Development

Linguistic ability and early language exposure

For more than 100 years, the scientific and educational communities have thought that age is critical to the outcome of language learning\(^2\), but whether the onset and type of language experienced during early life affects the ability to learn language is unknown. Here we show that deaf and hearing individuals exposed to language in infancy perform comparably well in learning a new language later in life, whereas deaf individuals with little language experience in early life perform poorly, regardless of whether the early language was signed or spoken and whether the later language was spoken or signed. These findings show that language-learning ability is determined by the onset of language experience during early brain development, independent of the specific form of the experience.

The ability to learn language, whether spoken or signed, declines with age\(^4\). How the onset and type of the initial language experience contributes to this critical-period phenomenon is unclear. This question cannot be investigated by studying hearing individuals only, because the factors of age and experience are inseparable in these individuals — all hearing babies experience language from birth. But the question can be investigated by studying individuals who were born deaf, because they often do not experience any language until they are enrolled in special programmes\(^5\). We therefore compared the language-learning capacities of deaf and hearing individuals as a function of early language experience.

We first investigated whether early experience of a spoken language could facilitate subsequent learning of a signed language. We tested two groups of adults who had learned American Sign Language (ASL) at school between the matched ages of 9 and 15 years and who had used it for over two decades. One group (\(n = 9\)) was born hearing, had experienced spoken English in early life, and had later learned ASL after becoming profoundly deaf (> 90 decibels) as a result of viral infection; the second group (\(n = 9\)) was born profoundly deaf and had had little experience of language before being exposed to ASL in school (auditory speech-perception abilities were at chance levels even with hearing aids). Deaf adults who had little experience of language in early life showed low levels of ASL performance; in contrast, late-deafened adults showed high levels of ASL performance (Fig. 1; paired \(t = 4.17\); d.f.; \(B < 0.0001\)).

We next investigated whether early experience of a signed language facilitates subsequent learning of a spoken language. We tested three groups of adults who had learned English in school at comparable ages between 4 and 13 years and who had used it for over 12 years. One group (\(n = 14\)) was born profoundly deaf and had little language experience before being exposed to ASL in school; the second group (\(n = 13\)) was born profoundly deaf and had experienced ASL in infancy; the third group (\(n = 13\)) was born hearing and had experienced various spoken languages in infancy (Urdur, French, German, Italian or Greek). Deaf and hearing adults who had experienced either a signed or spoken language in early life showed similarly high levels of performance on the later learned language, English, whereas deaf adults who had little experience of language in early life showed low levels of performance (Fig. 1; \(F_{3,37} = 11.32\), \(P < 0.0001\)).

Our results show that the ability to learn language arises from a synergy between early brain development and language experience, and is seriously compromised when language is not experienced during early life. This is consistent with current knowledge about how experience affects visual development in animals\(^6\) and humans\(^7\), and about learning and brain development in animals\(^8,9\). The timing of the initial language experience during human development strongly influences the capacity to learn language throughout life, regardless of the sensorimotor form of the early experience.

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