



Fig. 1 Map of Iceland, showing the smoothed position of the upper edge of the steep insular slope off the eastern half of the island, and a major basement edge inferred from marine magnetic and gravity data off southern and south-eastern Iceland^{1,2,7} to occur under shelf sediments. Both edges are indistinct between 64° and 65°N. Hatched areas: active volcanic zones in Iceland. B, D, Dredge localities.

Of the two dredge sites off western Iceland (20 km apart), one yielded six basalt boulders and six rhyolite boulders, while the other yielded 71 basalt and diabase boulders and two rhyolites. Alteration state and magnetic properties of these samples are similar to those found in lavas on shore.

At the Diönubodi dredge site 14 km off Gerpir promontory, eastern Iceland, the samples recovered were predominantly (21 out of 35) of acid and intermediate rock types, including granites, rhyolites, acid tuff, and andesites. Two samples contain epidote. The magnetic properties of this collection are also unusual: thus, nine specimens out of the 34 measured have volume susceptibilities exceeding $0.1 \text{ T A}^{-1} \text{ m}$ ($8 \times 10^{-3} \text{ G Oe}^{-1}$), compared with only 1% of the specimens in a collection from 740 Eastern Iceland basalt lavas recently measured by us.

We are confident that the Diönubodi dredge collection can only be derived from a local central volcanic complex, which also causes the large (up to 6,000 nT) magnetic anomaly⁷ observed there. It is, furthermore, difficult to explain the high proportion of acid rocks at one of the western sites without recourse to similar conditions. These findings strongly support previous hypotheses^{3,7} on the occurrence of other central volcanoes on the Icelandic shelf.

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How do children learn the meanings of verbs?

ONCE children have begun to learn their native tongue, they acquire vocabulary at a remarkable rate. An intelligent 6-yr-old is able to recognise 13,000 words, and more than double that number 2 yr later¹. According to orthodox linguistic theory, the learning of verbs and other relational terms ought to be difficult because, in addition to their meaning, they have 'selectional restrictions', which constrain the noun phrases that can occur with them². A child must learn, for example, both the meaning of the verb 'fly' and the fact that it takes subjects which are restricted to denoting moveable objects. This linguistic theory has, however, been criticised, and it may be a misleading basis for a model of language acquisition since meaning and selectional restrictions can hardly be independent³. In particular, the subjects and objects that occur with a verb might help the child to infer its meaning, and likewise the meaning of a verb might help to define its possible subjects and objects.

In order to investigate such assumptions, we provided 15 young children (mean age, 3.10 yr) with an opportunity to learn some verbs. On each trial, the experimenter told a story to one of the children and acted it out with puppets. A typical story ran as follows: 'John stepped out of the boat and the water mibbed his trousers so he went home to change into some dry clothes. The water had mibbed his trousers right through so Simon made him some hot tea. But John dropped his cup and the tea mibbed over the floor'. The novel verb, mib, has a transitive meaning similar to that of soak and an intransitive meaning similar to that of spill—there is no single word corresponding to it in English, but it always occurred with a subject noun phrase denoting a liquid. The child heard the story four times: on the first two occasions the experimenter acted it out appropriately, and on the second two occasions the child attempted to do so. As a test of what the child had learned, he or she was presented with four items unrelated to the story (for example a female doll, some orange juice in a container, a car, a ball) and asked 'Which one can mib?' Only one item—the orange juice—is in accord with the selectional restrictions of the verb. Any child who made a correct choice was retested 7–10 d later. In this retrial, only the test was carried out: the child was simply asked to pick out the item that mibbed from a new set of four.

Four different stories were devised in order to test the children's ability to acquire four sorts of verb defined in terms of their selectional restrictions: animate subject, animate object, liquid subject, liquid object. Earlier studies of children's comprehension of sentences suggested that animate subject and liquid object verbs should be easier to learn than liquid subject and animate object verbs^{4,5}. A fifth story was also used for reasons that will become apparent shortly. None of the novel verbs had any single semantic counterpart in English. They were based on five nonsense syllables, with association values of approximately 2.1 (ref 6), which were allocated to the stories in a counterbalanced way from one subject to another. Each child was individually tested with each of the stories in five separate sessions during the course of a morning. The order of presentation of the stories was randomised.

The children picked out a mean of 2.4 correct items on the five initial tests (with eight children performing significantly better than chance). There were 33% correct responses for animate subject verbs, 66% for animate object verbs, 60% for liquid subject verbs, and 46% for liquid object verbs. These differences fail to support the view that animate subject and inanimate object verbs should be easier to learn, and were not significant (Cochran's $Q = 2.42$, $P > 0.50$). A week later, the children who had responded correctly to a verb were retested with it, and the percentages of correct responses were: 76% for animate subject verbs, 66% for animate object verbs, 12% for liquid subject verbs, 28.5% for liquid object verbs. The animate

verbs were significantly better retained than the liquid verbs (Fisher–Yates exact probability, $P = 0.01$, on the assumption that all the data were independent).

Selectional restrictions probably involve an inference about whether a particular referent is a possible subject of a verb, and so on⁷. Hence, in the case of a sentence such as, ‘The Smiths saw the Rocky Mountains flying to California’, a child who lacks some pertinent general knowledge about mountains or relative motion will be unable to make the required inference and may well conclude that the Rocky Mountains were flying. In order to test this hypothesis, a fifth story was constructed with a nonsense verb that selects subjects capable of movement. As a test of what had been acquired, the children were asked to act out two sentences: ‘Jane saw the boat gebbing towards the ball’, and ‘John saw the house gebbing towards the park’. Their initial performance was 93% and 33% correct, respectively. When we retested the successful children a week later, performance was 100% and 50% correct, respectively. Evidently, it was easy for the children to learn that the subject of the nonsense verb denoted something that moved, but few children made the intended interpretation of the second test sentence. Its syntax suggests that the house is the entity that gebs and, in fact, 10 subjects attempted to move the house. They did not infer that the house cannot move with respect to the park. One subject, however, put the doll in front of the house with his hands in the air and explained: ‘He’s stopping the house from gebbing to the park’.

At least half the children learned something about the selectional restrictions on verbs from the stories they heard, which suggests that this experimental procedure is useful. But it does provide two clues to the meanings of the verbs: the accompanying actions and the linguistic context. A second study was accordingly carried out in which 14 children (mean age 4.3 yr) merely listened to the stories (4 times), which were not accompanied by any actions. Performance on the initial tests corroborated the results of the previous study: 11 subjects made two or more correct responses which, overall, were very evenly distributed across the four sorts of verb. There was also no significant difference, however, between the verbs on the retest a week later.

Young children are evidently capable of picking up incidental information about a variety of different sorts of verb. In previous studies of comprehension, selectional information has often been uncontrolled. For example, it has been found that 5-yr-olds tend to answer the question, ‘Is this doll easy to see?’, as though the doll were the subject of the verb. It remains unclear whether the response reflects a genuine syntactic bias⁸ or merely the fact that the major selectional restriction of the verb clearly points to an entity with eyes.

Our results suggest that children are sensitive to whatever cues are available to meaning. They readily pick up selectional information about both animacy and liquidity. With hindsight, it might be odd if this tacit skill were exercised to a significantly different extent with such familiar concepts. Their ability to retain newly acquired knowledge may, however, depend on its nature and on the sort of experience leading to its acquisition. The answer to our question does, indeed, seem to be that children learn the meanings of verbs rapidly, without their attention being deliberately drawn to them, and often in circumstances where the major cue is the selectional information provided by the sentence as a whole.

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Adoption study supporting genetic transmission in manic–depressive illness

COMPARISON of adoptive parents of persons with a psychiatric disorder with their biological parents provides a unique opportunity to separate the interacting aetiological roles of heredity and environment. We have conducted such a study in manic–depressive illness; the results strongly support the importance of genetic factors in the transmission of this disorder.

A genetic vulnerability to manic–depressive disorder has been demonstrated by family, twin, and linkage studies^{1–4}. To our knowledge, this is the first report of an adoption study of affective illness, but research involving adoptive families has been done for schizophrenia and other psychiatric disorders^{5–10}. Our investigation was carried out in Belgium because adoptive registers are available there, and the adoption agencies were willing to help us to obtain subjects.

Our subjects were the adoptive and biological parents of manic–depressive adoptees. There were three sets of controls: (1) the parents of manic–depressives who were not adoptees; (2) the adoptive and biological parents of normal adoptees, and (3) the parents of individuals who had contracted poliomyelitis during childhood or adolescence. This last group was designed to control for the effect on parents of bringing up a disabled child.

The group of affected offspring (that is, manic–depressive adoptees) was ascertained by systematically examining the medical records of five outpatient clinics and five inpatient services in the vicinity of Brussels. All admissions during a 5-yr period (1971–1976) were reviewed. Those persons who were designated as manic–depressive and who were described as having been adopted were interviewed by one of us (J.M.) to

Table 1 Demographic characteristics of the offspring

	Index cases		Controls	
	Manic–depressive adoptees <i>N</i> = 29	Manic–depressive non-adoptees <i>N</i> = 31	Normal adoptees <i>N</i> = 22	Polio <i>N</i> = 20
Ascertainment				
Adoption Agency	—	—	12	—
Inpatient	19	17	—	—
Outpatient	10	14	—	20
Age (mean, yr)	32.41	32.35	32.00	29.25
Sex				
Male	10	9	6	5
Female	19	22	16	15
Age at adoption (mean, in months)	5.41	—	6.00	—
Age of onset (mean)	22.07	24.26	—	8.35
National origin				
Flemish	16	18	13	13
Walloon (French)	13	13	9	7
Religion				
Catholic	25	26	22	17
Protestant	4	5	0	3
Socio-economic status*				
Education (mean)	3.83	3.90	3.86	3.80
Occupation (mean)	3.90	4.00	3.95	3.80
Marital Status				
Married	16	21	16	8
Single	10	5	4	12
Divorced	3	5	1	0
Separated	0	0	1	0

* Hollingshead–Redlich scale¹³.