Modularity and Modality in 'Second' Language Learning: The Case of a Polyglot *Savant*[*]

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Smith, Neil. 2003. **Modularity and Modality in 'Second' Language Learning: The Case of a Polyglot *Savant*.** *Korean Journal of English Language and Linguistics* 3-3, 411-426. I report on the case of a polyglot 'savant' (C), who is mildly autistic, severely apraxic, and of limited intellectual ability; yet who can read, write, speak and understand about twenty languages. I outline his abilities, both verbal and non-verbal, noting the asymmetry between his linguistic ability and his general intellectual inability and, within the former, between his unlimited morphological and lexical prowess as opposed to his limited syntax. I then spell out the implications of these findings for modularity. C's unique profile suggested a further project in which we taught him British Sign Language. I report on this work, paying particular attention to the learning and use of *classifiers*, and discuss its relevance to the issue of modality: whether the human language faculty is preferentially tied to the oral domain, or is 'modality-neutral' as between the spoken and the visual modes.

Key Words: modularity, modality, *savant* syndrome, British Sign Language, classifiers

A savant is someone who has an island of exceptional talent in an ocean of disability; the standard example is the character 'Rainman', played by Dustin Hoffman in the film of that name. Savants may have a variety of different talents: calendrical calculating, the ability to draw magnificent pictures despite serious intellectual disability or

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[*]All my work on C has been done in collaboration with Ianthi Tsimpli and, more recently, Gary Morgan and Bencie Woll. We were originally introduced to C by Neil O'Connor who had already studies him with Ati Hermelin. I am indebted to all of them for their input and hereby absolve them from any blame for what I have done with our joint work. Our research on C has been supported over many years by the Leverhulme Trust under grant number F.134AS.

spasticity, a genius for music, and so on. The conventional wisdom is that savants are severely language impaired: "their skills, however many they have, do not include the acquisition of language" (Treffert, 1989:9). That wisdom is wrong. For the last dozen years my colleagues and I have been studying a polyglot 'savant', Christopher (henceforth 'C' see Smith & Tsimpli, 1995, and references therein; Morgan et al, 2002a,b,c; Tsimpli & Smith, 1998).

C, now 41 years old, is a right-handed, native English speaker, who lives in sheltered accommodation as he cannot look after himself. He avoids eye-contact, he rarely initiates conversation, he is severely apraxic (doing up buttons is a serious chore for him), and he is mildly autistic. The basis for this latter claim is that he fails some false-belief tasks (Sally-Anne): that is, he appears to be unable to attribute to others a mental representation which is at variance with reality. The diagnosis is not entirely clear-cut, as he passes other such tests (Smarties), but in these, encyclopaedic information appears to play a crucial role (see Tsimpli & Smith, 1998). As a further indication of his intellectual ability, it is striking that he is inconsistent in conservation of number tasks, sometimes passing and sometimes failing them; and he cannot master a non-losing strategy for Noughts and Crosses (tic-tac-toe).

Despite such handicaps, he has some knowledge (ranging from fluency to the bare elements) of about twenty languages, including Berber, BSL, Danish, Dutch, Epun, Finnish, French, German, Modern Greek, Hindi, Hungarian, Italian, Norwegian, Polish, Portuguese, Russian, Serbo-Croat, Spanish, Swedish, Turkish, Ukrainian and Welsh. It should be noted that these languages are genetically, typologically, and orthographically heterogeneous. Most are Indo-European, but not Finnish, Hungarian, Turkish or BSL; most are SVO, but Welsh is VSO and Hindi and Turkish are SOV; most are written with the Roman alphabet, but Greek uses the Greek alphabet, Russian uses Cyrillic, Hindi uses Devanagari, and so on. It is also important to note (as must be true given the breadth of his

knowledge) that he acquires these languages extremely fast, that he is unreliable with regard to his insight into his own knowledge of many of these languages (e.g. Russian) and, like all linguists, he has considerable ability to identify languages from a cursory look at their orthographic form.

This striking combination of ability and disability can to some extent be quantified in terms of standard psychological tests, as witness the 'psychological profile' in (1):

(1) a. Raven's matrices: 75 76
[Administered at ages 14 and 32]
Wechsler Scale - WISC-R, UK 42 (performance)
[Administered at age 13.8] 89 (verbal)
Wechsler Adult Intelligence Scale (WAIS) 52 (performance)
[Administered at age 27.2] 98 (verbal)
Columbia Greystone Mental Maturity Scale: 56
[Administered at age 29.2]
Goodenough *Draw a Man Test*: 40 63
[Administered at ages 14 and 32]

b. Multi-lingual Peabody Picture Vocabulary Test, at age 28, (O'Connor & Hermelin 1991):
C scored: English 121; German 114; French 110; Spanish 89.

c. Kimura movement copy test of non-representational gesture: 7 points (29%) with his right hand and 0 with his left hand.

d. Warrington (1984): Faces: 32/50 Words: 47/50
27/50 48/50

Apart from the asymmetry which is the basic characteristic of any savant, there are other abnormal phenomena in C's profile. For instance, (1d) includes two figures, reflecting the results of a repetition of the test after a lapse of half an hour: as expected, C's face recognition got worse but, surprisingly, his word-recognition improved. We have observed this phenomenon on other tests on

other occasions, and it is clear that C present a problem for theories of memory as well as for general models of the mind.

No account of his abilities would be complete if we didn't draw attention to his very considerable general knowledge: he not only recognises the names and faces of people like Saddam Hussein, Margaret Thatcher, and Ronald Koeman, but he can immediately identify and define words like *baht*, *han'gul*, and even *tifinagh*, of whose meaning I was myself ignorant.

I have said that C's talent is language, and it is clearly essential to specify in as much detail as possible the precise nature of that talent both in English and in his numerous 'second' languages. C has normal command of English syntax, as tested in production, comprehension, and well-formedness judgments of examples including relatives, clefts, questions, negatives, *that*-trace effects, control relations, parasitic gaps, etc. His only obvious problem areas are topicalisation and dislocation, where his judgements are systematically at variance with those of other native speakers. We suspect (see Tsimpli & Smith, 1993) that these constructions crucially involve non-linguistic as well as linguistic ability: specifically, they presuppose mastery of LF′ as well as LF, where LF′ derives its properties from outside narrow syntax. C's problems with such constructions can then be attributed to a central deficit rather than a linguistic deficit, lending support to some version of the modularity hypothesis (of either Fodor, 1983, or Chomsky, 1975, 1984). Surprisingly, there is confirmatory evidence of this hypothesis from one other area, namely sequence of tenses, which also advert to LF′ and with which he also has difficulty.

It is reasonably clear that C's syntactic ability is essentially the same as that of other normal native speakers. Given the asymmetry in his psychological profile, however, one might expect that his pragmatic ability would be somewhat – or even severely – impaired. Here the results are less clear-cut and somewhat puzzling, showing surprising ability in some directions and inability in others. For instance, he can

handle the correct distribution of discourse connectives like *anyway, so,* etc.; he performs reasonably well on tasks involving Modus Ponens and similar inferential strategies; and he can happily exploit the use of Implicated Assumptions and Conclusions. Perhaps unsurprisingly, given his mild autism, he cannot use Metarepresentation (in particular, 'interpretive use' in the sense of Sperber & Wilson, 1995), and so is quite impervious to irony and metaphor, to jokes, to the use/mention distinction,to metalinguistic negation, to the use of rhetorical questions, or 'scheduling' sentences.

Given this at least partial pragmatic ability, it was somewhat surprising to see his reaction to n^{th} order approximations to English (or other languages) of the kind seen in (2). The passage in (2a) was produced by deleting blocks of n (here 5) words from a given text, leaving in the next n words, and so on. C's consistent reaction was simply to translate such passages into some other language (here French, as in (2b)) and, as can be seen from his reaction in (2c), he detected nothing wrong with it:

(2) a. The Pharaohs had enough stone to build enough papyrus, too, so there was nothing as large as floating islands. The papyrus a modest fifth of the Sphinx's length. Of the underworld of mummies and stood it made us realise what giant structures.

b. Les Pharaohs ont beaucoup de pierres pour, pour construire des papyrus, aussi, so il n'y était pas si grand comme leîle flottante. Le papyrus, un modeste quinze - cinq de le longueur du Sphinx. Et je ne sais pas.

c. NVS What did you think of that passage?
C Très bon, très bon. [Very good, very good]

This reaction is anomalous because his linguistic talent might have been expected to outweigh his limited cognitive abilities in such a linguistic domain and make him sensitive to the peculiarity. The reason is probably that C uses language not so much for

communication as for obsessive intellectual (especially lexical) satisfaction. As a result, he tends to translate like an automaton, working from left to right with little attention paid to context or relevance. Indeed, this is a reflection of a more general asymmetry within his linguistic talent: he is superb at morphology and learning new lexical items, but his syntactic ability soon reaches a plateau beyond which he seems unable to pass. Consider another 'anomalous' property of his language.

C masters the early stages of second language acquisition with consummate ease, acquiring new lexical items and morphological paradigms with no difficulty. This accounts in part for his extremely high scores on tests of 'verbal IQ', as these normally concentrate simply on vocabulary. At first sight, his ability in syntax seems comparable, but once a certain degree of complexity has been reached, his syntactic prowess stagnates. To take a specific example, consider his behaviour with '*that*-trace effects' in (e.g.) *Greek* (though the phenomenon generalised to all the relevant languages he knows). It is well-known that, despite a certain fractionation, the existence of null subjects correlates with a variety of other phenomena, such as long wh-movement and 'violations' of *that*-trace effects. Accordingly, an example like (3a) is well-formed in Greek, even though its English congener is ungrammatical, as indicated. Despite the fact that he uses null subjects in Greek appropriately, despite having been exposed over the years to dozens of relevant examples, and despite explicit teaching, C still rejects such examples (hencethe [R]), and attempts to replace them with (ungrammatical) sentences containing overt subjects as in (3b). This is anomalous because his linguistic talent is such that he might have been expected to master something so relatively elementary, but C's results in such examples were totally consistent.

(3) a. Pjos ipan oti paretithike? [R]
who-nom said-3p that resigned-3s

Who did they say resigned? cf. *Who did they say that resigned?

b. *"Pjos ipan oti aftos paretithike?"
who said-3p that he-nom resigned

As part of our investigations, we taught C two new languages under conditions where we could 'control the input'. The idea was that if we compared a rigorously controlled input to C's output, we could determine reasonably certainly what aspects of his knowledge were a function of learning, and what were due to the role of UG. The languages we chose were Berber (an Afro-Asiatic language with a rich morphology spoken in Morocco and adjacent areas) and Epun, a language we invented (Smith et al, 1993).[1)] C's reaction to Berber was enthusiastic and he rapidly mastered great swathes of the morphology and lexicon. He even leapt to the linguistically sensible conclusion that Berber was pro-drop, even though we were careful not to give him null-subject sentences in the input: presumably the effect either of UG or of parallels with other morphologically complex languages he knew. Despite his remarkable flair, his syntax, however, reached the expected plateau, with the result that he made the same kind of mistakes with Berber *that*-trace sentences as he had in Greek. His syntax seemed to be filtered through English.

The second 'new language' project to teach C Epun was prompted by a remark of Chomsky's to the effect that "knowing something about UG, we can readily design 'languages' that will be unattainable by the language faculty" (Chomsky, 1991:40). We taught C and a group of undergraduate controls a language which was perfectly 'normal' but, after a few months we began to introduce 'impossible' constructions. There were various kinds of such construction, but the most relevant were ones involving structure-independent processes. As is well-known, all rules in all languages are 'structure-dependent'

[1]For the Berber we relied heavily on Professor Jamal Ouhalla, now of University College Dublin.

such that (for example) it is impossible for any language to have a rule which involves arithmetical processes. Epun was deliberately designed to violate this condition of UG. Specifically, emphatic congeners of normal sentences in Epun are formed by the suffixation of *nog* to the third orthographic word. The hypothesis to be tested was that C would be unable to master such constructions because they are not catered for by UG, and his limited cognitive abilities would stop him solving the problem non-linguistically, whereas the undergraduates would be able to master them in virtue of their intelligence, essentially solving the difficulty like an intellectual problem. The hypothesis proved to be partly right and partly wrong: C failed as predicted, but so did the undergraduates. In a linguistic domain, the mind is apparently unable to use non-linguistic (arithmetical) devices, however simple.

On the assumption that (double) dissociation constitutes *prima facie* evidence for modularity, the various dissociations documented so far lead to the interim conclusion that C provides strong support for **modularity** (in both Fodor's and Chomsky's senses). I turn next to the question of modality and the project to teach C BSL.

It is important to emphasize that, except for the modality in which it is manifest, BSL is just another language, with the same expressive power as any other (spoken or signed) language (see Sutton-Spence & Woll, 1999). It is not related to English; it is distantly related to American Sign Language (ASL), though ASL is closer to French Sign Language than either is to BSL; and it is not a gestural system, even though there is a larger iconic component to sign languages than there is to spoken languages.

The combination of C's linguistic abilities with the visuo-spatial difficulties caused by his apraxia and autism suggested an interesting test: would his linguistic talent outweigh the disadvantages of the medium if he learned BSL? To find out, we devised a programme of research in which we monitored the learning of BSL by C and a comparator group of talented second-language learners.

On the basis of our previous work, we made a number of predictions, listed in (4):

(4) a. His knowledge and comprehension of BSL should be unaffected by his apraxia, though his autism (with its concomitant avoidance of eye-contact) might be a problem.
b. His production of BSL could be severely affected by his motor problems.
c. His ability in BSL should mirror his mixed abilities in spoken languages:
i. He should make rapid initial progress
ii. His morphology and vocabulary should be better than his BSL syntax, which should reach a plateau
iii. Syntactic properties, such as word order, that differentiate BSL from spoken English, should occasion him difficulty.

There is neither time nor space to give a full account of all the relevant linguistic properties of BSL, but the following are essential. The lexicon uses five parameters for a sign: hand-shape, location, movement, orientation of the palms relative to the body, and facial actions. Most importantly for the issue of the effects of modality, space is used in three different ways: **phonologically** (in the encoding of individual words), **anaphorically** (in the encoding of syntactic mapping: for instance, an antecedent may be picked out by a point in a particular direction), and **topographically** (to represent the spatial location and arrangement of items in the real world).

In the course of the project we investigated C and the comparator group's developing ability in five areas: Vocabulary, Negation, Questions, Agreement, and 'Classifiers', of which the most pertinent is the last. Because it raises problems in interpreting the results, it is important to note that C knows no spoken language (such as Cantonese) which makes use of classifiers, where "a classifier denotes some salient perceived or imputed characteristic of the entity to which

the associated noun refers" (Allan 1977: 285). In fact, it is not entirely obvious that the notion classifier is used identically in the literature on signed and spoken languages, and even for signed languages there is some disagreement about what precisely the term should be taken to designate (for discussion, see Morgan et al, submitted). Be that as it may, for BSL we looked at so-called 'entity classifiers', as used in sentences which describe, for example, a person walking or a pencil located on the left side of the table. The underlined word determines the handshape of the relevant classifier, where this handshape represents some spatial or geometric characteristic of the object. A number of such classifiers, using the handshapes designated as 'C', 'B', 'G' and '5', are illustrated in (5):

(5) BSL handshapes and their use as classifiers:

C

Curved object e.g. a cup, tube

B

Flat object e.g. a sheet of paper, car, table

G

Long thin upright object e.g. a person, pole

5

Object with many linear projections e.g. a tree, fence

The results of C's attempts to learn BSL were partly in accord with our predictions, but partly at variance with them. The literature on the acquisition of BSL as a second language is rather meagre, but the comparative data we were able to obtain from our controls reassures us that our conclusions are in general valid. C mastered the vocabulary of BSL within normal limits. Although his production of signs was far from elegant, his understanding in a variety of tests indicated that as with spoken languages he was making good, though not spectacular, progress. An important reason for this 'normality', rather than the prodigious talent we might have expected to see manifest, was the absence of any written representation of the sign. In the acquisition of his many spoken languages, C is heavily dependent on the existence of a written input, and there is no writing system for BSL (except a complex representational system used not by signers but only by researchers).

In the case of negation, C gradually mastered the elements of a complex system, including exhibiting some over-generalisation. In BSL negation can be marked by any or all of: facial action, a head-shake, a manual sign, and incorporation, of which the last is most interesting. One sub-class of verbs in BSL can be negated by incorporating a negative element into the sign. This class includes WANT and KNOW, but not WATCH, for instance; but C over-generalised the process, as indicated in (6a) in lieu of the correct (6b):

(6) a. * ME WATCH-NOT
'I don't watch (TV)'

b. __hs
TELEVISION WATCH
'I don't watch TV'

C's behaviour with questions was interesting for a different reason.

He gradually mastered some aspects of their syntax, but with some radical mistakes. Specifically, he made no use of facial expression, which is a necessary component of the construction in BSL and probably all sign languages. However, he had no real problem with the sign order of questions, despite its difference from that of English: in BSL the WH word occurs sentence finally. This is particularly striking in view of his difficulty with the non-standard word orders (even in English) characteristic of topic and focus constructions. This was one area where our predictions had been unduly pessimistic.

His performance on agreement phenomena was again with normal limits, in that he showed comprehension comparable to that of the controls, even though his own production of correct agreement was minimal. This contrasted markedly with the last area to be investigated: his mastery – or rather his lack of mastery – of classifiers. In this domain, even his comprehension was minimal, and he performed significantly worse than the comparator group. This behaviour cannot be attributed to any inherent complexity in the relevant signs, but rather must be a function of the need to exploit space topographically as well as anaphorically. The kind of sentence that C found difficult is illustrated in (7), where (7a) represents the sign sentence in canonical notation, (7b) illustrates the simultaneous use of space anaphorically and topographically in the signing of the main elements referred to, and (7c) provides an English gloss:

(7) a. TABLE CUP.CL-C_L PEN CL-G_C KEY CL-5-$CLAW_R$

b.



c. 'On the table there is a cup on the left, a pen in the middle and a bunch of keys on the right'

In this domain, "C's performance showed a systematic asymmetry

between classifiers and other aspects of BSL, whilst that of the controls was consistent across these different domains. C's pattern suggests a dissociation between the various cognitive components – linguistic and spatial – involved in the representation of classifiers; in particular it suggests that C has problems with features that draw on spatial cognition" (Morgan et al, submitted). This conclusion was corroborated by the results of picture identification tasks, in which the presence of topographic information consistently raised more difficulties for him than purely syntactic information.

We can draw a number of general conclusions from this part of the study, as indicated in (8):

(8) a. C treats BSL as a language.
b. His use of space is very limited.
c. His use of word-order is not as subject to English influence as expected.
d. There is a serious effect of the absence of a written input.
e. The effect of modality is, apparently, not great except insofar as the topographic use of space is concerned.

(8a) may seem banal, but given the alien nature of the modality it is not entirely trivial: he might well have reacted to the system as though it consisted simply of gestures. (8b) follows from our initial predictions: C's apraxia meant that his own manipulation of space was very constrained, but this did not in general carry over to his perception of the use of space by others. It follows that, as far as knowledge is concerned, C's competence in BSL was like that of any other second language learner at a similar stage of learning. Significantly, it was not better than the controls; probably because of (8d). The result in (8c) indicate that the filtering of second language syntax through English takes effect only in domains more abstract than that of basic word-order patterns, which C seems able to master without undue difficulty. (8e) is perhaps the most vexed conclusion,

because it is hard to determine whether C's problems with classifiers were due to his inexperience with this category in any of his spoken languages, or to the simultaneous use of space in two different ways. Nonetheless, it seems plausible to argue for the second alternative.

C had some success in unpacking the linguistic contrasts carried by classifiers in those contexts where their function was purely syntactic, and he showed some understanding of the lexical basis of classifier signs when they involved few morphemes. But once they were used for spatial – topographic – mapping, he showed very limited learning. Further evidence in support of the hypothesis that C's difficulties arose from the interface between the linguistic and the spatial comes from the results of his performance on the comprehension of different uses of classifiers. He was consistently better at understanding classifiers not involved in spatial mapping than those which made reference to some topographic map. For monolinguals, talking about space presumably involves similar requirements at the conceptual level whether the language being used is signed or spoken. C had to conceptualise the spatial relations and then extract from the specific language chosen those devices suitable for encoding this semantic representation. Yet he performed worse in mapping out the semantic relations through BSL than in any of his spoken languages. So it would seem that, for C, describing spatial relations in BSL requires him to exploit precisely those areas of cognition in which he has most deficits. The issue is, however, still open.

Finally, I would reiterate that the case of C provides – on suitable analysis – strong evidence for modularity and, if the remarks in the last paragraph are correct, some limited evidence for the modality neutrality of the language faculty.

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(Those marked with * are about C)

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received: July 4, 2003
accepted: August 28, 2003