is achieved. Prior to stabilization, neural networks do not jump around between points in activation space. Stabilization is the process whereby a network first generates a determinate activation pattern, and thereby *arrives* at a point in activation space.

So a real neural network does not generate a pattern of activation, and thus a determinate representational content, until it achieves some measure of stability. Consequently, there is no distinction between "stable" and "transient" activation patterns. Stable activation patterns are physical objects, objects moreover that are structurally distinct from a neural network's configuration of connection weights. And it is this distinction, between activation pattern representation and connection weight representation, that according to our vehicle theory marks the boundary between the conscious and the unconscious.

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Commentary on **Anne Campbell (1999). Staying alive: Evolution, culture, and women's intrasexual aggression. BBS 22(2):203–252.**

Abstract of the original article: Females' tendency to place a high value on protecting their own lives enhanced their reproductive success in the environment of evolutionary adaptation because infant survival depended more upon maternal than on paternal care and defence. The evolved mechanism by which the costs of aggression (and other forms of risk taking) are weighted more heavily for females may be a lower threshold for fear in situations which pose a direct threat of bodily injury. Females' concern with personal survival also has implications for sex differences in dominance hierarchies because the risks associated with hierarchy formation in non-bonded exogamous females are not off-set by increased reproductive success. Hence among females, disputes do not carry implications for status with them as they do among males, but are chiefly connected with the acquisition and defence of scarce resources. Consequently, female competition is more likely to take the form of indirect aggression or low-level direct combat than among males. Under patriarchy, men have held the power to propagate images and attributions which are favourable to the continuance of their control. Women's aggression has been viewed as a gender-incongruent aberration or dismissed as evidence of irrationality. These cultural interpretations have "enhanced" evolutionarily based sex differences by a process of imposition which stigmatises the expression of aggression by females and causes women to offer exculpatory (rather than justificatory) accounts of their own aggression.

Hierarchy disruption: Women and men

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Abstract: The application of evolutionary perspectives to analyzing sex differences in aggressive behavior and dominance hierarchies has been found useful in multiple areas. We draw attention to the parallel of gender differences in the worsening health status of restructuring societies. Drastic socio-economic changes are interpreted as examples of hierarchy disruption, having differential psychological and behavioral impact on women and men, and leading to different changes in health status.

Campbell's (1999) target article about gender differences in aggression and status-seeking behavior describes a convincing body of evidence and presents a plausible evolutionary explanation. The target article and the commentaries raise a number of questions concerning the consequences and practical implementations of an evolutionary theory. We propose that several new findings in the areas of epidemiology and health psychology yield parallel results that fit well with Campbell's model. The phenomenon of health status deterioration in restructuring societies, primarily those of Central and Eastern Europe, and the until-now not convincingly explained gender differences in health deterioration are results that could serve as a bridge between a behaviorally oriented evolutionary model and large-scale epidemiological findings. Reading the article and the following debate was a profound intellectual experience; the recognition of parallel results between different fields was even more exciting.

Socio-economic changes following political transition in the countries of Central and Eastern Europe have influenced people's lives in a variety of ways. Among these phenomena, one of the most striking is the declining health status of these societies (Feachem 1994). The dynamics of the process show different characteristics in different countries according to the chronological nature of the political changes. In Hungary, deterioration began in the early 1970s at a constant slow grade, and male life expectancy decreased by three years between 1970 and 1995, parallel with political softening and the beginning of economic polarization (Bobak & Marmot 1996; Kopp 2000). As a more severe

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example, male life expectancy in Russia fell by six years between 1990 and 1994 (Notzon et al. 1998). Paradoxically, women have not been affected as severely as men by these processes of deterioration, giving rise to a higher gender gap in life expectancy (12.1 years in Russia) and mortality. Gender ratios in mortality of the middle aged have risen threefold in several Eastern European countries (Hungarian Central Statistical Office 1999). According to these epidemiological results, women are better at staying alive. One must ask, what were the toxic effects that induced the fast deterioration of health status and the greater impact on men than on women?

The link between dominance and resource holding in humans can be described in several ways: by means of social status, education, income, occupation, and political influence. These are exactly the factors which the political and socio-economic changes turned upside-down, giving rise to a general loss of control and predictability. Hence, we consider our hypothetical model of hierarchy disruption useful for analyzing the epidemiological phenomena registered recently.

A large body of evidence supports the inverse association between socio-economic status, and morbidity and mortality (Marmot et al. 1991). Worsening health status and rising mortality in connection with socio-economic changes have been similarly thoroughly studied, as has the gender-relatedness of these phenomena (Kopp et al. 1995; Mackenbach et al. 1999; Weidner 1998). In accordance with the literature, our own results from 1988 and 1995 – two turning points during the socio-economic changes – indicate that income showed a strengthening connection to self-reported morbidity in men, measured as the number of sick days per annum, but only to a much lesser degree in women (Kopp et al. 2000; Réthelyi et al. 2002). Men seem to be more susceptible to hierarchy disruption and the loss of hierarchy status.

Parallel findings in primatology are meaningful. From a biological point of view, the political and socio-economic changes may have similarities to patterns referred to analogously as hierarchy disruption, which have been observed in baboons living in patriarchal dominance hierarchies (Sapolsky 1990a; 1990b). Observations among male baboons indicate that higher rank position goes together with protective physiological profiles for stress-related illnesses connected with lower levels of basal cortisol and faster cortisol normalization. However, not rank itself but the sense of control and predictability are the factors that determine physiologic reactions. Dominant males at the time of newly formed hierarchies do not enjoy the beneficial effect of high rank until the new order is settled. Studies regarding female dominance hierarchies in Cynomolgus macaques in connection with coronary artery atherosclerosis found that social subordination increases the development of atherosclerosis in experimental settings. Social isolation, however, had an even greater atherogenic effect on female macaques in similar experimental settings (Shively et al. 1998).

Returning to our original question, we must consider possible psychological mediators of hierarchy disruption. According to our results mentioned earlier, depression is an important mediator between income and self-reported morbidity in men, but not in women. This association might seem paradoxical because women report generally more depression. However, they also report more adaptive coping strategies, and are able to recognize depression and more willingly take effective steps to counter depression, anxiety, and pain of any kind, in forms of health-care utilization (Unruh 1996), a fact cited by Campbell as well. Social support and cohesion are other protective factors which women make more use of (Knox et al. 1998). Besides their important role in health psychology, the evolutionary importance of social support and cohesion in connection with child rearing and human socialization seems plausible, fitting well in Campbell's model. Such a framework is comparable with the results of modern epidemiology. Growing evidence supports the hypothesis that the worsening health status and the evident gender gap in health decline can be explained only by a combination of traditional risk factors and psychosocial factors. Standard risk factors for noncommunicable diseases such as smoking, diet, alcohol consumption, and obesity do not differ sufficiently in Eastern and Western countries to explain the striking differences in health status. However, there are striking differences in psychosocial risk factors such as depression, exhaustion, social support, hostility, and adaptive coping strategies (Kristenson et al. 1998).

In her response to the commentaries, Campbell addresses questions of dominance hierarchies in democracy and capitalism. From an epidemiological point of view, history is teaching us the lesson that neither an ideologically based egalitarianism (i.e., socialism), nor a change to a democratic system, reduced status seeking.

In summary, we suggest an evolutionary mechanism of tradeoffs between the possible costs and benefits of status-seeking behavior and those of social cohesion and integration, which are most apparent at times of hierarchy disruption (Kopp & Réthelyi 2004). Further research on socio-economic factors and health should bring a better understanding of causal relationships and even offer possibilities of social and medical intervention.

Editors' Note: There is no Author's Response to this commentary.

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Commentary on **Friedemann Pulvermüller (1999). Words in the brain's language. BBS 22(2)253–336.**

Abstract of the original article: If the cortex is an associative memory, strongly connected cell assemblies will form when neurons in different cortical areas are frequently active at the same time. The cortical distributions of these assemblies must be a consequence of where in the cortex correlated neuronal activity occurred during learning. An assembly can be considered a functional unit exhibiting activity states such as full activation ("ignition") after appropriate sensory stimulation (possibly related to perception) and continuous reverberation of excitation within the assembly (a putative memory process). This has implications for cortical topographies and activity dynamics of cell assemblies forming during language acquisition, in particular for those representing words. Cortical topographies of assemblies should be related to aspects of the meaning of the words they represent, and physiological signs of cell assembly ignition should be followed by possible indicators of reverberation. The following postulates are discussed in detail: (1) assemblies resembling phonological word forms are strongly lateralized and distributed over perisylvian cortices; (2) assemblies representing highly abstract words such as grammatical function words are also strongly lateralized and restricted to these perisylvian regions; (3) assemblies representing concrete content words include additional neurons in both hemispheres; (4) assemblies representing words referring to visual stimuli include neurons in visual cortices; and (5) assemblies representing words referring to actions include neurons in motor cortices. Two main sources of evidence are used to evaluate these proposals: (a) imaging studies focusing on localizing word processing in the brain, based on stimulus-triggered event-related potentials (ERPs), positron emission tomography (PET), and functional magnetic resonance imaging (fMRI), and (b) studies of the temporal dynamics of fast activity changes in the brain, as revealed by high-frequency responses recorded in the electroencephalogram (EEG) and magnetoencephalogram (MEG). These data provide evidence for processing differences between words and matched meaningless pseudowords, and between word classes, such as concrete content and abstract function words, and words evoking visual or motor associations. There is evidence for early word class-specific spreading of neuronal activity and for equally specific high-frequency responses occurring later. These results support a neurobiological model of language in the Hebbian tradition. Competing large-scale neuronal theories of language are discussed in light of the data summarized. Neurobiological perspectives on the problem of serial order of words in syntactic strings are considered in closing.

Perceptual fluency and lexical access for function versus content words

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Abstract: By examining single-word reading times (in full sentences read for meaning), we show that (1) function words are accessed faster than content words, independent of perceptual characteristics; (2) previous failures to show this involved problems of frequency range and task used; and (3) these differences in lexical access are related to perceptual fluency. We relate these findings to issues in the literature on event-related potentials (ERPs) and neurolinguistics.

Pulvermüller (1999) posits that lexical access for function words involves the perisylvian region whereas lexical access for content words additionally involves other cortical areas related to the specific meanings. Function word cell assemblies should produce faster lexical access times, because they are more concise in the geographical sense and possibly because functions whose representations are restricted to this area are deemed to be more automatized (Whitaker 1983). However, the experimental literature on function word and content word lexical access times does not support this. Pulvermüller et al.'s (1995) own data show that lexical decisions are slower for function words than for content words. We (and many others) have found this too: lexical decisions for function words took more that 40 msec longer than for nouns and verbs (which did not differ from each other), $F(2, 34) = 21.9, p < .001$ (Segalowitz & Chevalier, unpublished data).

Some researchers have suggested that the lexical decision paradigm is not an appropriate one for comparing function and content words on access times. Taft (1990) showed that lexical decisions are slower for words that do not comfortably stand alone, whether of the function type or the content type, and Schmauder (1996) found that function words and content words show the same lexical decision times when they are embedded in sentences that are read for meaning. Some support for a faster access time for function words is presented in Neville et al.'s (1992) ERP finding of a distinctive negative component at 280 msec for function words and at 350 msec for content words. The result was not found to be due to word frequency (although there were range restrictions) or word length; however, repetition within the paradigm, and word predictability, were not explored. (The original object of the study was to examine variations in the congruity of the last word with respect to sentence meaningfulness.) In order to examine lexical access of words read for meaning while controlling word characteristics, we presented sentences from Neville et al. (1992) and Schmauder (1996) one word at a time (500 msec duration, 1200 msec SOA) to subjects who read them aloud for sentence meaning. We then scored the reading times for each word, not including the first and the last word of each sentence or the few words where subjects' articulation did not distinguish adjacent words (Segalowitz & Lane 2000).

We obtained similar results whether we analyzed frequency (high, medium, low) by word type in a standard ANOVA procedure (see Table 1), or whether we treated words as cases in a regression by standardizing each subject's reading times (RTs) and averaging across subjects: We found unique variance contributions to RT from length (shorter words were faster), $t = 3.1$, $p < .005$; frequency (higher frequency words were faster), $t = 3.1$, $p < .005$; and word type (function words were faster by 23 ms), $t = 2.3$, $p < .025$, in addition to the common variance. This shows for the first time that functions words are indeed accessed faster than are content words in meaningful contexts independent of these other characteristics. As expected, function words are of higher word frequency and shorter length on average. They also repeated more of-

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