COMPREHENSION AND PRODUCTION OF SYNTAX IN HIGH-FUNCTIONING INDIVIDUALS WITH DOWN SYNDROME*

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1. Overview of the project

This paper is an interim report on an ongoing project on the syntactic comprehension and production abilities of high-functioning individuals with Down Syndrome (DS). Our subjects are selected for their (reported) ability to read and write. The first part of the study tests comprehension of a range of syntactic constructions in English, including simple active and passive, control of the PRO subject of *tell*-type verbs and *promise*, control of adjunct PRO, and *easy-eager* constructions. An act-out task and a written forced-choice comprehension task are used. A speech sample is elicited using M. Mayer's picture book *A Boy, a Dog and a Frog.* Standardized tests are also administered: The Peabody Picture Vocabulary (PPVT) test, the Test of Auditory Comprehension of Language (TACL) and the Gates-MacGinitie reading test .

Subjects who discriminate between simple active and passive go on to a second battery of tests, which evaluate (i) performance on actional vs. non-actional passive, in an act-out task and a judgment test based on Fox and Grodzinsky (1998); and (ii) comprehension of *wh*-questions and sensitivity to adjunct islands, in a question response task taken from Goodluck, Sedivy and Foley (1992).[1] To date 15 subjects, chronological age range 11-33 years, have completed the first part of the test. Eight subjects discriminate between simple active and passive in the initial test battery, and have gone on to the second set of tests.[2] We focus here on these eight subjects' performance on the passive tests, and on the production abilities of two of the eight.

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[1] Results of the *wh*-movement experiment are reported in Eriks-Brophy, Goodluck and Stojanovic 2003.

[2] We are liberal in our definition of 'discriminate', allowing subjects to go on to the second set of tests when they had only one or two correct interpretations of the passive in the first battery.

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2. The highest functioning individuals

The chronological age of the eight subjects ranged from 11-33 years. Scores on standardized tests ranged from 6,03-12,11 (Peabody Picture Vocabulary Test) and 1.5-3.9 (Gates MacGinitie).

2.1 Passive

On the standard analysis, the passive is an example of A-movement (movement to an argument position). The direct object of the verb is moved into the empty subject position. The passive has been quite extensively s quite extensively tested in normally developing children, with a repeated finding that children have more difficulty comprehending the passive of experiencer verbs (2b) than the passive of action verbs (1b).

1a. Sue kissed Bob
1b. Bob was kissed by Sue
2a Sue heard Bob
2b Bob was heard by Sue

However, Fox and Grodzinsky (1998) found the difficulty of non-actional passives is eliminated for some children when the *by*-phrase is removed. They propose that children have difficulty with the *by*-phrase as transmitter of a non-agentive theta role (experiencer). Children's problems are thus not with A-movement per se, but with the theta-role transmission.[3]

2.2 Passive experiments

The following constructions were tested:

Active, actional:	Paul tickles Sue
Active, non-actional:	Mom hears Dad in the kitchen
Passive, actional,+by-phrase	Sue is tickled by Paul
Passive, non-actional,+by-phrase	Dad is heard by Mom
Passive, non-actional,-by-phrase	Dad is heard in the kitchen

Two different tests were used: Act-out, in which subjects act out sentences with a toy family and props, and aTruth Value Judgement, modeled onFox and Grodzinsky (1998). In the judgment task subjects judge sentences as 'true/false' or 'right/wrong' following a short three-four sentence story acted out for them by the experimenter. Examples of the test materials are given in (3) and (4).

[3] Fox and Grodzinsky's interpretation of their results is a matter of on going debate (see Babyonyshev, Ganger, Pesetsky and Wexler 2001).

(3) Actional verb
Paul teases Sue all the time about being a cry baby. Sue wants to show Paul what a big girl she is. He tells her "I will make you cry". Then he starts to tickle her. He doesn't stop until the tears run down her cheeks.
Sentence for judgment: Paul tickles Sue (Match -> True)

(4) Non-actional verb
Mom has decided that no one in the house will drink pop. One night, Dad sneaks out of the bedroom to get some pop. By mistake, he drops the bottle on the floor. Mom hears Dad making noise and wakes up. Dad is cleaning up the mess when Mom walks into the room.
Sentence for judgment: Mom was heard by Dad (Mismatch -> False)

In both the act-out and the judgement tasks, each subject received four tokens of each construction tested. In the sentence judgment task the correct answer was 'false' for two tokens of each construction (mismatch tokens) and 'true' for the other two tokens (match tokens). The mismatch was achieved by assigning the NP that is theme in the story the surface subject role in the test sentence (see the non-actional example above).

2.3 Results

The results are presented in Table 1, in terms of the percentage correct responses for each sentence type tested. As the figures and statistics for the group data in Table 1 show, the Fox-Grodzinsky effect is found in both tasks. In the act out task, there are significant differences between active and passive with the by phrase for both actional and non-actional verbs, but the difference falls short of significance for the non-actional *-by* condition. However, there is an unpredicted bigger difference for active and passive for the actional *+by* condition than the non-actional *+by* condition. In the judgement task the *+by* conditions follow the normal pattern of greater difficulty with non-actional *+by* than actional *+by*, and when the *by* phrase is removed, the difference between active and passive for non-actionals is non-significant (the Fox-Grodzinsky effect).

Table 1

Mean Percentage Correct Responses in Passive Experiments

	Act-out	Judgment
Active, actional:	97	84
Active, non-actional:	78	66
Passive, actional, + by-phrase	59	62
Passive, non-actional, + by-phrase	41	34
Passive, non-actional, - by-phrase	47	85

t-tests (2-tail)

Act-out:	Active vs passive actional, +by	t(7) = 3.00, p =.020
	Active vs passive non-actional, +by	t(7) = 2.39, p = .048
	Active vs passive non-actional, - by	t(7) = 2.11, p = .072
Judgment:	Active vs passive actional, +by	t(7) = 1.99, p = **.**087
	Active vs passive non-actional, +by	t(7) = 3.42, p = .011
	Active vs passive non-actional, - by	t(7) = -1.158, p = .285

We also examined the individual response patterns of the subjects. The results for the act-out are given in Table 2. One subject who scored 100% correct is not included in this Table. There are two subjects who show the Fox-Grodzinsky effect in the act-out, two who show no Fox-Grodzinsky effect and three who have global difficulty with the passive. Table 3 gives the individual response patterns on the judgment task, with subjects grouped according to their performance on the act-out. All eight subjects showed the Fox-Grodzinsky effect in the sense of having more correct answers to non-actional passives without *by* than non-actional passive with *by*. The unexpected higher performance on the non-actional passive without *by* than on the non-actional active sentences is due to three of the subjects; three showed no difference between the two conditions, and one the reverse pattern (more correct on active than passive).

Table 2

Individual Response Patterns (Number Correct out of 4)

Act-Out Passive Experiment

	A-Act	A-NAct	Pass-Act +by-phrase	Pass-NAct +by-phrase	Pass-NAct -by-phrase
F-G Pattern					
MN	4	4	3	3	4
JT	4	4	3	2	4
Mixed Pattern/No F-G effect					
JN	4	2	4	4	3
A	4	3	3	0	0
Global Problems with Passive					
KW	3	3	1	0	0
JF	4	3	1	0	0
MT	4	2	0	0	0

F-G = Fox- Grodzinsky

A-Act = Active-Actional
A-Nact = Active-Nonactional
Pass-Act = Passive-Actional
Pass-Nact = Passive-Non-actional

Table 3

Individual Response Patterns (Number Correct out of 4)

Judgment Experiment

Grouped by Performance on the Passive Act-out Experiment

	A-Act	A-NAct	Pass-Act +by-phrase	Pass-NAct +by-phrase	Pass-NAct -by-phrase
All Correct					
T	4	2	4	3	4
F-G Pattern					
MN	3	2	2	1	3
JT	3	3	1	2	3
Mixed Pattern/ No F-G effect					
JN	3	4	3	2	4
A	3	2	2	1	2
Global Problems with Passive					
KW	3	3	2	1	3
JF	4	2	1	0	3
MT	4	3	2	1	2

It is interesting to note that the different tasks appear to bring out knowledge better for some individuals that others. We divided subject s into those who score three or less correct on the three passive conditions combined on the act-out task (n=4) and those who scored four or more correct (n=4, the lowest score being nine correct). Subjects in the former group overall do better on the act-out than on the judgment, while the reverse is true for the latter group, as shown in Table 4.

Table 4

Distribution of Correct Responses on the Passive Conditions

	Act-Out	Judgment
6-12 correct on AO	42	32
0-5 correct on AO	5	20

This distribution is significant (Chi-square = 10.59, $p < .005$). We can speculate that the act-out is a cognitively more challenging task that engages the interest of the more able subjects, whereas act-out overtaxes the abilities of less able subjects, leading them to resort to a first N = agent strategy (Grodzinsky 1995)

To summarize the results of our passive tests, some, if not all, persons with DS can deal well with the passive. Individuals with DS benefit from the elimination of the *by*-phrase in non-actional passives, although this is not true of all subjects in the act-out task. Following Fox and Grodzinsky, the greater difficulty of non-actional passive with a *by*-phrase can be attributed to inability to transmit a non-agentive theta role through the *by*-phrase.

3. A comparison of two subjects

In this section we compare the performance of two of the subjects who went on to take part in the passive experiments, JT and MT. These two individuals have scores that are very close on standardized tests, as shown in Table 5.

Table 5
Standardized Test Scores for JT and MT

	PPVT[a]	TACL[b] Word Classes	TACL[b] Grammatical Morphemes	TACL[b] Elaborated Sentences	Gates-MacGinitie[c]
JT	10;03	87.5	50	47.5	Not completed
MT	10;03	95	47.5	35	1.7

[a] age equivalent score
[b] percentage correct
[c] grade equivalent score

However, JT clearly outperforms MT on the comprehension tasks. For example, in the first battery of tests, MT shows evidence that he relies to some degree on a 'first

N = agent' strategy, leading him to correctly interpret the PRO subject of the complement to *promise* (*Mom promised Dad PRO to leave*), but make errors with the PRO subject of the complement to *tell* (*Mom tells Dad PRO to leave*). JT shows the more usual child pattern of good performance with *tell* and error with *promise*. In the first battery, MT scored only 2/6 correct on simple passive, whereas JT scored 6/6 correct. In the passive experiments reported in the last section, MT is one of the three subjects characterized as having global problems with the passive in the act-out, whereas JT is one of the subjects who show the Fox-Grodzinsky effect (see Table 2).

Despite the fact that MT is clearly not as competent as JT in the comprehension tests, their performance on the elicited production task does not completely fit with this difference in ability. Mayer's book *A Boy, a Dog and a Frog* consists of pictures that prompt the subject to tell a story. The main events depicted are: a boy and a dog go fishing with a net; the boy tries to catch a frog, but the frog outwits him and the boy ends up in the water; the boy and the dog go home; the frog then misses them and follows their footprints back to the boy's house; the frog finds the boy and the dog taking a bath and jumps in with them.

JT accurately conveys the gist of the story, in approximately 120 words. MT produces over a 1000 words, with only a moderately coherent story line, but with a fairly fluent delivery and a syntactically diverse range of sentences. Examples of JT's and MT's production of complex syntactic structures are given in (5) and (6), respectively.

(5) a. The boy is trying ..trying to climb the tree to find the dog
Infinitival complement to V; reduced in order to clause

b The boy is going to catch the frog but he slips
Infinitival complement to V; conjoined clause

c I think it's pretty quiet with the frog
Tensed complement to V

(6) a I see a boy um walking the dog with a ne(s)t
Gerundial complement to V/Reduced relative clause

b In the various nights and mornings , the frog had
a bad day, but he decided to go on the leaf and did pond surfing,
while the dog jumped into the water…
Conjoined clause; infinitival complement to V; tensed temporal adjunct

c when the dog was jumping and skipping
like he was going cuckoo
Tensed temporal adjunct; Comparative clause

d … then he realized that it's not that depressed anymore
because he was still okay at the time
Tensed complement to V; Tensed reason adjunct

e …when the tree that had a hole in there..
Tensed relative clause

4. Conclusions

The results of this study to date support the view that language development in individuals with DS can progress to include complex syntax, both in terms of comprehension and production. Our results with the passive support the view of Bridges and Smith (1984) that that construction develops in a normal, but delayed manner in DS. However we do not wish to claim that our subjects are representative of the DS population as a whole - Perovic (2001) reports very poor performance with the passive in the subjects she studied, and three of the subjects in our study who went on to the passive experiments had a low level of success performance on the passive, particularly on the act-out test.

Methodologically, the difference on performance of more and less able subjects on the act-out out versus judgment tasks suggests that there is no best task to evaluate syntactic abilities in our subjects. Moreover, the comparison we have made in the comprehension and production abilities of MT and JT argues that standardized tests are not always good predictors of grammatical ability. MT and JT have very similar scores on standardized tests but quite striking differences in their comprehension ability. Neither would MT's comprehension abilities lead us to predict his loquacious, syntactically complex and varied performance in the elicited production task.

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