentation of the hand with the tools, such as the drumstick and various writing devices (e.g. initially sticks, stones, bones, and later pens). It is at this point of human history that the **'augmented' human communication orders** (abbreviated as AHCO), based on the culture-determined engineering of the mouth-ear-hand coordinates, have emerged. In what follows, a brief discussion is offered concerning the evolution of the human communication orders.



The Natural Human Communication Order (NHCO)

Nr 1

2. The evolution of the human communication orders: from the NHCO to the AHCO

The key concept of the 'human communication order' is defined here as comprising the overall architecture and operations accomplished by the human communicators (i.e. in more or less public

performances) of a highly complex and optimized system which is accessed and exercised by the entire human population and which has in its evolutionarily-determined sequence become fine-tuned to the exigencies of the evolving human communication practice as a part of the global (i.e. universal) communication potential in the universal communication space. Subsequently, the human communication orders, as viewed from the perspective of the entire human population and the universal human species-determined communication potential contained within the universal communication space as well as in the natural language global arena, may be approached as generated and sustained within the classical Shannon-Weaver (1949) model of human communication, where the information flow is organized into a communicative flow configuration. The latter is partitioned more or less equally between the message-generating source (i.e. the human communicating agent as information-encoding sender) and the message-receiving perceiver (i.e. the human communicating agent as information-decoding receiver, cf. Shannon and Weaver, 1949; also Cherry, 1957; Hauser, 1997), and finally mediated by the common code of message transmission 'flowing', as it were, along a selected channel of transmission.

Following Bejan (2001), a major proponent of the so-called constructal theory, it is assumed that the spatial and temporal organization/construction of the human communication orders is based on the 'principle of equipartition' of the design's constituents which is expressed by such fundamental and universal pairs of symmetries occurring in the process of human communication as: 'sender-receiver', 'encoding-decoding', and bi-directional flow of information. In addition, it is assumed that the evolution of the organization of human communication into appropriate communication orders is subject to the functioning of the following principles operating in synergy: the principle of performance improvement, the principle of efficiency increase, and the principle of channel maximization, all having to do with the communication process understood as some kind of a 'flow' (e.g. flow of energy and information) exchanged between and among the human communicating agents. In this sense, we may view the problem of the human communication orders, their evolution and efficiency, as belonging to a branch of linguistics which may be referred to as 'rheolinguistics', or 'the study of language flows' (for detail see Puppel, 2009; 2012).

3. Characteristics of the NHCO vis-à-vis the written/graphic order of communication

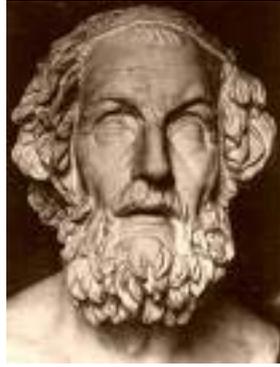
The Natural Human Communication Order has had a very long and obviously very successful history with mankind. Our historically earliest communication practices had been carried out in the audio-vocal and visual-tactile modalities, irrespective of whether in their co-history any of the two had precedence over the other (cf. e.g. Hewes, 1999). Although they could be used (and are used) as separate subdesigns, their joint advantages have been the following:

- they allow for a systematic use of repeatable phonological and gestural canonical (discrete) entities due to their biologically and culturally established discreteness (as unitary gestures) and biologically and culturally established perceptual discriminability (as unitary perceptual wholes),
- they involve the presence of advanced mental representations of these entities in the minds of the human communicators,
- they are characterized by inherent linkability subjected to the dynamic and holistic action imperative, summoned for the holistic tasks of speaking and signing,
- they are characterized by a very high degree of learnability, that is, they are learned and remembered relatively easily in the caregiver-offspring interactive dyads in the process known as 'first language acquisition' as well as in formal instruction, also known as foreign/second language teaching (cf. Puppel, 2006).

However, one should not forget that the original mouth-hand complex has also had its disadvantages. They comprise the following:

- the use of unitary phonological and gestural entities is limited to relatively shorter (i.e. audibly, temporally and spatially) interpersonal distances,
- the audio-vocal and gestural signals are evanescent, i.e. they quickly fade away (cf. Hockett's design features of language, 1966),
- their use requires direct physical (i.e. face-to-face, close-range) contact with other human communicating agents,
- their more extended social-cultural use requires greater physical mobility on the part of the human communicators.

The best known example of a representation of a human communicator functioning solely in the NHCO, especially in the most traditional audio-vocal modality, was the head of the Greek poet Homer (see picture nr 2 below), usually shown as a blind old man, which captured the sculptor's idea emphasizing the definite predominance of the audio-vocal modality in the initially oral/vocal culture and thus of communication in the primary oral/vocal human communication order accomplished by means of the audio-vocal modality (the oral culture, *Totum per os*).



The primacy of the audio-vocal modality (*Totum per os*)

nr 2

In turn, a fine illustration of a communicator who is using the combined audio-vocal and visual-tactile modalities in the oral culture (*Totum per os et manum*) is shown below:



The combined use of the primary AVO modality and the supporting VIT modality (*Totum per os et manum*)

Nr 3

However, owing to the above mentioned shortcomings and to the occurrence of a very decisive event in human evolution, namely the evolution of the human upright posture and the

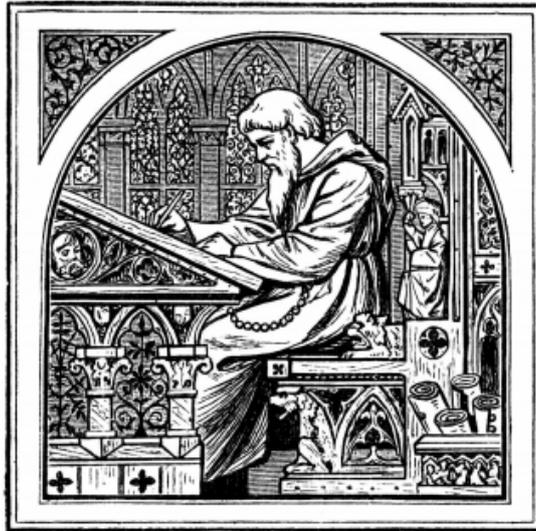
subsequent freeing of the human hands, an augmentation of the above natural communication order could be expected to develop in the evolution of communication. Indeed, the graphic turn has occurred in the form of the augmentation of the hand with the (signing) tools and the use of these tools in the manufacture of various symbolic signs. This development has thus provided the human communicating agents with an extremely efficient system of communication within an entirely new order of human communication, the 'augmented human communication order' (AHCO), where the communicating agents, armed with some kind of a stylus, would be able to perform graphic communications (*Totum per stilum*, see nr 4).



The augmented nature of the hand-stylus connection (*Totum per stilum*)

Nr 4

This kind of augmentation, no doubt, has appeared to have revolutionary consequences, both in terms of the volume of communicative productions, in terms of their distribution as well as in terms of their longevity, thus successfully replacing the parameter of evanescence, present in oral/vocal productions mentioned above, with the parameter of greater or lesser durability of any graphic production. A very simple example of advanced tool use for the purpose of graphic communication in the new communication order is shown below (nr 5)

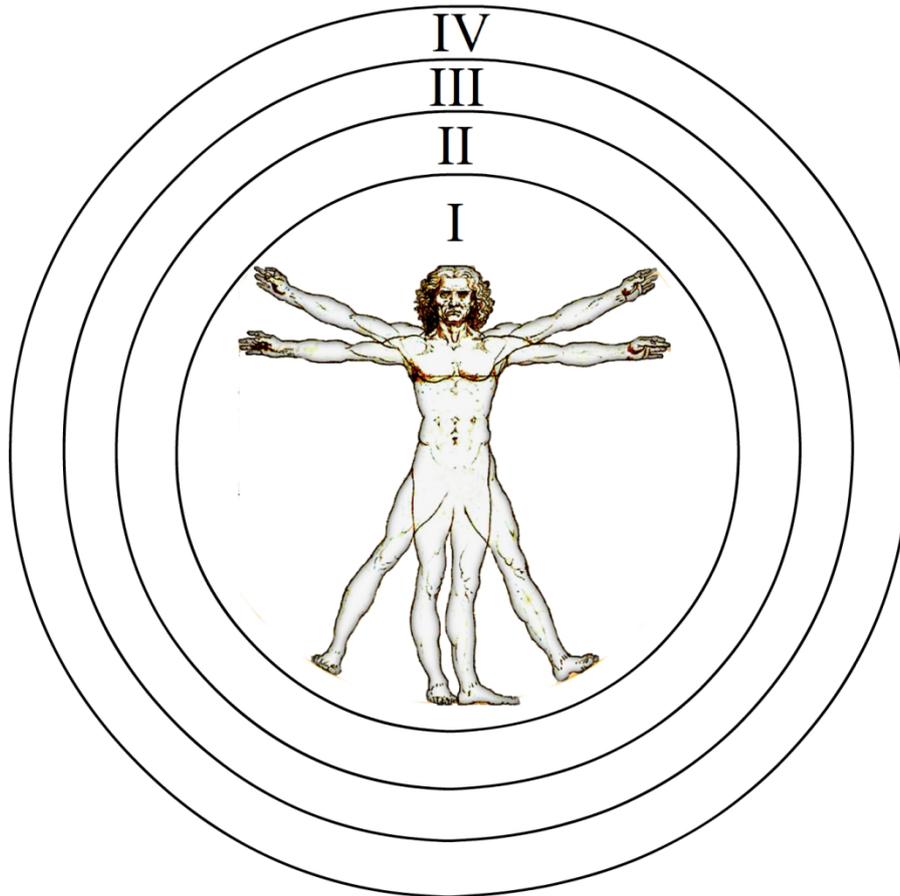


Totum per stilum

nr 5

4. The hybrid human communication order of communication (HHCO)

The massive application of the graphic augmentation in human communication has multiplied the linguistic resources by an unimaginably thick volume of written and graphic records archived all over the world and in every language which has managed to invent and develop its own written code (cf. Ong, 1982). However, the primary fundamental communicative dichotomy: oral/vocal order of communication – written/graphic order of communication, which has initially resulted in the establishment of the ‘primary hybrid human communication order’ (PHHCO), has turned out not to be the final exercise in communicative augmentation. The hybrid communication order (i.e. the combinatorial communication system), by combining the vocal and visual elements, especially in the form of portable sound-image complexes, has finally emerged and has literally exploded in the human communication space throughout the span of the XXth century thus multiplying the universally accessible linguistic resources by providing endless possibilities of communicative practice in the said order. The fourth communication order, the ‘secondary hybrid human communication order’ (SHHCO), has been finally established. The four human communication orders may be illustrated by means of the following diagram:



The human communication orders combined

Nr 6

Where:

I - the primary/natural oral/vocal human communication order (NHCO) which is primarily based on the audio-vocal modality in the 'orality' dimension of communicator performance and supported by the visual-tactile modality in the 'gestural' dimension of communicator performance (AVO; the carrier: the human body)

II - the augmented written/graphic human communication order (AHCO), secondary to the NHCO, which is based on the visual-tactile modality (VIT; the carrier: the writing/print)

III - the AHCO with its major extension in the form of the primary hybrid human communication order (PHHCO), where the two modalities are used jointly in a multiplicity of uses (the carriers: the human body, the writing/print)

IV - the AHCO with its further extension in the form of the secondary hybrid human communication order (SHHCO), where the primary 'orality-gestural' connection has been strengthened by other technologically more and more sophisticated media, such as the quickly expanding electronic media, resulting in the establishment of the most sophisticated combinatorial communication systems (the carriers: all the multimedia).

The combined effect of the presence and use of the four orders of communication, shown in an evolutionary sequence, from isolated single modality systems to combinatorial hybrid communication systems, may be illustrated by means of the following diagram:

A model of Integrated Cross-modal / Multimodal Communication

(reflecting a possible evolutionary sequence of human communication in relation to present-day (multimedia) communication)

Type of communication system:	Nr.	Type of communication:	Description:
Isolated communication systems (double systems)	1.	<p>(a) Bimodal: audio-vocal modality</p> <div style="border: 1px solid black; background-color: yellow; text-align: center; padding: 5px; width: 100px; margin: 0 auto;">AVO</div> <p>The oral/vocal human communication order</p>	<p><u>Pre-linguistic vocalizations</u> leading to fully developed spoken language code (<i>spolco</i>). The Audio-vocal modality, which is a close-range modality, in spatial terms leads to close-range networks of HCAs</p> <p><u>Rule of the oral culture.</u> Basic expression: vocal performance. (all of humanity) Functions: AVO is primary.</p>
	2.	<p>(b) Bimodal: visual-tactile modality</p> <div style="border: 1px solid black; background-color: red; text-align: center; padding: 5px; width: 100px; margin: 0 auto;">VIT</div> <p>The written/graphic human communication order</p>	<p><u>Pre-linguistic gestural behaviour</u> leading to fully developed graphic language codes (<i>graco</i>). The visual-tactile modality, which is a long-range modality, in spatial terms leads to long-range networks of HCAs.</p> <p>Basic expression: gestural performance. (all of humanity) Functions: VIT is primary.</p>
Combinatorial communication systems (hybrid double systems)	3.	<p>(c₁) Multimodal: the <i>spolco-graco</i> system</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; background-color: yellow; text-align: center; padding: 5px; width: 40px;">AVO</div> <div style="border: 1px solid black; background-color: red; text-align: center; padding: 5px; width: 40px;">VIT</div> </div> <p style="text-align: center;">(a) + (b) The hybrid human communication order</p>	<p><u>The necessary and inevitable conflation of both codes:</u> the spoken language code is supported by the graphic language codes at the dawn of literacy.</p> <p>Basic expression: combined vocal-gestural performance. (all of humanity) Functions: AVO is primary, VIT is subsidiary and supporting AVO.</p>
Combinatorial communication systems (hybrid triple systems)	4.	<p>(c₂) Multimodal: (a) + (b₁)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; background-color: yellow; text-align: center; padding: 5px; width: 60px;">AVO</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; background-color: red; text-align: center; padding: 2px; width: 20px;">VIT</div> <div style="display: flex; justify-content: space-between; width: 20px;"> <div style="border: 1px solid black; background-color: purple; text-align: center; padding: 2px; width: 10px;">H</div> <div style="border: 1px solid black; background-color: green; text-align: center; padding: 2px; width: 10px;">I</div> </div> </div> </div> <p>The hybrid human communication order</p>	<p><u>The early AVO-dominant phase:</u> the <i>spolco</i> dominates, while VIT is subservient (within the VIT modality the graphic mode (<i>gramo</i>) is developed; within <i>gramo</i>, handwriting (H) and image making (icon; I) are developed => the Ancient times, the Medieval times in Europe.</p> <p><u>Rule of the oral culture</u> supported by handwritten <i>gramo</i>.</p> <p>Basic expression: combined vocal-graphic performance. (all of literate humanity)</p>
	5.	<p>(c₃) Multimodal: (a) + (b₂)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; background-color: yellow; text-align: center; padding: 5px; width: 60px;">AVO</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; background-color: red; text-align: center; padding: 2px; width: 20px;">VIT</div> <div style="display: flex; justify-content: space-between; width: 20px;"> <div style="border: 1px solid black; background-color: orange; text-align: center; padding: 2px; width: 10px;">P</div> <div style="border: 1px solid black; background-color: green; text-align: center; padding: 2px; width: 10px;">I</div> </div> </div> </div> <p>The hybrid human communication order</p>	<p><u>The late AVO-dominant phase:</u> the <i>spolco</i> dominates, while VIT is subservient (within the VIT modality the graphic mode (<i>gramo</i>) is developed; within <i>gramo</i>, print (P) is discovered and image making (icon; I) is further developed => end of the Medieval times up to the Modern times.</p> <p><u>Rule of the oral culture</u> supported by printed <i>gramo</i>.</p> <p>Basic expression: combined vocal-graphic performance. (all of literate humanity)</p>
	6.	<p>(c₄) Multimodal: (a) + (b₃)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; background-color: yellow; text-align: center; padding: 5px; width: 40px;">AVO</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; background-color: red; text-align: center; padding: 2px; width: 60px;">VIT</div> <div style="display: flex; justify-content: space-between; width: 60px;"> <div style="border: 1px solid black; background-color: orange; text-align: center; padding: 2px; width: 30px;">P</div> <div style="border: 1px solid black; background-color: green; text-align: center; padding: 2px; width: 30px;">I</div> </div> </div> </div> <p>The hybrid human communication order</p>	<p><u>The early VIT-dominant phase:</u> <i>gramo</i> dominates (the P-dominant phase => Western society, the modern era).</p> <p>Basic expression: combined graphic-vocal performance and via all kinds of graphic texts, possibly early electronic media.</p> <p><u>Beginning of the rule of the print culture.</u> (all of literate humanity) the beginning of graphic affluence and graphic diversity on a global scale.</p>
	7.	<p>(c₅) Multimodal: (a) + (b₄)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; background-color: yellow; text-align: center; padding: 5px; width: 40px;">AVO</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; background-color: red; text-align: center; padding: 2px; width: 60px;">VIT</div> <div style="display: flex; justify-content: space-between; width: 60px;"> <div style="border: 1px solid black; background-color: orange; text-align: center; padding: 2px; width: 30px;">P</div> <div style="border: 1px solid black; background-color: green; text-align: center; padding: 2px; width: 30px;">I</div> </div> </div> </div> <p>The hybrid human communication order</p>	<p><u>The late VIT-dominant phase:</u> <i>gramo</i> dominates (the I-dominant phase => Western society, present-day situation).</p> <p>Basic expression: combined vocal-graphic performance and via the latest electronic media, all kinds of graphic texts.</p> <p><u>Rule of the print culture</u> supported by <i>spolco</i>. (all of literate humanity: advanced human-machine symbiosis) growing graphic affluence and diversity on a global scale.</p>
	8.	<p>(c₆) Multimodal: (a) + (b₅)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; background-color: yellow; text-align: center; padding: 5px; width: 40px;">AVO</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; background-color: red; text-align: center; padding: 2px; width: 60px;">VIT</div> <div style="border: 1px solid black; background-color: green; text-align: center; padding: 2px; width: 60px;">I</div> </div> </div>	<p><u>The late VIT-dominant phase:</u> <i>gramo</i> has reduced the AVO modality to its minimum dimension => <u>rule of the print culture</u> supported by <i>spolco</i>.</p> <p>Basic expression: combined graphic-vocal performance and via the latest electronic media and graphic materials (e.g. cartoon books and periodicals) which contain no printed</p>

Combinatorial communication systems	8.	(c ₆) Multimodal: (a) + (b ₅)	<p>The late VIT-dominant phase: <i>gramo</i> has reduced the AVO modality to its minimum dimension ⇒ <u>rule of the print culture</u> supported by <i>spo/co</i>. Basic expression: combined graphic-vocal performance and via the latest electronic media and graphic materials (e.g. cartoon books and periodicals) which contain no printed language. (all of literate humanity: advanced human-machine symbiosis) further growth of graphic affluence and diversity on a global scale.</p>														
		<table border="1"> <tr> <td>AVO</td> <td>VIT</td> </tr> <tr> <td></td> <td>I</td> </tr> </table> <p>The hybrid human communication order</p>	AVO	VIT		I											
AVO	VIT																
	I																
Isolated communication systems	9.	(c ₇) Multimodal: (a) + (b ₆)	<p>The latest VIT-dominant phase: a logical follow-up of phase nr 8 where <i>gramo</i> has reduced the AVO modality to its minimum dimension ⇒ <u>rule of the print culture</u> supported by <i>spo/co</i>. Basic expression: combined graphic-vocal performance and via the latest electronic media, also books and periodicals which do not contain graphic images but printed language only. (all of literate humanity: advanced human-machine symbiosis) extreme degree of graphic affluence and diversity on a global scale.</p>														
		<table border="1"> <tr> <td>AVO</td> <td>VIT</td> </tr> <tr> <td></td> <td>P</td> </tr> </table> <p>The hybrid human communication order</p>	AVO	VIT		P											
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	10.	Bimodal: (a)	<p>The latest AVO-dominant phase: the <i>spo/co</i> has completely obliterated the <i>graco</i>. A very unlikely but logically possible development ⇒ <u>return to the rule of the oral culture</u>. Basic expression: vocal performance. (all of humanity ?)</p>														
			<table border="1"> <tr> <th colspan="2">Abbreviations:</th> </tr> <tr> <td>AVO</td> <td>audio-vocal modality</td> </tr> <tr> <td>HCA</td> <td>human communicating agent</td> </tr> <tr> <td>I</td> <td>image/icon</td> </tr> <tr> <td>H</td> <td>handwriting</td> </tr> <tr> <td>P</td> <td>print</td> </tr> <tr> <td>VIT</td> <td>visual-tactile modality</td> </tr> </table>	Abbreviations:		AVO	audio-vocal modality	HCA	human communicating agent	I	image/icon	H	handwriting	P	print	VIT	visual-tactile modality
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Notes:			<p>1. The above communication systems may be activated and used in mono-lingual, bilingual and multilingual (plurilingual) conditions of language contact and within either the natural "language competition" or natural "language cooperation" patterns of coexistence.</p> <p>2. We live in an "all is adaptive" world where the above modalities tend to occur in a state of conflation in order to produce a maximally versatile and diversified communication systems in the service of human communication.</p>														

5. Conclusions: The ecolinguistic significance of the additive effect of the human communication orders for natural language sustainability

If it so happens that a natural language has reached the stage at which it is expressed through the use of the four afore mentioned communication orders, the overall 'protective robustness' of the four orders increases the particular language's survivability, Thus, it is assumed that the combined presence of the four communication orders in the life of any NL and, subsequently, in human communicative practice, is directly related to the problem of increasing natural language sustainability. The relationship may be expressed by means of a simple principle, referred to here as 'the principle of natural language sustainability', which may be formulated as follows:

the principle of natural language sustainability:

A particular natural language is likely to be most effectively preserved (i.e. sustained) if its resources are used jointly in all the communication orders, for in this hybrid way the highest degree of its overall protective robustness is demonstrated.

The ecological value of the above principle is unquestionable in the light of the fact that the four orders, while being actively present and synchronized in the communicative practices of the ever growing number of the human communicating agents, at the same time allow them to perform in a particular natural language in an extremely rich array of possibilities, that is, either in a uni-carrier, bi-carrier, or multi-carrier ways. In this way, these possibilities contribute jointly to the particular language's power as a means of communication (i.e. to its protective robustness), as well as they contribute to its survivability in the natural language global arena (cf. Puppel, 2007; 2011), irrespective of how big the language's 'linguomass' happens to be. The latter may be expressed by the sheer number of its native and non-native users in the universal communication space.

Bibliography:

Armstrong, D.F., W.C. Stokoe and S.E. Wilcox. 1995. **Gesture and the nature of language**. Cambridge: Cambridge University Press.

Bejan, A. 2001. "Constructal theory: from engineering design to predicting shape and structure in nature". **Engenharia Térmica** 1. 27-31.

Chałacińska-Wiertelak, H. and K. Kropaczewski. (eds.). 2007. **Dyskurs wielokulturowy. Prace Humanistycznego Centrum Badań**. Łódź: Drukarnia i Wydawnictwo "PIKTOR".

Cherry, C. 1957. **On human communication**. Cambridge, Mass.: The MIT Press.

Corballis, M.C. 2002. **From hand to mouth: the origins of language**. Princeton: Princeton University Press.

De Ruiter, J.P. 2000. "The production of gesture and speech". In McNeill, D. (ed.). 284-311.

- Dray, N.L. and D. McNeill. 1990. "Gestures during discourse: the contextual structuring of thought". In Tsohatzidis, S.L. (ed.). 465-487.
- Duranti, A. and C. Goodwin. 1992. **Rethinking context: language as an interactive phenomenon**. Cambridge: Cambridge University Press.
- Greenberg, J.H. (ed.). 1966. **Language universals with special reference to feature hierarchies**. The Hague: Mouton.
- Hauser, M.D. 1997. **The evolution of communication**. Cambridge, Mass.: The MIT Press.
- Hewes, G.W. 1999. "A history of the study of language origins and the gestural primacy hypothesis". In Lock, A.J. and C.R. Peters. (eds.). 571-595.
- Hockett, C.F. 1966. "The problem of universals in language". In Greenberg, J.H. (ed.). 1-29.
- Johnson, M. 1987. **The body in the mind: the bodily basis of meaning, imagination, and reason**. Chicago: The University of Chicago Press.
- Kendon, A. 1972. "Some relationship between body motion and speech: an analysis of an example". In Siegman, A. and B. Pope. (eds.). 177-210.
- Kita, S. 2000. "How representational gestures help speaking". In McNeill, D. (ed.). 162-185.
- Levelt, W. 1989. **Speaking**. Cambridge, Mass.: The MIT Press.
- Lock, A.J. and C.R. Peters. (eds.). **Handbook of human symbolic evolution**. Oxford: Blackwell.
- Mayberry, R. and J. Jaques. 2000. "Gesture production during stuttered speech: insights into the nature of gesture-speech integration". In McNeill, D. (ed.). 199-214.
- McNeill, D. 1992. **Hand and mind: what gestures reveal about thought**. Chicago: The University of Chicago Press.
- McNeill, D. (ed.). 2000. **Gesture and language**. Cambridge: Cambridge University Press.
- McNeill, D. 2005. **Gesture and thought**. Chicago: The University of Chicago Press.
- Nobe, S. 1996. **Representational gestures, cognitive rhythms, and acoustic aspects of speech: a network/threshold model of gesture production**. Doctoral dissertation. Chicago: The University of Chicago, The Department of Psychology.
- Ong, W. 1982/2002. **Orality and literacy: the technologizing of the word**. London: Routledge.
- Puppel, S. 2006. "Phonological development: a brief survey". In Zybert, J. (ed.). 185-193.

Puppel, S. 2007. "Tężyzna języków naturalnych". In Chałacińska-Wiertelak, H. and K. Kropaczewski. (eds.). 7-15.

Puppel, S. 2009. "Natural language robustness-, natural language 'viscosity'-, and teacher population density-dependence as co-indicators of success in foreign/second language teaching and learning: a combined ecolinguistic-rheolinguistic approach to English". In Wolny, R.W. (ed.). 235-241.

Puppel, S. 2011. "The universal natural language preservation mechanism: an ecological approach". In Puppel, S. (ed.). 91-99.

Puppel, S. (ed.). 2011. **Transkomunikacja. W stronę sprofilowania przestrzeni publicznej jako wielopłaszczyznowej przestrzeni komunikacyjnej. Scripta de Communicatione Posnaniensi.** Tom III. Poznań: Zakład Graficzny UAM.

Puppel, S. 2012. " W stronę reolinguistycznego podejścia do języka". In Zaniewski, J. and A. Serwicka-Kapała. (eds.). 101-118.

Robinson, A. 1995. **The story of writing: alphabets, hieroglyphs and pictograms.** London: Thames and Hudson, Ltd.

Senner, W.M. (ed.). 1989. **The origins of writing.** Lincoln: University of Nebraska Press.

Shannon, C.E. and W. Weaver. 1949. **The mathematical theory of communication.** Urbana, IL: University of Illinois Press.

Siegmán, A. and B. Pope. (eds.). 1972. **Studies in dyadic communication.** Elmsford, NY: Pergamon Press.

Tsohatzidis, S.L. (ed.). 1990. **Meanings and prototypes: studies in linguistic categorization.** London: Routledge.

Wolny, R.W. (ed.). **On time: reflections on aspects of time in culture, literature and language.** Opole: Wydawnictwo Uniwersytetu Opolskiego.

Zaniewski, J. and A. Serwicka-Kapała. (eds.). **Edukacja dla przyszłości.** Białystok: Wydawnictwo Uczelniane Wyższej Szkoły Finansów i Zarządzania. Tom IX.

Zybert, J. (ed.). 2006. **Issues in foreign language learning and teaching.** Warszawa: Wydawnictwa Uniwersytetu Warszawskiego.