語言工程實驗室
Language Engineering Laboratory

SOME ISSUES IN LANGUAGE EVOLUTION

CIEL - 5

William S-Y. Wang
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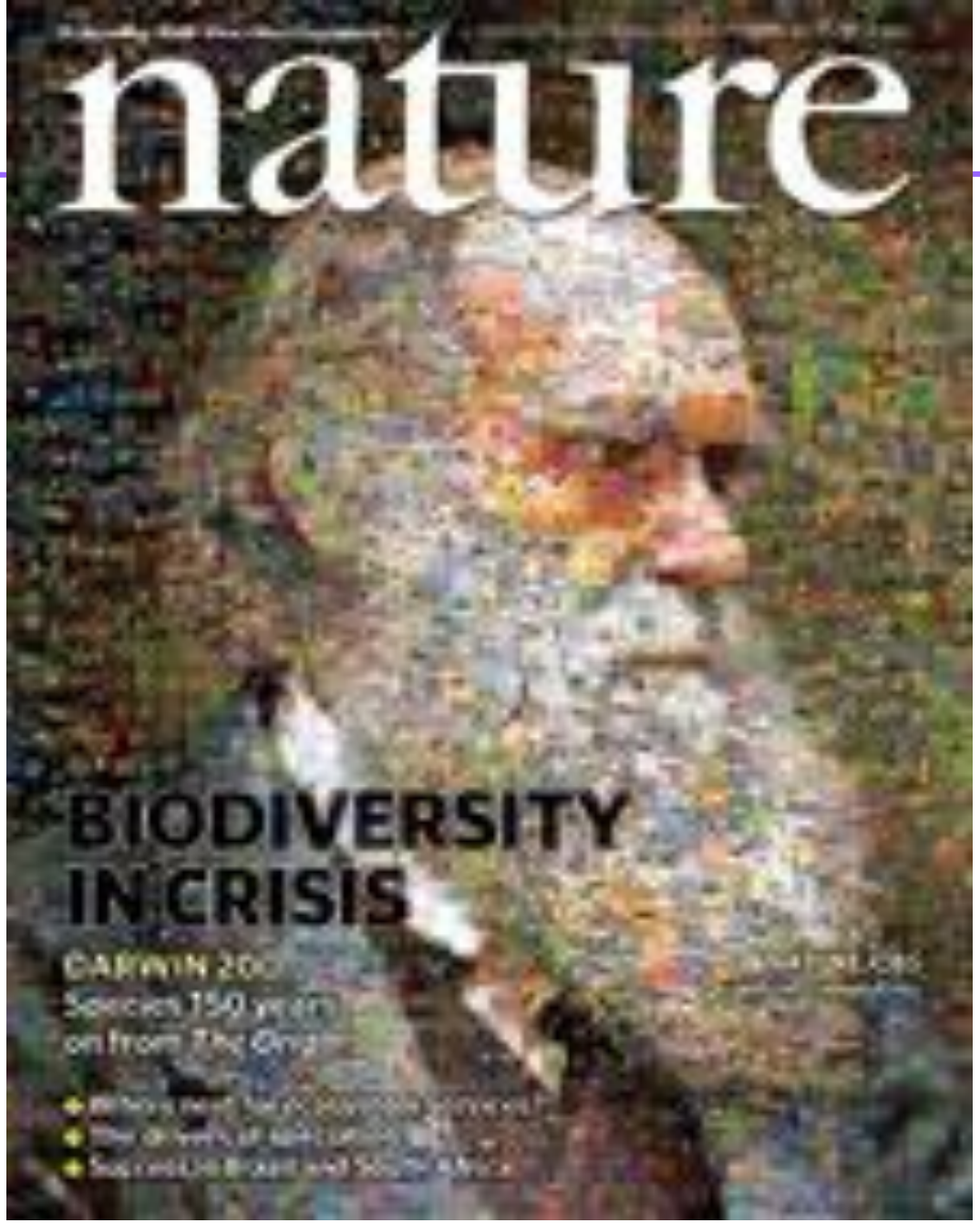
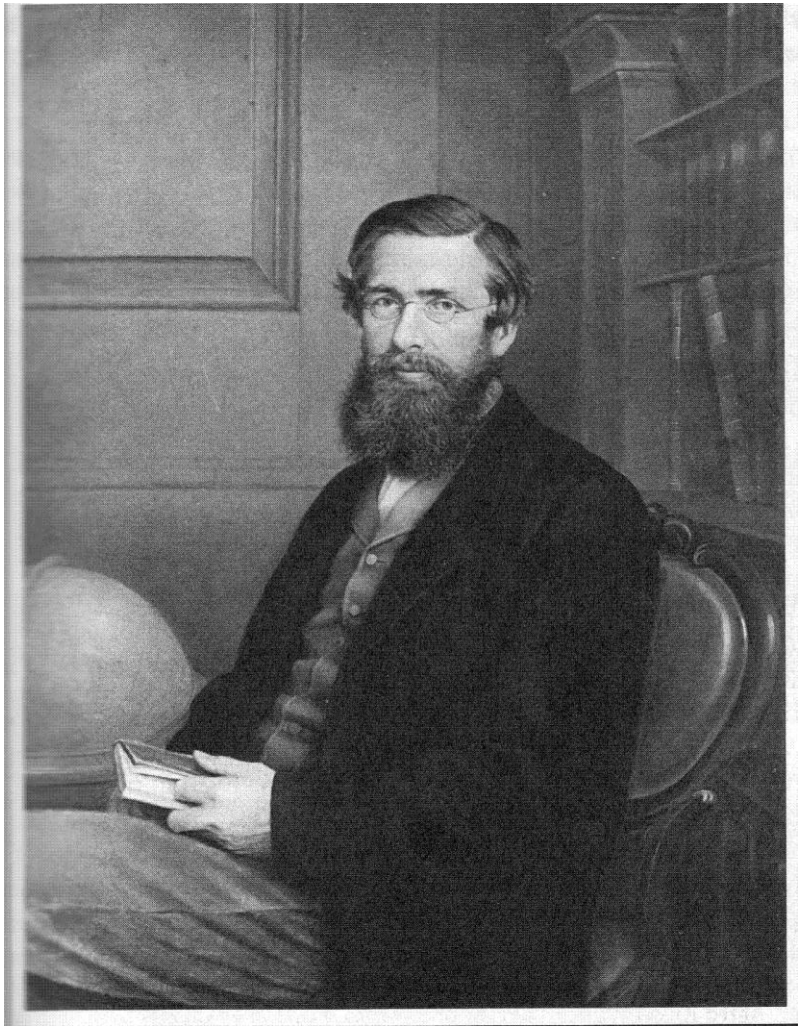


1809 – 1882

Alfred Russel Wallace



1823 - 1913

*"**Natural selection** could only have endowed savage man with **a brain a few degrees superior** to that of an ape, whereas he actually possesses one very little inferior to that of a philosopher ... It seems as if **the organ had been prepared in anticipation of the future progress in man**, since it contains latent capacities which are useless to him in his earlier condition."*

Alfred Russel Wallace

*"The same line of argument may be used in connection with **the structural and mental organs of human speech**, since that faculty can hardly have been physically useful to the lowest class of savages; and, if not, the delicate arrangement of nerves and muscles for its production could not have been developed and coordinated by natural selection. This view is supported by the fact that, among the lowest savages with the least copious vocabularies, the capacity of uttering a variety of distinct articulate sounds, and of applying them to an almost infinite amount of modulation and inflection, is not in any way inferior to that of the higher races. An instrument has been developed in advance of the needs of its possessor."*

"… Compare this with the savage languages, which contain no words for abstract conceptions; the utter want of foresight of the savage man beyond his simplest necessities; his inability to combin or to compare, or to reason on any general subject that does not immediately appeal to his senses."

Alfred Russel Wallace

"*I grieve to differ from you, and it actually terrifies me and makes me constantly distrust myself. I feel we shall never quite understand each other.*"

Charles Darwin

"When it comes to linguistic form, Plato walks with the Macedonian shepherd, Confucius with the head-hunting savage of Assam.“

Edward Sapir 1921:219.

Consonant systems of Kabardian & Hawaiian

		Labial	Alveolar		Post-alveolar	Alveolo-palatal	Velar			Uvular		Pharyngeal	Glottal	
			Central	Lateral			plain	pal.	lab.	plain	lab.		plain	lab.
Plosive	voiceless	p	t				k	(kʲ)	kʷ	q	qʷ		ʔ	ʔʷ
	voiced	b	d				(g)		gʷ					
	ejective	p’	t’				k’	kʲ’	kʷ’	q’	qʷ’			
Affricate	voiceless		t͡s		t͡ʃ					q͡χ	q͡χʷ			
	voiced		d͡z		d͡ʒ									
	ejective		t͡s’		t͡ʃ’									
Fricative	voiceless	f	s	ɬ	ʃ	ɕ	x		xʷ	χ	χʷ	ħ		
	voiced	v	z	ɮ	ʒ	ʑ	ɣ			ʁ	ʁʷ			
	ejective	f’		ɬ’		ɕ’								
Nasal		m	n											
Approximant				l			j		w					
Trill			r											

p k ʔ

h

m n

w l

		Labial	Dental/Alveolar		Postalveolar	Velar	Glottal
			central	lateral			
Click	plain		[kǀ] *c*	[kǁ] *x*	[kǃ] *q*		
	aspirated		[kǀʰ] *ch*	[kǁʰ] *xh*	[kǃʰ] *qh*		
	slack voice		[g̊ǀʱ] *gc*	[g̊ǁʱ] *gx*	[g̊ǃʱ] *gq*		
	nasal		[ŋǀ] *nc*	[ŋǁ] *nx*	[ŋǃ] *nq*		
	slack-voice nasal		[ŋǀʱ] *ngc*	[ŋǁʱ] *ngx*	[ŋǃʱ] *ngq*		
	glottalised nasal[8]		[ŋǀˀ] *nkc*	[ŋǁˀ] *nkx*	[ŋǃˀ] *nkq*		

Xhosa consonant system: 48 common consonants plus 18 clicks. The language has over 7 million speakers, including Nelson Mandela.

"A summary of the surprising facts will include at least the following: Pirahã is the only language known without numbers, numerals, or a concept of counting. ... It is the only language known without color terms. It is the only language known without embedding [putting one phrase inside another of the same type ...] It has the simplest pronoun inventory known, and evidence suggests that its entire pronominal inventory may have been borrowed."

Everett 2005:622.

Everett, Daniel L. 2005. **Cultural Constraints** on Grammar and Cognition in Piraha: Another Look at the Design Features of Human Language. Current Anthropology 46.621-46.

Evans, Nicholas & Stephen Levinson. 2009. The **Myth of Language Universals**: Language diversity and its importance for cognitive science. Behavioral and Brain Sciences 32.429-92.

Chao, Y.R. 1968.
A Grammar of Spoken Chinese.

- divides measure words into 9 groups, starting with a group of measure words he calls classifiers, Mc.
- Chao lists 51 Mc's in his book for Putonghua. To exemplify with animals, the Mc for horse is *pi*, for dog is *zhi*, for cow is *tou,* for fish is *tiao*. To exemplify with furniture, the Mc for door is *shan*, for chair is *ba*, for bed is *zhang*, for mirror is *mian*.
- there is considerable variation among Chinese dialects as well as across individuals. Instead of Putonghua 條 *tiao* for fish, for instance, the Mc in Taiwanese Min is 尾 *bue*^{2}. The Mc for tree is 棵 *ke* in Putonghua, *po*^{1} in Hong Kong Cantonese, and *tsang*^{5} in Taiwanese Min.

Yip, Virginia & Stephen Matthews. 2007.
The Bilingual Child: Early Development & Language Contact . Cambridge U. Press.

*"Santa Claus bei^{2} lei^{5} **go^{3}** coeng^{1} le^{1}?"*

Where is the gun Santa Claus gave me?

Timmy [2;08;25]

"Here the child appears to use the default classifier go^{3} for coeng^{1} 'gun', where adult Cantonese would use a more specific classifier such as zi^{1} or baa^{2}**."** *p.187.*

Concord in Swahili
from H.A.Gleason, Jr.

Class 1 noun:

Mtu mzuri mmoja yule ameanguka.

Person good one that fell down.

Watu wazuri wawili wale wameanguka.

Class 4 noun:

Kikapu kizuri kimoja kile kimeanguka.

Basket good one that fell down

Vikapu vizuri viwili vile vimeanguka.

0- *The dog$_1$ chased$_1$ the cat.*
1- *The dog$_1$ the horse$_2$ kicked$_2$ chased$_1$ the cat.*
2- *The dog$_1$ the horse$_2$ the farmer$_3$ bought$_3$ kicked$_2$ chased$_1$ the cat.*
3- *The dog$_1$ the horse$_2$ the farmer$_3$ the girl$_4$ married$_4$ bought$_3$ kicked$_2$ chased$_1$ the cat.*

The cat was chased$_1$ by the dog$_1$ that was kicked$_2$ by the horse$_2$ that was bought$_3$ by the farmer$_3$ that the girl$_4$ married$_4$.

Cross-serial dependencies

Peter$_1$, Paul$_2$, and Mary$_3$ are our cook$_1$, driver$_2$, and instructor$_3$ respectively.

… omdat ik$_1$ Cecilia$_2$ Henk$_3$ da nijlpaarden zag$_1$ helpen$_2$ voeren$_3$.

… because I saw Cecilia help Henk feed the hippo.

Bach, E. et al. 1986. Crossed and nested dependencies in German and Dutch: A psycholinguistic study. Language and Cognitive Processes 1.249-62.

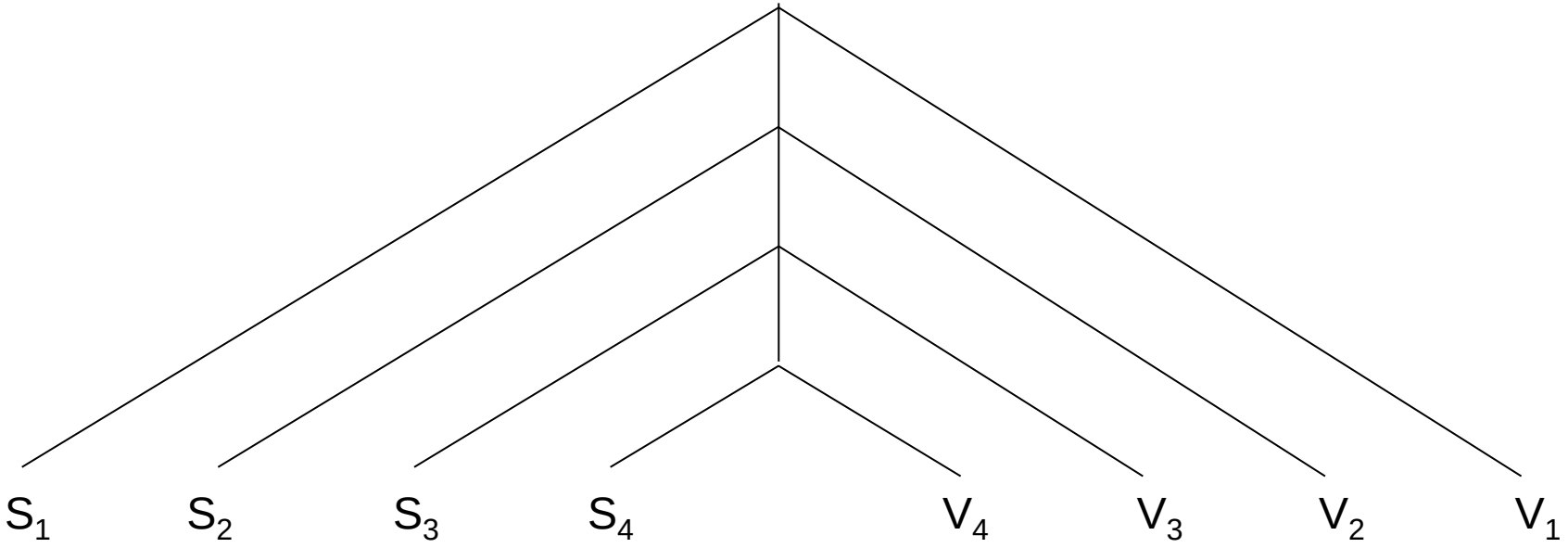
(1) Center embedding:

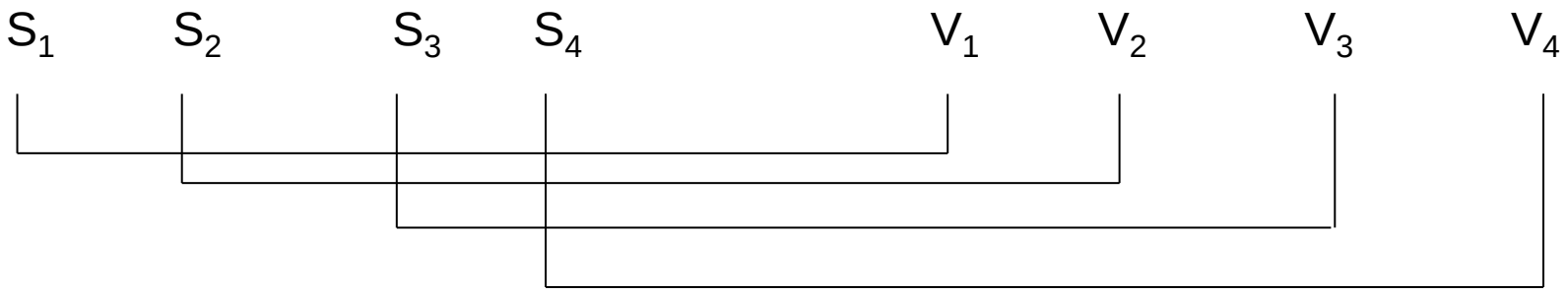
$$\begin{array}{ccccc} (& S_4 & .. & V_4 &) \\ & (& S_3 \quad .. & V_3 &) \\ & & (\; S_2 \quad .. & V_2 &) \\ & & (\; S_1 \quad .. & V_1 &) \end{array}$$

(2) Cross-serial dependency:

$$\begin{array}{ccccc} (S_1 & .. & V_1) & & \\ & (S_2 & .. & V_2) & \\ & & (S_3 & .. & V_3) \\ & & & (S_4 & .. \quad V_4) \end{array}$$

Two types of syntactic discontinuity





"The universality and the diversity of speech lead to a significant inference. We are forced to believe that language is an ***immensely ancient*** *heritage of the human race, whether or not all forms of speech are the historical outgrowth of* ***a single pristine form****. It is doubtful if any other cultural asset of man, be it the art of drilling for fire or of chipping stone, may lay claim to a greater age. I am inclined to believe that it antedated even the lowliest developments of material culture, that these developments, in fact, were not strictly possible until language, the tool of significant expression, had itself taken shape."*

Sapir 1921:23.

Deacon, Terrence W. 1997. The Symbolic Species: the Co-evolution of Language and the Brain. New York: W.W. Norton.

Stringer, Chris B. 2012. The Origin of Our Species: Penguin.

Hockett, C.F. 1978. In search of Jove's brow. American Speech 53.243-313.

Monogenesis vs. Polygenesis

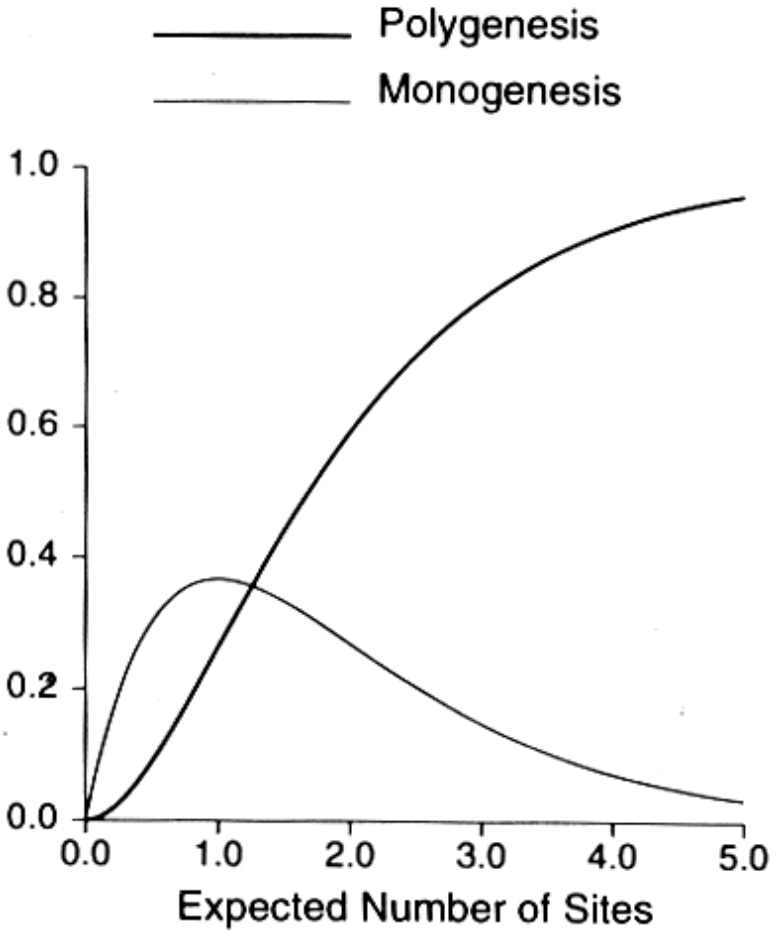


Fig. 1. Poisson model for language emergence. The heavier curve shows the probability of polygenesis; the lighter curve, monogenesis. Probability is a function of the expected number of sites at which language emergence (horizontal axis).

Freedman, D.A. & W.S-Y. Wang. 1996. Language polygenesis: a probabilistic model. *Anthropological Science* 104.2.131-8.

Coupé, Christophe & Jean-Marie Hombert. 2005. Polygenesis of linguistic strategies: a scenario for the emergence of languages. *Lanaguage Acquisition, Change, and Emergence*, ed. by J.W. Minett & W.S.-Y. Wang, 153-201: City University of Hong Kong Press.

"Someone was drawing water and my teacher placed my hand under the spout. As the cool stream gushed over one hand she spelled into the other the word 'w-a-t-e-r', first slowly, then rapidly. I stood still, my whole attention fixed upon the motions of her fingers. Suddenly I felt a misty consciousness as of something forgotten–a thrill of returning thought; and somehow the mystery of language was revealed to me. I knew then that "w-a-t-e-r" meant the wonderful cool something that was flowing over my hand. That living word awakened my soul, gave it light, hope, joy, set it free!"

Helen Keller 1905.

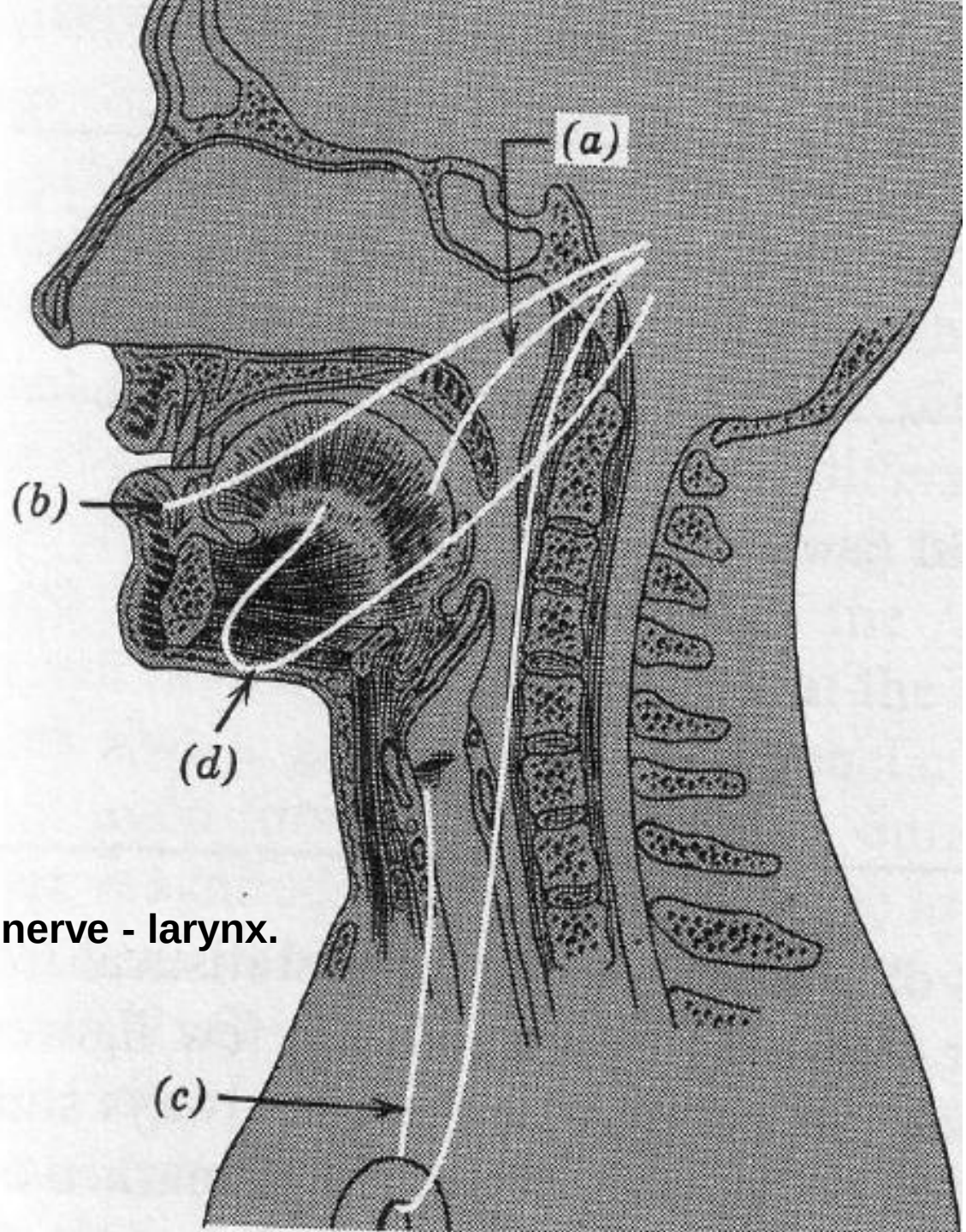
"Physiologically, speech is an ***overlaid function****, or, to be more precise, a group of overlaid functions. It gets what service it can out of organs and functions, nervous and muscular, that have come into being and are maintained for very different ends than its own."*

Sapir 1921:9.

Jacob, François. 1977. Evolution and Tinkering. *Science* 196.1161-66.

Gould, Stephen Jay & Elizabeth S. Vrba. 1982. Exaptation - a missing term in the science of form. *Paleobiology* 8.4-15.

Lenneberg, E.H. 1967:95. <u>Biological Foundations of Language</u>.



a: branch of trigeminal – jaw.

b: branch of facial – lips.

c: branch of vagus, recurrent nerve - larynx.

d: hypoglossal – tongue.

Jürgens, Uwe. 2002.
Neural pathways underlying vocal control.
Neuroscience & Biobehavioral Reviews 26.235-58.

Wang, W.S-Y. 2008.
王士元。宏觀語音學. *中國語音學報* 1.1-9.

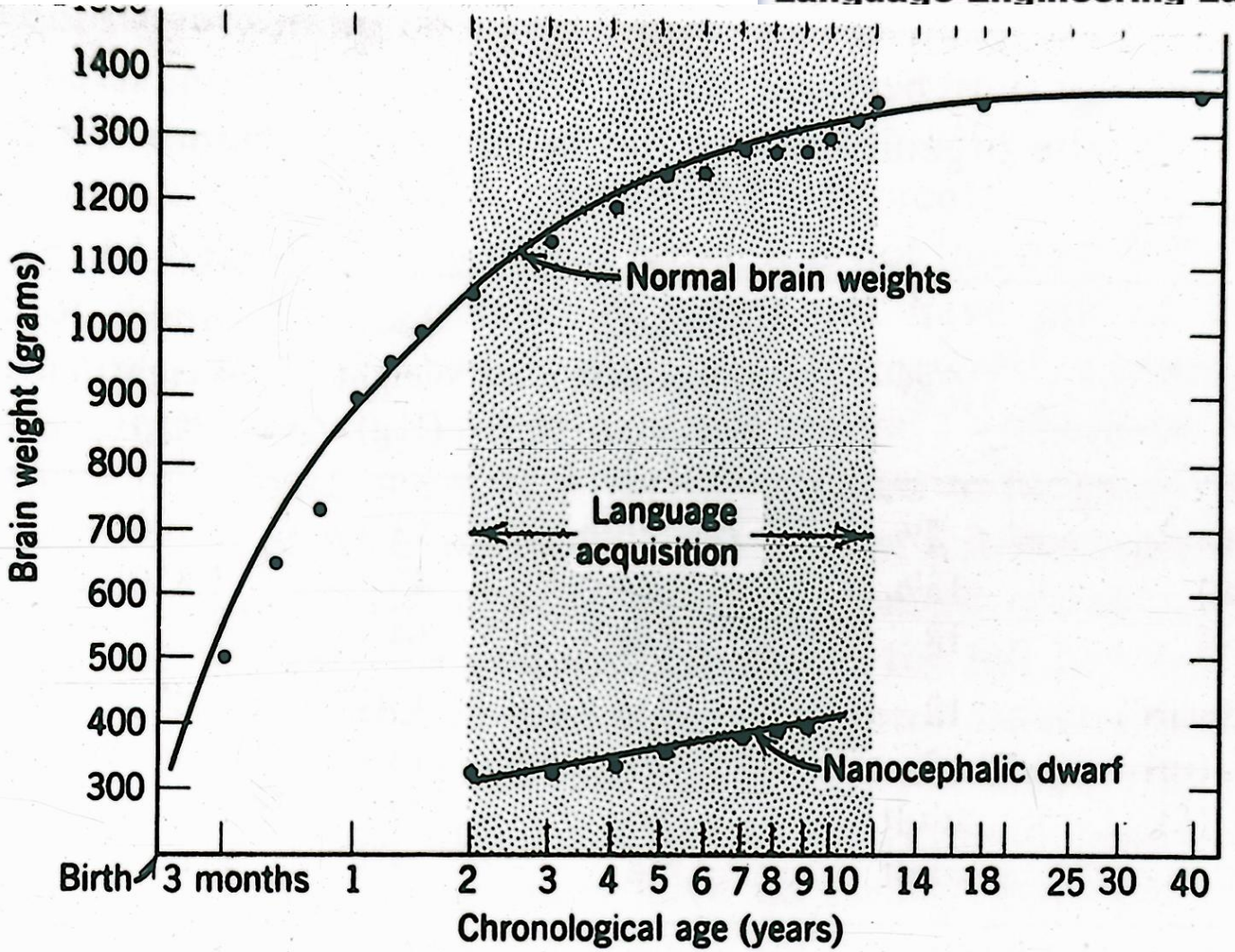
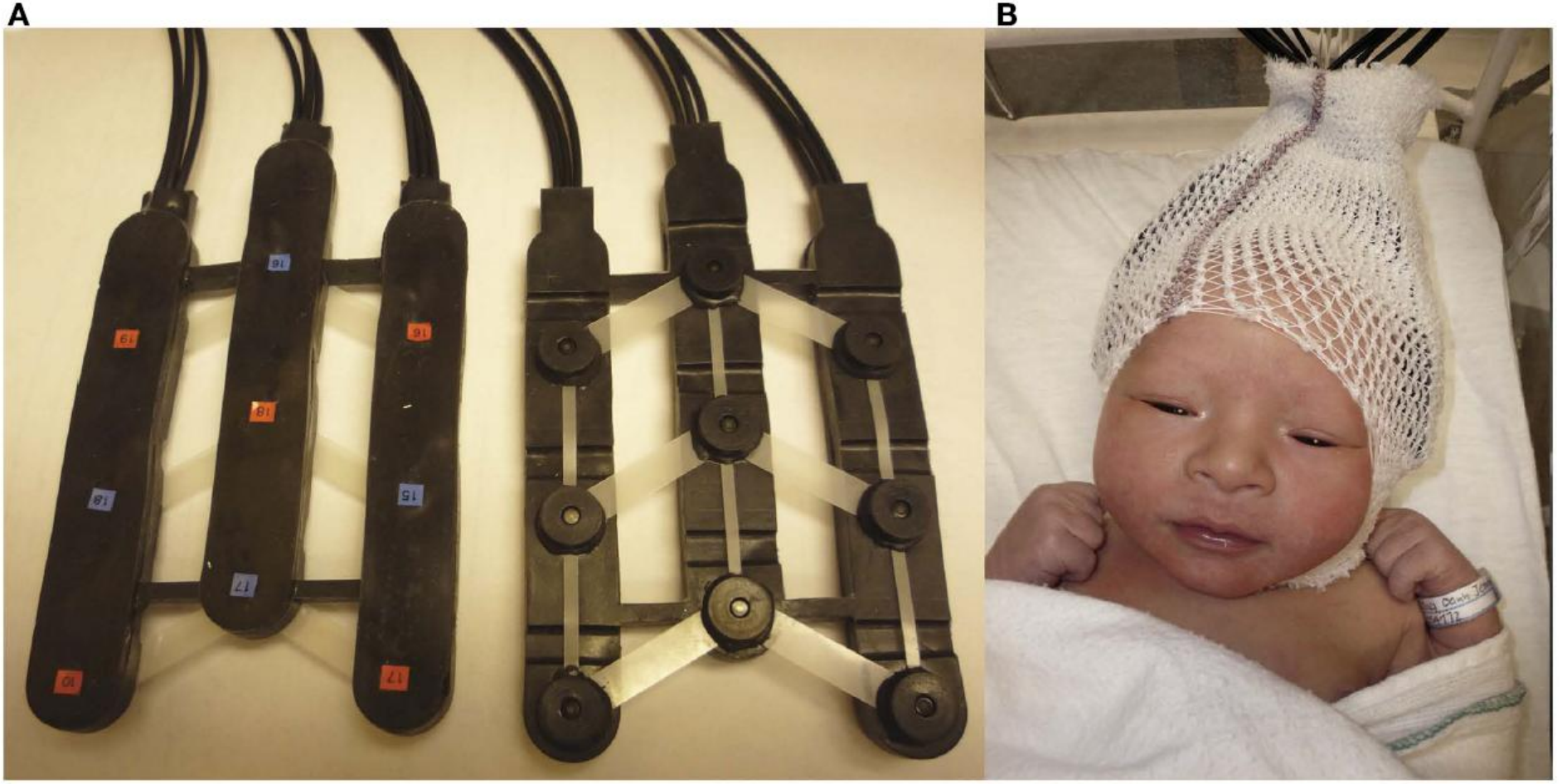


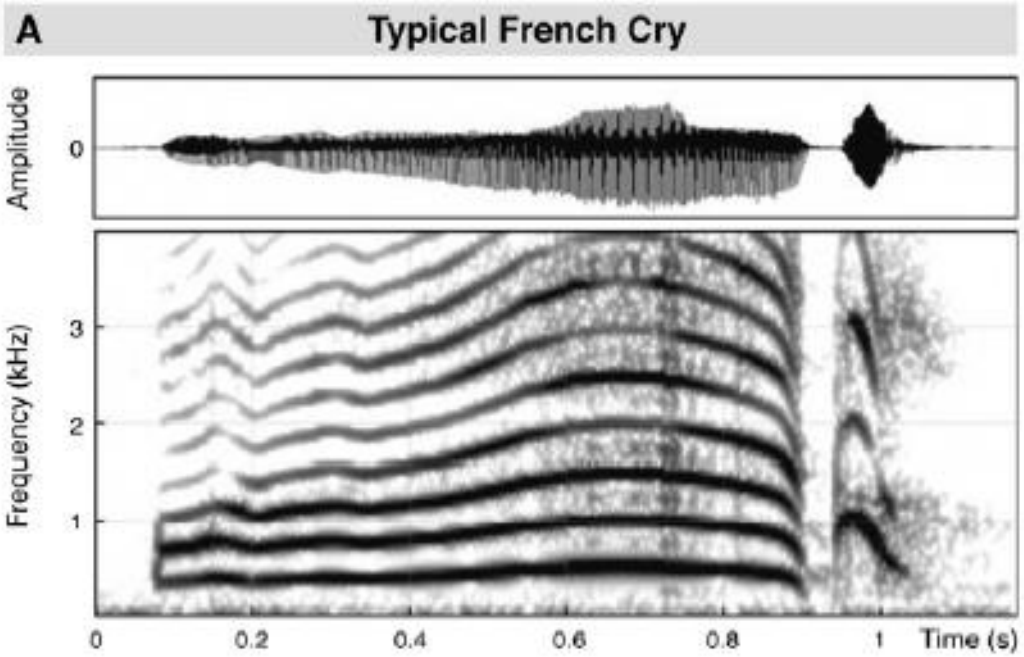
FIG. 2.25. Brain weights determined at autopsy plotted as function of patients' chronological age; data from Coppoletta and Wolbach (1933). *Bottom plot:* various measurements of head-circumference of patient described by Secker (1960), converted to estimates of brain weight.

May et al. 2011. Language and the newborn brain: does prenatal language experience shape the neonate neural response to speech? *Frontiers in Psychology* Article 222.

"…*The peripheral auditory system is mature by* 26 weeks *gestation, and the properties of the womb are such that the majority of* low-frequency sounds *(less than 300Hz) are transmitted to the fetal inner ear. The low frequency components of language that are transmitted through the uterus include* pitch*, some aspects of* rhythm*, and some phonetic information ... Fetuses respond to and discriminate speech sounds. Moreover, newborn infants show a preference for their* mother's voice *at birth ... Finally, ..., newborn infants born to monolingual mothers prefer to listen to their* native language *over an unfamiliar language from a different rhythmical class...."*

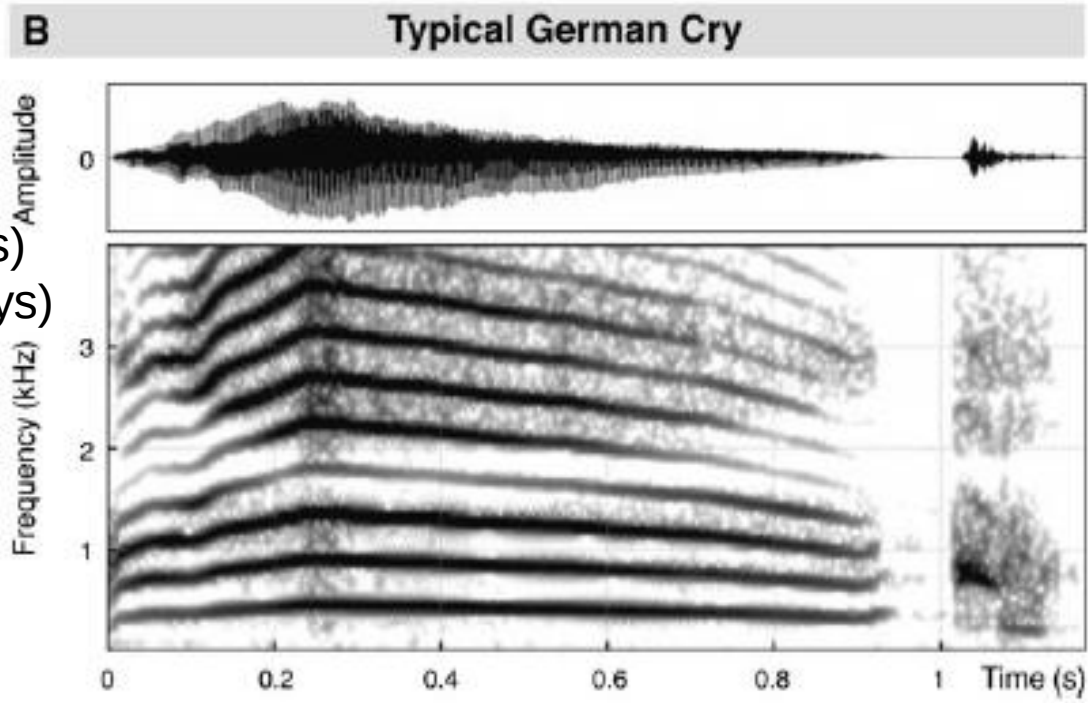


May, L., K. Byers-Heinlein, J.Gervain & J.F.Werker. 2011. Language and the newborn brain: does prenatal language experience shape the neonate neural response to speech? *Frontiers in Psychology* 2.Article 222.
12 NIRS probes per hemisphere, 20 monolingual neonates 0 – 3 days old. English and Tagalog, played forward and backward.



Mampe, B. et al. 2009. Newborns' Cry Melody Is Shaped by Their Native Language. Current Biology 19.1994-7.

30 French (11 female; range 2–5 days)
30 German (15 female, range 3–5 days)



Kuhl, P.K. 2004. *Nature Reviews Neuroscience*.

Foreign phonetic test:

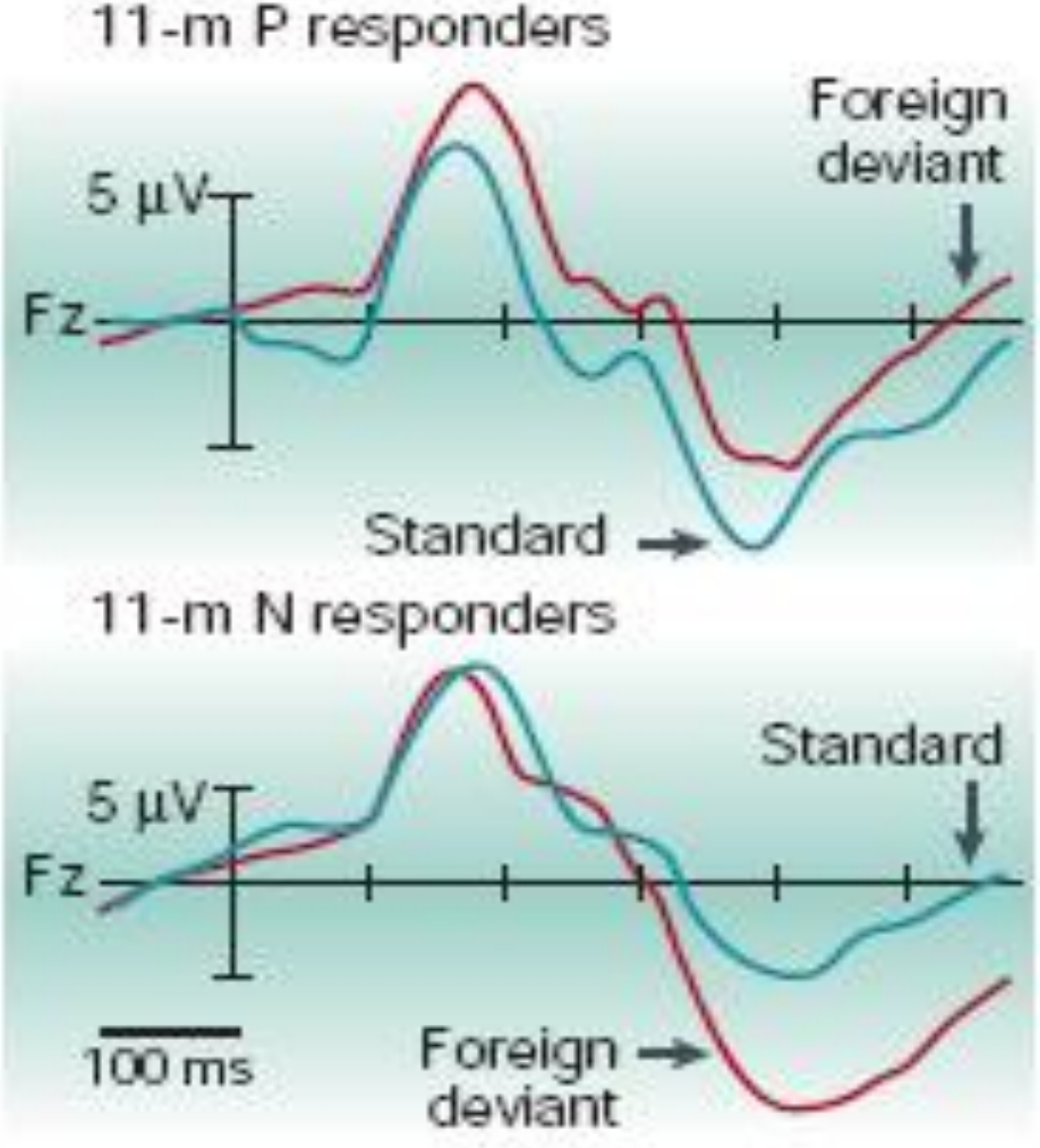
'ta-ta-ta-DA' (Spanish)

English listeners hear the Spanish syllable 'ta' as 'da'

Native contrast:

'da-da-da-$T^{H}A$' (English)

Reponses to foreign contrast at 11 months of age



Kuhl, P. K., et al. 2008.
Phonetic learning as a pathway to language. *Phil. Trans. R. Soc.* B 363.979–1000.

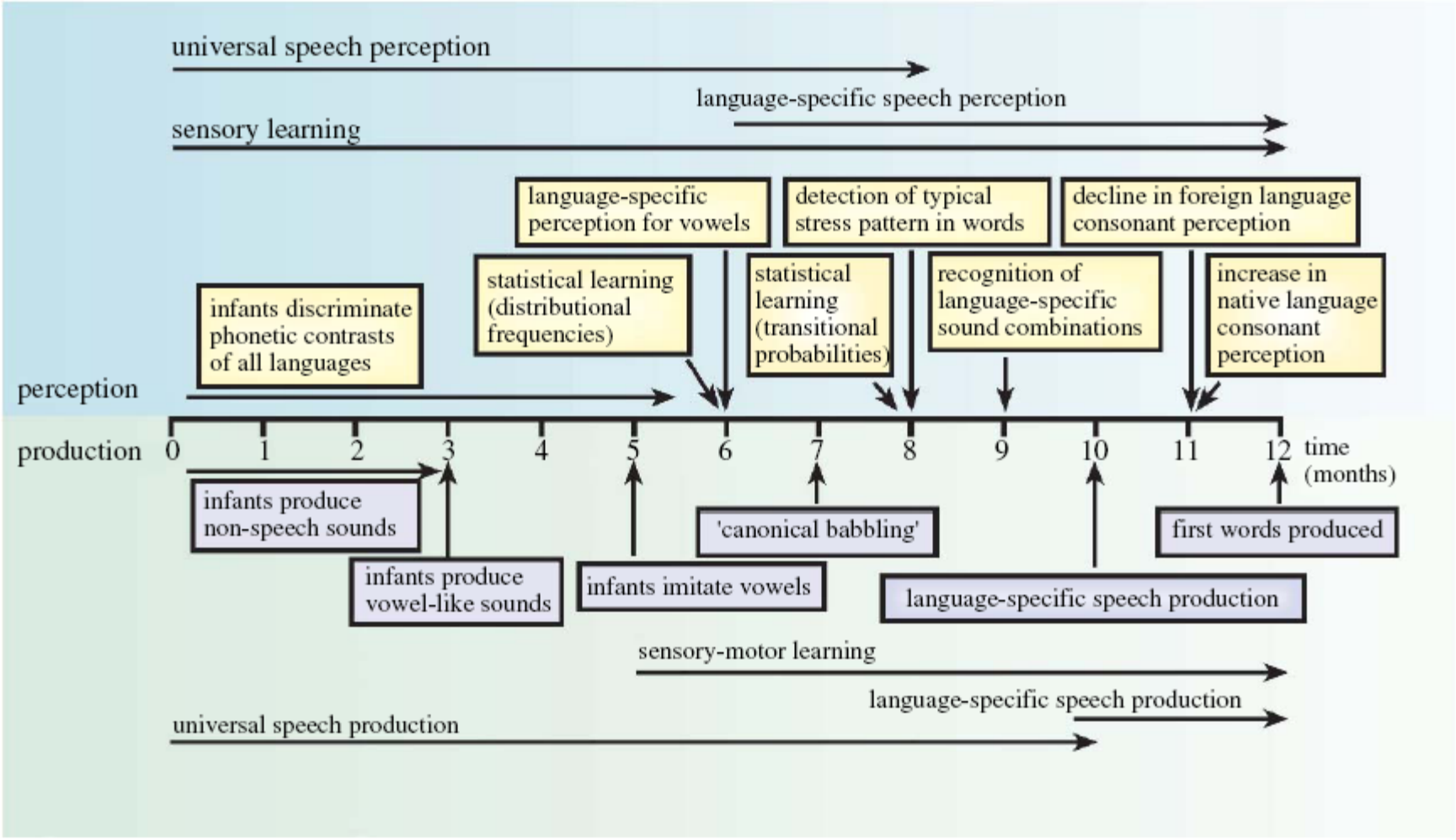


Figure 1. Universal timeline of infants' perception and production of speech in the first year of life. Modified from Kuhl (2004).

Saffran, J.R., et al. 1996. Statistical Learning by 8-Month-Old Infants. *Science* 274.1926-28.

tupirogolabubidakupadoti

padotibidakutupirotupiro

golabubidakupadotigolabu

bidakutupirogolabupadoti

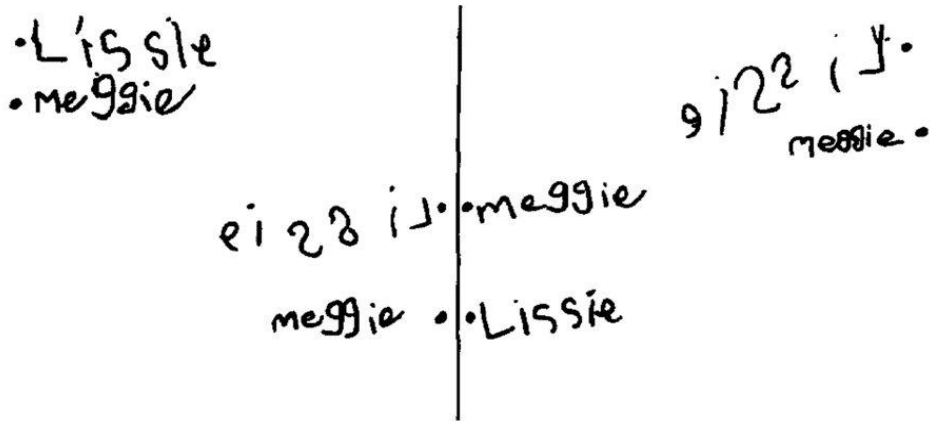
Saffran, J.R., et al. 1996. Statistical Learning by 8-Month-Old Infants. *Science* 274.1926-28.

tupirogolabubidakupadoti

padotibidakutupirotupiro

golabubidakupadotigolabu

bidakutupirogolabupadoti



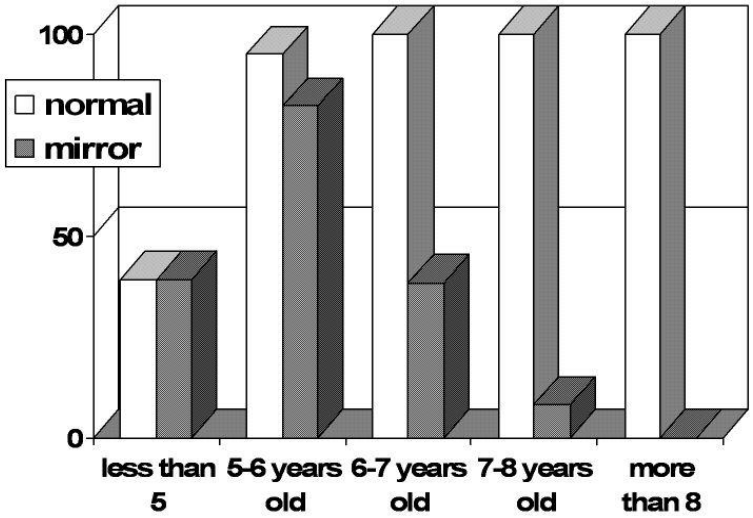


Figure 7.1. Most children go through a “mirror stage” during which they tend to confuse left and right when they read and write. As a simple demonstration, James Cornell asked two sisters to write their names next to a black dot. Whenever there was not enough space for normal left-to-right writing, Lissie, who was five, spontaneously wrote her name in mirror image, from right to left. Meggie however, who was six, always wrote her name in the right direction (after Walsh et Butler, 1996). As the bottom graph shows, almost all children, around the age of five, go through a stage where they seem to be equally competent at writing in both directions (data from Cornell, 1985).

Dehaene, S. 2009.

Reading in the Brain.

Penguin Viking.

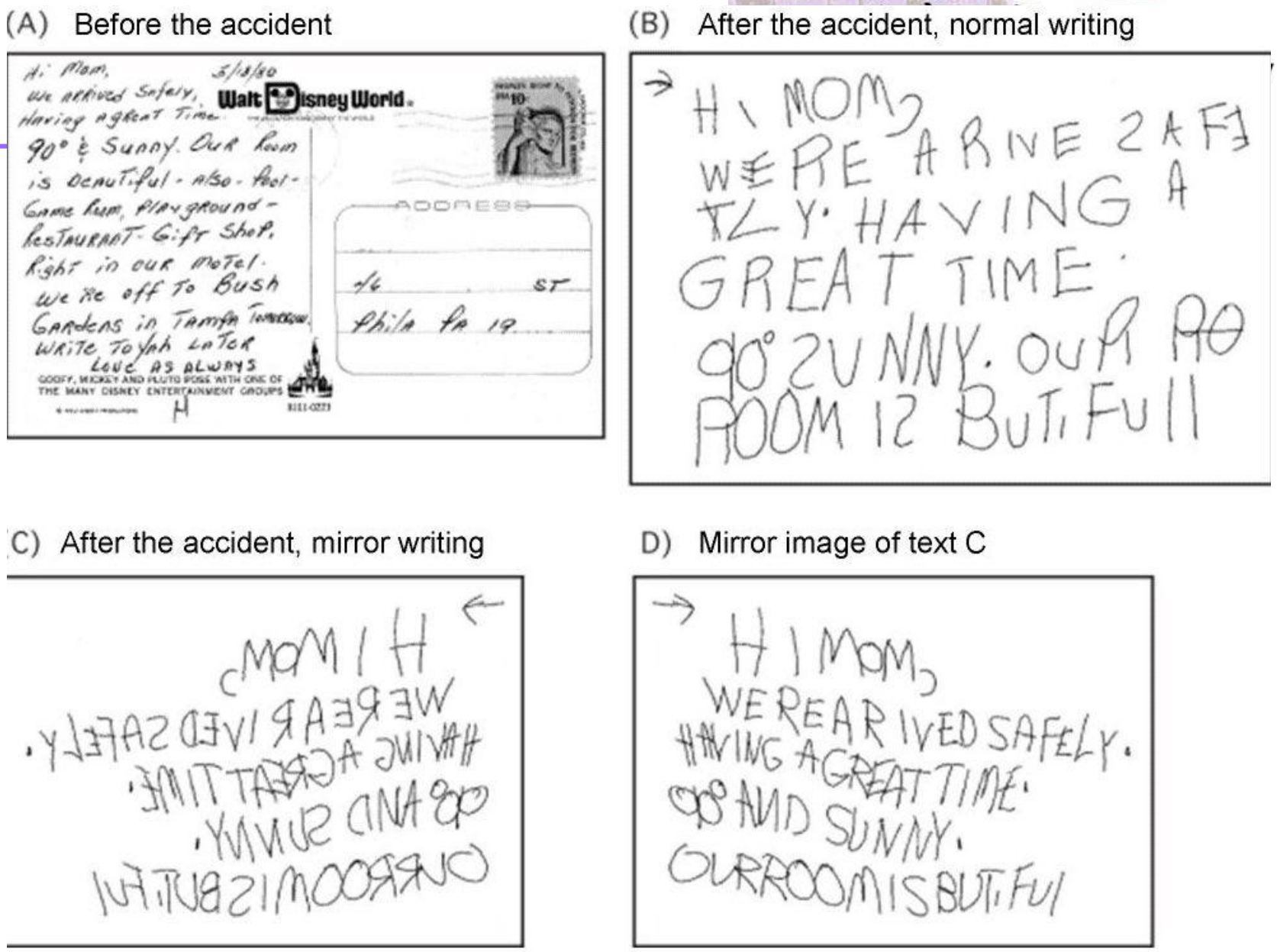
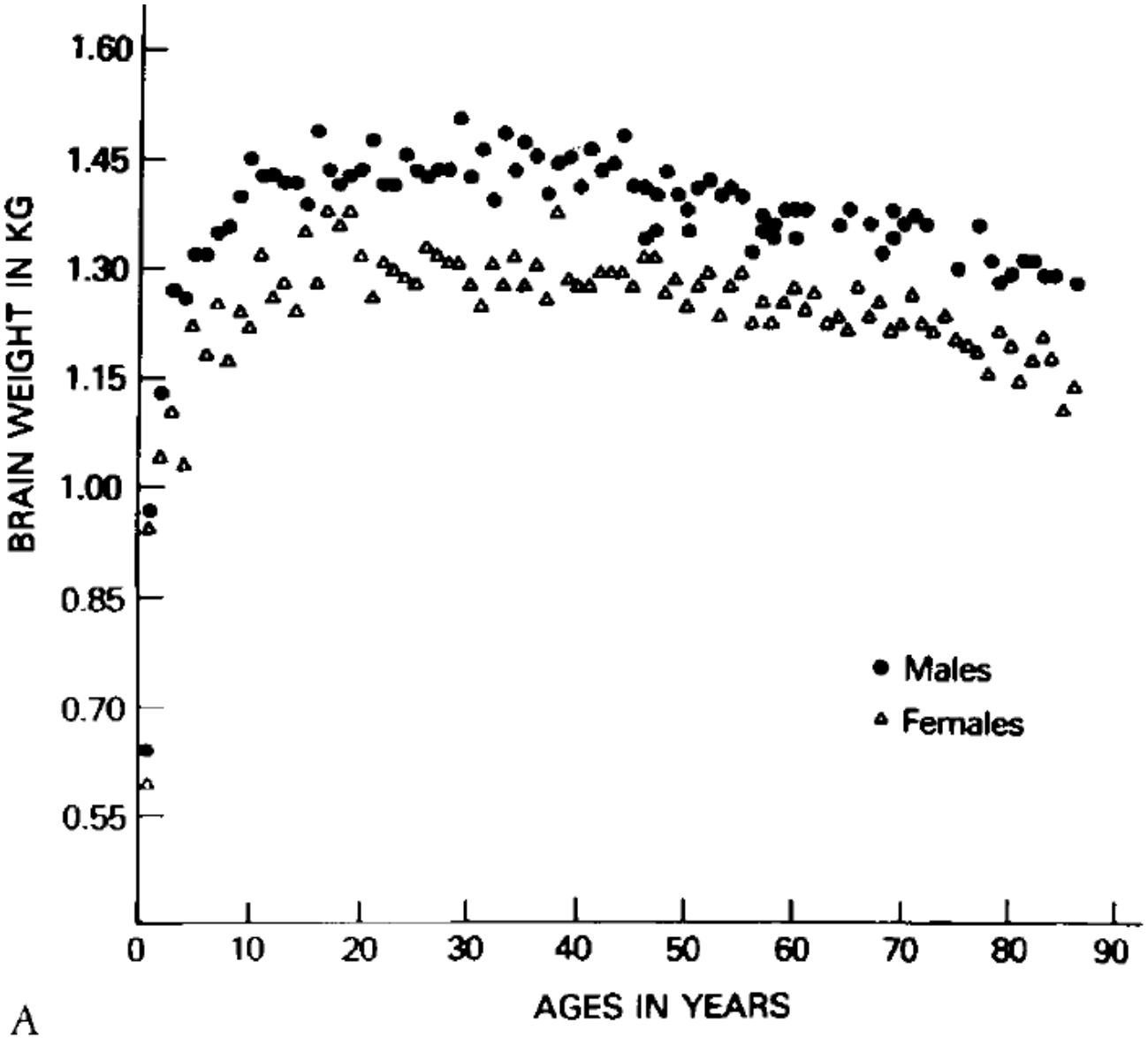
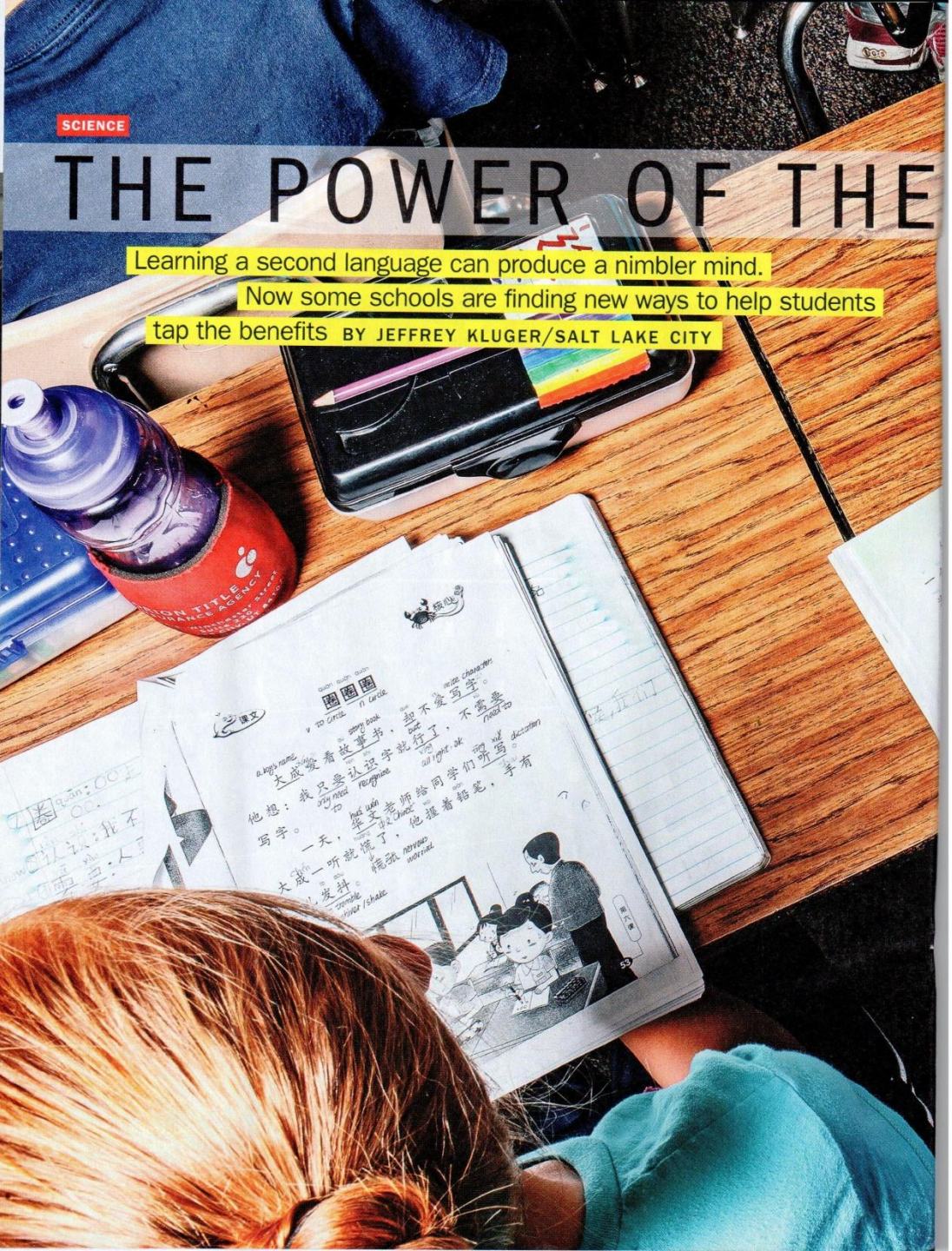


Figure 7.7. Some patients with brain lesions suddenly start to read and write in mirror image. The figure shows writing samples of patient H.N., before and after her car accident (after Gottfried et al., 2003)

Dekaban, A.S. & D. Sadowsky. 1978. Changes in brain weights during the span of human life: Relation of brain weights to body heights & body weights. *Annals of Neurology* 4.345-56.



Scattergram of means of brain weights at actual age in 2773 males and 1963 females between birth and 86+ years.



THE POWER OF THE BILINGUAL BRAIN

TIME

2013.7.29

We began by referring to an issue which deeply divided the two co-discoverers of the theory of evolution: **whether human language could have arisen by natural selection**. A century and half of linguistic research since Darwin's Origin of Species, we now have a much better idea of what human language is like. Against the background of their controversy, we briefly surveyed **the range of variation** that can be seen in modern languages, **both in their phonological systems and morphosyntactic systems**. We see that languages are quite diverse in their structures, and repeated Sapir's observation that there is no necessary correlation between the complexity of a language and the complexity of the culture in which the language is embedded.

We further suggested that **language emerged polygenetically**, perhaps as early as 2 million years ago at some sites, that the emergence of language may be marked by the all important insight of **symbolization**, and that an important landmark along the evolutionary trajectory is the development of **segmental phonology**. We then briefly discussed the biological foundations of speech production and perception, noting that language influences can be traced even to fetal life, since the peripheral auditory system is mature by 26 weeks gestation.

Given the impressive advances recently made in cognitive neuroscience, we should explore their potential contributions toward **deepen our understanding of language acquisition, learning, and teaching** on the one hand, and **language disorders, impairment, and loss on the other**. It is hoped that research on language within a broad multi-disciplinary framework will be not only intellectually exciting, but also of concrete benefit within the applied contexts of education and medicine.

Thank you !

謝謝 !