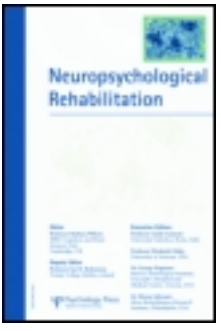

Neuropsychological Rehabilitation: An International Journal

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/pnrh20

Speaking in ellipses: The effect of a compensatory style of speech on functional communication in chronic agrammatism

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Version of record first published: 11 Feb 2010.

To cite this article: Marina B. Ruiter, Herman H. J. Kolk & Toni C. M. Rietveld (2010): Speaking in ellipses: The effect of a compensatory style of speech on functional communication in chronic agrammatism, Neuropsychological Rehabilitation: An International Journal, 20:3, 423-458

To link to this article: http://dx.doi.org/10.1080/09602010903399287

NEUROPSYCHOLOGICAL REHABILITATION
2010, 20 (3), 423–458

Psychology Press
Taylor & Francis Group

Speaking in ellipses: The effect of a compensatory style of speech on functional communication in chronic agrammatism

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This study investigated whether a Dutch and adapted version of Reduced Syntax Therapy (REST) could stimulate and automatise the production of ellipses in Dutch-speaking, chronically agrammatic speakers ($N = 12$). Ellipses are syntactic frames in which slots for grammatical morphology tend to be lacking (e.g., *everybody inside*). When elliptical style is applied on a regular basis, the linguistic impairment is circumvented, at least for the greater part. We therefore hypothesised that REST increases participants' functional communication skills (i.e., communicative efficacy and efficiency). This is of relevance because not all chronically agrammatic speakers become skilled at employing ellipses independently. The results of the present study suggested that when elliptical style is applied regularly, chronically agrammatic speakers get their message across more efficiently when compared to error-strewn production of sentential style.

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We thank Walter Huber, Francesca Longoni, and Paul Conroy for their valuable and constructive comments on an earlier version of this paper. We would also like to thank Luise Springer and colleagues for allowing us to use the label *Reduced Syntax Therapy* in evaluating a Dutch and adapted version of this approach.

The study described in this article was supported by the rehabilitation centre of the Sint Maartenskliniek in Nijmegen and conducted in collaboration with the Donders Centre for Cognition as well as the Department of Linguistics of the Radboud University Nijmegen.

http://www.psypress.com/neurorehab DOI:10.1080/09602010903399287

Keywords: Agrammatic speech; Compensation therapy; Speaking in ellipses; Functional communication; Between-subject variability.

INTRODUCTION

The ultimate goal of therapy is to improve agrammatic speakers' skills to be effective and efficient in spoken language production (e.g., Blomert, 1990; Frattali, 1992; Ramsberger, 2005; Worrall, 1995). Only with true restoration will agrammatic speakers be able to produce sentences at the pre-morbid level of accuracy and speed. However, restoration therapy may be unprofitable for aphasic speakers who are severely impaired (Robertson & Murre, 1999). If restoration fails, the production problems are chronic. Chronically agrammatic speakers can only improve functional communication through compensation. Although compensation is a concept that is often used to provide a rationale for conducting therapy (see for example Code, 2001; Kolk, 2002), it should be specified how it takes form. This means that the neuropsychological processes responsible for compensation should be described explicitly, and that it should be made clear why this particular kind of compensation diminishes the consequences of the linguistic deficit it is supposed to compensate for. Furthermore, as compensation entails behavioural change, the psychological consequences of this change should also be taken into account.

Compensation

The *adaptation theory* (e.g. Kolk, 1995; Kolk & Van Grunsven, 1985; Kolk, Van Grunsven, & Keyser, 1984) does not explicitly address aphasia therapy; however, it provides a strong theoretical framework for planning compensation therapy for chronically agrammatic speakers. The adaptation theory consists of two components. The first component specifies the underlying linguistic impairment: Due to a temporal disorder, the capacity for language production is reduced. As a result, sentence production is hampered and morphological errors, such as subject–verb agreement errors, are likely to occur. The second component specifies how the speaker compensates for this disorder. Through adaptation, chronically agrammatic speakers avoid making errors and still get their messages across. We therefore argue that agrammatic symptoms reflect both a syntactic disorder and compensatory speech behaviour.

A first form of compensation consists of *correcting* (i.e., repairing) the errors that result from using the reduced language production system for sentence production. By restarting the computational process a number of times, repair is possible; however, this has two serious drawbacks for communication. Since agrammatic speakers make many sentence production errors, corrective adaptation is time-consuming for both the speaker and the listener. Even more importantly, success is not guaranteed: in producing a sentence of

a certain complexity, the linguistic processing capacity may be too strongly reduced for the restart strategy to work successfully.

It can be argued that a second kind of compensation is more successful, because it *prevents* sentence production difficulties right from the start. Agrammatic speakers may adapt to the linguistic disorder by producing simple sentences that lack embedding, negation, or question form (e.g., Kolk, 1995; Kolk & Van Grunsven, 1985; Kolk et al., 1984). If the conceptual message is simplified even further, syntactic processing becomes biased towards the part of the normal repertoire that has the lowest degree of complexity, being *ellipses*.

Elliptical constructions are non-finite clauses that contain root infinitives, root participles, or contain no verb at all. What distinguishes elliptical from sentential constructions is that they contain fewer grammatical morphemes. In using the term elliptical, Kolk (2006) refers to well-formed incompleteness, as was outlined by Progovac (2006). The latter uses the term *non-sentential* to denote single-phrase utterances (e.g., *nice lady!*) as well as root small clauses (e.g., *problem solved*). There is evidence from brain imaging that ellipses require less linguistic processing than full sentences (Indefrey et al., 2001).

As stated above, along with De Roo, Kolk, and Hofstede (2003), we assume that chronically agrammatic speakers typically lack the capacity required to produce a full sentence. Since ellipses fit the reduced linguistic capacity best, we argue that the regular use of ellipses is a better compensatory strategy than the use of simple sentences, which is the other form of *preventive adaptation*. The study of De Roo, Kolk, and Hofstede indicates that agrammatic speakers not only give up finiteness to simplify syntax but also apply further simplification strategies *within* the elliptical repertoire. In their experiment, 13 Dutch-speaking chronically agrammatic speakers were presented with a picture description test consisting of 20 drawings of circles and squares depicted in specific spatial relationships (Hofstede, 1992; Hofstede & Kolk, 1994). The participants' task was to describe the spatial relations between objects in such a way that the experimenter could reproduce them. Unambiguous description of the drawings required them to attempt morphological forms (i.e., adjectival and prepositional structures) that they tend to avoid in free conversation. These task demands led the agrammatic participants to simplify the complexity of their elliptical constructions. For example, they tended to describe a picture of a blue square on top of a red circle by saying *cirkel rood, vierkant blauw, boven*, "circle red, square blue, on top". That is, they produced ellipses without a verb rather than verbal constructions. They also produced predicative adjectives (e.g., *vierkant blauw*, "square blue") instead of attributive adjectives (e.g., *blauw vierkant*, "blue square"). This way of using the adjective allowed them to grammatically omit the adjective inflection. Lastly, they tended to use intransitive prepositions (e.g., *erop*, "on top of it") rather than transitive

ones (*op*, "on"). These findings indicate that, even within the category of ellipses, different degrees of complexity exist. When informational demands are particularly high, agrammatic speakers aim at the lowest degree of elliptical complexity.

Reduced Syntax Therapy and preventive adaptation

The Reduced Syntax Therapy (REST; Schlenck, Schlenck, & Springer, 1995, see also Springer, Huber, Schlenck, & Schlenck, 2000) is a therapy that teaches German and English agrammatic speakers to produce reduced utterances. Along the lines of the adaptation theory, Springer et al. (2000) claim that the basic rationale of REST is compensatory. In contrast to the adaptation theory, however, Springer et al. argue that "... REST most likely enhances elementary proto-language functions of labelling and sequencing in the unimpaired right hemisphere, which may become the starting point for a gradual and laborious learning of simple syntax and grammar" (p. 279).[1] Thus, according to these authors, the REST structures – even though there is some resemblance – are no part of the normal elliptical repertoire: The REST structures would require additional function words in natural ellipses. Springer et al.'s interpretation of telegraphic style is closely related to the points of view of Byng and Black (1989) as well as Goodglass, Christiansen, and Gallagher (1994), who argue against an overlap between telegraphic style and normal ellipses.

In support for the claim that agrammatic speakers use a subset of the normal repertoire, Kolk (2006) provides a number of arguments. Firstly, Dutch and German agrammatic speech has all the grammatical features of normal ellipses. Kolk has listed 14 different features of normal ellipses, such as subject-omission and sentence-final position of the verb. These features were, with very few exceptions, present in both German and Dutch-speaking patients. Only 1–3% of the ellipses that the agrammatic speakers produced were ungrammatical. Secondly, agrammatic and normal speakers employed the same types of elliptical constructions and the

[1]Springer et al. (2000) take the bilaterally represented *protolanguage* as a basis for explaining agrammatic symptoms, which consists of sequencing content words. Due to brain damage, the left hemispheric inhibition of the right hemisphere decreases. Consequently, right hemispheric protolanguage mechanisms may become operative again. This typically occurs only in the chronic phase. In arguing against this claim of Springer et al., Kolk (2002) raises two issues. First of all, the REST constructions are not only produced by chronically agrammatic speakers but also by healthy adults. This empirically refutes the claim that the left hemisphere inhibits the right hemispheric production of such constructions. What is more, even if the protolanguage theory could account for the occurrence of spontaneous recovery, it cannot explain "guided" recovery (i.e., recovery that is increased as the result of training, see Robertson & Murre, 1999). Treatment, especially if it aims at restoration, will strengthen the left hemispheric language functions rather than diminish it. Thus, restoration therapy should inhibit rather than facilitate right hemispheric protolanguage mechanisms.

distributional properties of these types were highly similar. That is, although normal speakers of course employ elliptical style much less frequently than agrammatic speakers, the *relative* frequencies of the various types of ellipses are the same. This generalisation even extended to the samples of child language that were studied. Ten types of elliptical constructions could be distinguished. A major subdivision was that between so-called *isolated predicates* and *subject-predicate connection*s. In isolated syntactic phrases the subject is not produced. The listener has to derive it from the conversational context. In subject-predicate connections, on the other hand, isolated predicates are combined with a subject NP. For example, both Dutch agrammatic speakers and children produce subject-predicate connections consisting of two NPs ("ik tabletje", *I pill* and "pappa cola" *daddy coke*, respectively). Subject-predicate connections occur only infrequently in the speech of both aphasics and children, but they are also relatively rare in normal elliptical speech.[2] Finally, the various ways in which the elliptical frames were elaborated (e.g., by an additional adverb or noun phrase) also had very similar relative frequencies in the three populations.

We therefore maintain that REST trains normal ellipses. Put differently, REST enhances a normal – but previously infrequently used – linguistic operation of the dominant hemisphere.

Between-subject variability

One could wonder why it would be necessary to train agrammatic speakers to use elliptical style, if they already do so. There is, however, considerable variability between agrammatic speakers in the form of their grammatical output (Goodglass, Christiansen, & Gallagher, 1993; Hofstede, 1992). Under our description, this means that some agrammatic speakers learn to apply preventive adaptation on their own accord (henceforward referred to as *preventive speakers*), while other speakers – the *corrective* ones – stick to the error-strewn production of sentences, which typically fails. For example, before proceeding into REST, a corrective speaker participating in the present study described his illness as follows:

Eh . . . toen ik eh ziek werd . . . toen ik eh . . . was eh . . . drie jaar eh . . . vrachtwagenchauffeur ehm . . . eh . . . mijn hartklep die zat eh . . . een

[2]Five out of the 10 levels of the Dutch and adapted version of REST (Ruiter et al., 2003) train subject-predicate connections. Compared to isolated predicates, subject-predicate connections may be more difficult to produce, because the subject and predicate are not integrated in a single syntactic frame (De Roo, 1999). A subject NP is frequently added in producing the isolated predicate for a second time (e.g., "drinking coffee woman drinking coffee"). The fact that subject-predicates are more difficult to produce, may explain why they occur only infrequently in agrammatic speech. These connections are trained in REST because they allow speakers to express their messages less ambiguously.

bacteriën eh onder en eh toen eh . . . . . eh . . . ja weet niet eh . . . eh . . . Utrecht eh ben ik eh . . . o . . . eh geopereerd en eh daar had ik eh twee of drie herseninfarcts eh . . . overheen gekregen

[Uh . . .when I got uh ill. . . then I uh . . . was uh . . . three years uh . . . truck driver uhm . . . uh . . . my heart valve there was uh . . . a bacteria uh underneath and uh then uh . . . . . uh . . . well don't know uh . . . uh . . . Utrecht uh I have uh . . . s . . . uh had surgery and uh there I have had uh two or three heart attacks uh . . . as well.]

Through ellipses, the same message could be conveyed more efficiently, and could remain comprehensible nevertheless:[3]

Ik vrachtwagenchauffeur geweest. Drie jaar lang. Toen ziek geworden. Bacterie onder hartklep. Naar ziekenhuis in Utrecht. Hartoperatie. Ook twee of drie hartinfarcten gehad.

[Me truck driver. Driving trucks for three years. Then ill. Bacteria under heart valve. To hospital in Utrecht. Heart surgery. Also two or three heart attacks.]

If we are right in assuming that aphasic patients with the same underlying language deficit may react differently to this deficit, this has methodological consequences. Group studies may be misleading, as they tend to ignore differences between patients. Case studies, on the other hand, do acknowledge the differences but ignore the communalities present in the whole group, neglect the possibility that patients that appear to be very different are in fact extreme cases belonging to the same distribution. Our approach represents a "middle road". We will evaluate therapy outcome at the group level. However, at the same time, we will try to account for strategic differences between patients by constructing a continuum of language performance as it existed before therapy and relating this continuum to various measures of therapy outcome.

Effects of REST on grammatical output and functional communication

As discussed above, we hypothesise that compensation therapy will enable agrammatic speakers to use normal elliptical constructions more regularly. As a consequence, communicative efficacy and efficiency will increase. This hypothesis has been explored in two studies; although only in part.

[3]We do not claim that ellipses can be understood as easily as correctly and fluently produced sentences. From the listener's point of view, ellipses require more inferential work to compensate for the omitted elements. In discussing the effect of elliptical style on communication, we compare preventive to non-preventive style.

In the study of Van den Berg and Kolk (1996) two chronically agrammatic speakers participated. One had a corrective style of speech predominantly; the other a preventive style. Both learned to produce elliptical style and improved communicative efficacy after a therapy that was similar to the REST approach. Interesting to note is that the participant who used corrective adaptation predominantly before therapy demonstrated the greatest shift in style of speech. He showed not only the largest effect of therapy on grammatical output, but also the greatest improvement in functional communication. This lends support for the claim that functional communication improves if elliptical style is employed more frequently. It also suggests that REST-like approaches are more effective for corrective speakers. The results of this study, however, have to be interpreted cautiously because Van den Berg and Kolk did not only stimulate the agrammatic speakers to produce ellipses, but also simple sentences.

Springer et al. (2000) investigated the effect of REST on the grammatical output of 11 German-speaking, chronically agrammatic speakers. Each participant's spontaneous speech production was analysed with the semi-standard interview of the Aachen Aphasia Test (AAT; Huber, Poeck, & Willmes, 1985) before and after 30 hours of REST. Treatment effects could be demonstrated: 9 of the 11 German participants produced significantly more utterances consisting of more than one constituent. Of the nine participants whose utterance lengths significantly increased, five participants produced significantly more verbs and three participants produced significantly more specified nouns. Four out of these nine participants showed a significant increase in the percentage of closed class words. The spontaneous speech analysis was repeated after 10–18 months for four of the nine participants who had shown a significant therapy effect. Three of them still produced significantly longer utterances.

Springer et al. (2000) did not investigate the effect of REST on functional communication, but their results provide support for the hypothesis that REST produces an effect on grammatical output. It is important to note that their data do not necessarily support the claim that REST enables agrammatic speakers to produce ellipses more regularly. The authors seem to have computed the linguistic parameters over sentences and ellipses taken together. This is indicated by the fact that both finite and non-finite verbs were included in counting the number of utterances with a verb and the fact that the number of function words increased after REST. Such an analysis is in line with their approach, which assumes that, by training protolanguage, simple syntax may be relearned. From our theoretical point of view, however, ellipses result from normal but infrequent language production routines. As a result, they are grammatically well-formed. From this perspective on agrammatic symptoms, ellipses and sentences should be distinguished in evaluating REST.

Possible limitations of compensation

Although it can be argued that the continuous usage of elliptical constructions is the best solution to the permanent linguistic disorder in the chronic phase, REST has some possible limitations. Compensation asks for new speech behaviour and this particular aspect can be a challenge for stroke patients.

A first possible limitation is that the continuous production of ellipses requires executive – attention – control because it is non-automatic (e.g., Miyake et al., 2000; Purdy, 2002; Rende, 2000). It is to be expected that this attentional cost will decrease with practice; however, the use of ellipses will probably never reach the level of automaticity of the pre-morbid sentence production routine. Since aphasic speakers are often claimed to have impaired executive functioning, they may have difficulty learning and applying elliptical style on a regular basis. That is, there is some support for the role of executive function in the outcome of compensation therapy. Purdy, Duffy, and Coelho (1994), for example, examined the ability to acquire and use trained symbols on a functional communication task in 15 English-speaking adults with non-fluent aphasia. The participants were taught to convey common concepts in three modalities (i.e., speaking, gesturing, and using a communication board). This provided subjects with more than one option for communication. Although the participants were able to convey the concepts in at least two of the three modes, they did not switch to other modalities following failures to verbally express their message. The authors concluded that cognitive flexibility – an executive function – may be required for successful use of trained modalities.

Purdy and Koch (2006) re-analysed the data of the 15 aphasic patients that participated in the study of Purdy et al. (1994). With these data, Purdy and Koch derived a cognitive flexibility score from the Communicative Abilities in Daily Living (CADL; Holland, 1980). The score was calculated by dividing the total number of successful switches between communicative response modes to the number of opportunities to switch. A significant relation between a cognitive flexibility score and participants' performance on the Wisconsin Card Sorting Test (WCST; Grant & Berg, 1948) was found, which confirmed the validity of the cognitive flexibility score. Purdy and Koch also found a significant relationship between the cognitive flexibility score and strategy use on a referential communication task (picture description task). This relationship remained significant when the overall severity of aphasia was taken into account. These results were taken to confirm the hypothesis that cognitive flexibility is a stronger predictor of strategy usage than severity of aphasia.

Secondly, agrammatic speakers may choose not to produce ellipses because it is less rewarding (Springer et al., 2000). It may have a childish or incompetent impact on the listener. Finally, by applying compensatory

behaviour, the aphasic implicitly admits to not being able to recover any more (for a retrospection, see Van der Horst & Boenders, 1984).

Taking these cognitive and socio-emotional factors into account, the question arises whether the benefits of overusing ellipses outweigh the costs. This question has not been systematically explored in the studies of Springer et al. (2000) and Van den Berg and Kolk (1996). That is, neither study investigated the non-linguistic cognitive factors that could influence the ability to apply compensatory strategies regularly.

Research aims

In summary, the current study seeks to provide an answer to the question whether a Dutch and adapted version of the REST (Ruiter, Kolk, & Holtus, 2003) will enable chronically agrammatic speakers of Dutch to use elliptical constructions more frequently and whether this will bring about an increase in functional communication. This research question can be subdivided into several sub-questions:

- Can chronically agrammatic speakers of Dutch learn to use an elliptical style of speech on a regular basis in therapy?
- Does REST demonstrate an effect on participants' grammatical output on untrained material?
- Can they maintain this training effect over time, i.e., can they still produce ellipses regularly on untrained material 6 months after ending REST?
- Does REST yields larger effects on grammatical output in corrective than in preventive speakers?
- With the more frequent use of ellipses, will functional communication increase?

Although the present study focuses on a sub-type of aphasia and a specific therapy, there are also broader aims:

- What factors determine the ability and the willingness to apply compensatory strategies?
- Secondly, can we find a compromise between group and case studies by constructing a style of speech continuum?

METHOD

Design

Although multiple single-case designs cannot yield the highest level of evidence (e.g., Robey & Schultz, 1998), we used this design in the current

efficacy study because it allows determination of the range of subject characteristics in which the therapeutic effect manifests itself (American Speech-Language-Hearing Association, 2005; McReynolds & Thompson, 1986).

We sought to design the experiment in such a way that experimental control was maximised. First of all, an a priori statistical power analysis was carried out, which indicated that a sample size of 10 participants was required in order to detect a difference of 20% in the outcome measure, with a Type I error of 0.05 and a power of 0.85.[4] Secondly, independent speech therapists conducted the measurements of spoken language production at the various points in time at which the treatment effect was assessed. Thirdly, the present study controlled spontaneous recovery of sentence production by testing participants' ability to produce well-formed sentences with an adapted version of the Sentence Order and Inflection Test (SOIT; Kok, Kolk, & Haverkort, 2006) at all points in time. In the SOIT, the participants' task was to read out loud well-formed sentences of varying complexity by putting written constituents in the right order and inflecting the verb (for details, see Kok et al., 2006; Ruiter, 2008). The dependent measure of the SOIT was the percentage of well-formed sentences. None of the 12 participants produced significantly more well-formed sentences in the SOIT, all p values $> .05$. Thus, spontaneous recovery cannot explain possible improvements after therapy.

In order to investigate the efficacy of the Dutch and adapted version of REST, the participants were presented with several tasks and tests, which measured spoken language production and executive functioning (cf. Figure 1, details will be given below), at three points in time: pre-therapy (T1), post-therapy (T2), and 6 months after ending the therapy programme (T3). Between T2 and T3, participants did not receive any speech therapy for their sentence production problems.

Participants

In the current study, 12 Dutch-speaking adults with chronic agrammatism participated. The participants were all native speakers of Dutch and had suffered a single stroke in the left hemisphere (for participants' characteristics, see Table 1). All participants, except for one (i.e., participant EL), were at least 12 months post-onset. Participants were recruited among former patients

[4]In the study of Van den Berg and Kolk (1996), the two participants significantly increased the percentage of ellipses produced after a therapy that was very similar to REST. An increase of 16.3% caused the A-scale score of the Amsterdam-Nijmegen Everyday Language Test (ANELT; Blomert et al., 1995) to increase with 16 points. An increase of at least 7 points on this scale indicates a reliable change in verbal communication skill (Blomert, 1994). Since the data obtained by Van den Berg and Kolk indicated a clinically relevant increase in communicative efficacy, we estimated the effect size at 20%.

Pre-therapy measurements (T1)	REST	Post-therapy measurements (T2)	6 months	Follow-up measurements (T3)
Spoken language production: - Interview AAT - PDT - Games of HF - SOIT Neuropsychological factors: - Executive functioning (Stroop, WCST, TOL) - Intellectual awareness (CIAQ)	16 weeks 4 hrs a week or withdrawal of therapy	Spoken language production: - Interview AAT - PDT - Games of HF - SOIT Neuropsychological factors: - Executive functioning (Stroop, WCST, TOL) - Acceptation ellipses (AESQ)		Spoken language production: - Interview AAT - PDT - Games of HF - SOIT Neuropsychological factors: - Executive functioning (Stroop, WCST, TOL)

Figure 1. Schematic summary of the study design (for explanation see text).

of two rehabilitation centres in The Netherlands: the Sint Maartenskliniek in Nijmegen ($n = 10$) and Tolbrug in 's-Hertogenbosch ($n = 2$). The Human Research Committee approved this study. All participants signed informed consent forms.

In order to prevent verb retrieval problems from interfering with the REST programme, all participants - except for RK – met the criterion of being able to retrieve at least 20 of the 40 verbs on the naming actions test of the Dutch Werkwoorden en Zinnentest (WEZT; Bastiaanse, Maas, & Rispens, 2000). Although all participants produced agrammatic speech output, some participants also demonstrated mild apraxia of speech (AJ, RK, PO, and TW) or mild dysarthria (GJ). However, these five participants produced at least 95% intelligible speech output.

Corrective and preventive speakers had to be distinguished to test the hypothesis that REST yields the largest effects in corrective speakers. Although many researchers (e.g., Hesketh & Bishop, 1996; Kolk, 1995; Kolk et al., 1984; Van den Berg & Kolk, 1996) have differentiated between both adaptation styles in theory, there are no clear-cut parameters to do so in clinical practice. This could be due to the fact that agrammatic symptoms are task-dependent (e.g., Hofstede & Kolk, 1994).

Assuming that the distinction between preventive and corrective style is not absolute, we constructed a continuum. We counted all utterances in which participants appeared to aim at a level of complexity that was beyond their capacity. The two primary indications for this were errors and non-fluencies. If an agrammatic speaker makes an error, either in constructing a full sentence or in constructing an elliptical one, one can assume that this was the consequence of a capacity shortage and that the construction was too complex for the speaker. Non-fluencies also signal a shortage, but this

TABLE 1
Subject characteristics ($N = 12$)

Subject		*Age (yrs)*[a]	*Post-onset (yrs)*[b]	*Syndrome AAT*[c]	*Syntactic structure*[d]	*Severity aphasia*[e]	*Aetiology*[f]	*Education*[g]
GJ	f	61.3	3.7	Broca	1	45.75	ICVA, LH, tempero-parietal area	2
EL	m	39.10	0.8	Broca	2	48.64	HCVA, LH, temporal regions	5
CP	m	36.9	4.4	Nonclass.	2	64.77	CVA, LH, exact location unknown	4
AJ	m	51.10	2.1	Broca	1	50.66	CVA, LH, exact location unknown	5
ML	f	64.11	1.1	Broca	2	56.54	ICVA, LH, arteria cerebri media	4
HK	f	66.6	4.0	Broca	2	59.99	ICVA, LH, exact location unknown	4
RK	f	35.8	1.11	Broca	1	43.52	ICVA, LH, parieto-occipital area	5
JP	m	67.2	5.8	Nonclass.	2	60.08	ICVA, LH, exact location unknown	4
PO	m	41.11	1.11	Broca	2	49.23	ICVA, LH, exact location unknown	6
AH	m	62.8	4.8	Broca	2	61.72	HCVA, LH, arteria cerebri media	4
TW	f	54.9	8.5	Broca	1	52.51	ICVA, LH, arteria cerebri media	3
WR	m	51.0	15.4	Broca	2	43.01	ICVA, LH, arteria cerebri media	5
Mean		52.10	4.6					
Range		*35.8–67.2*	*0.8–15.4*					

All participants ($N = 12$) were right-handed.

[a, b] Years (yrs) refer to the age versus time post-onset during the pre-therapy measurements.

[c] AAT diagnosis based on the nonparametric discriminant analysis programme (ALLOC)

[d] Syntactic structure of participants' speech output rated on the 6-point scale of the subtest Spontaneous Speech of the Dutch Aachen Aphasia Test.1 = mostly one or two word utterances; almost no inflection forms or function words; 2 = short, simple sentences, which are mostly syntactically incomplete; frequent absence of function words and inflected forms.

[e] Severity of aphasia is expressed as the average profile height of the Dutch Aachen Aphasia Test.

[f] ICVA = ischemic cerebrovascular accident, HCVA = hemorrhagic cerebrovascular accident.

[g] Level of education according to Verhage (1964).

time an attempt is made to overcome this shortage by repair behaviour. In all other cases, the complexity of the utterance is optimally tuned to the speaker's linguistic capacity. So, our continuum goes from non-optimal, characterised by errors and corrective behaviours, to optimal adaptation, characterised by fluently as well as correctly produced sentences and ellipses. In the text, we

will refer to these two sides of the continuum as *non-preventive* and *preventive* styles of speech, respectively. Please note that the non-preventive style includes, but is not identical to, corrective adaptation.[5]

The participants ($N = 12$) were ranked according to the extent to which they showed either errors or non-fluencies before proceeding into REST. In general, elliptical style is more often observed in free conversation than in constrained production tasks (Hofstede, 1992; Kolk & Heeschen, 1992). Given the fact that the semi-standard interview of the Aachen Aphasia Test (AAT; Graetz, De Bleser, & Willmes, 1992) is closest to spontaneous speech, the ranking was based on utterances that were produced in the pre-therapy AAT. Non-fluency may not only reflect non-preventive style but also lexical retrieval problems (Oomen, Postma, & Kolk; 2001; Postma, 2000). In order to exercise some restraint in interpreting these symptoms, all utterances containing fillers or corrections were labelled non-fluent. The properties of normal ellipses in Dutch (Kolk, 2006; Kolk & Heeschen, 1992) were used as a criterion for elliptical well-formedness.

As Table 2 illustrates, GJ may be positioned on the *non-preventive* end of the style of speech continuum as she produced the highest percentage (i.e., 95.24%) of non-fluent and incorrect utterances before proceeding into REST. The next most non-preventive speaker is EL, and so on. Because WR produced the least non-fluent and incorrect utterances in the pre-therapy AAT (i.e., 38.97%), he is positioned at the other end – the *preventive* end – of the continuum. Accordingly, it is hypothesised that the effect of REST can be predicted along this continuum: REST should be most effective for GJ and least for WR.[6]

Although it could be argued that non-preventive speakers would be the optimal candidates for this kind of therapy, as they have more room for

[5]The implicit assumption underlying the definition of the style of speech continuum is that every agrammatic speaker who does not demonstrate paragrammatism or non-fluencies is a *preventive* speaker, who employs elliptical constructions predominantly. As Table 2 demonstrates, to a large extent this is true. However, there is also a small percent of correct sentences. The large majority of these sentences, however, were simple sentences, and could therefore still be seen as the consequence of preventive adaptation. This is indicated by the observation that only 4 of the 17 fluent and full sentences that were produced by a few of our participants contained a subordinate clause.

[6]One reviewer remarked that the style of speech continuum cannot be considered a true continuum since 10 of the 12 participants (all except TW and WR) show outstandingly high values for corrective style of speech. However it is to be noted that the variation in the group as a whole was large enough to bring about significant correlations. Without TW and WR, the significance of these correlations did not change for the greater part. That is, with $N = 10$, all correlations between the style of speech continuum and the primary outcomes measures as well as the neuropsychological measures remained significant. The only exception is the correlation between the AESQ and the style of speech continuum, which failed to reach significance with $N = 8$ (ML and HK had missing data for the AESQ), $r = -.083$, $p > .05$. These correlations confirm our assumption that there is truly a continuum that underlies the stylistic differences within our group of agrammatic patients.

TABLE 2
Percentage of non-fluent and incorrect utterances produced in the pre-therapy AAT used for constructing the style of speech continuum

	Sentences (in %)			*Ellipses (in %)*			*Total non-fluent and incorrect (in %)*
Subject	*Correct, fluent*	*Correct, non-fluent*	*Incorrect*	*Correct, fluent*	*Correct, non-fluent*	*Incorrect*	
GJ	0.00	42.86	23.81	4.76	28.57	0.00	95.24
EL	6.45	32.26	38.71	3.23	16.13	3.23	90.33
CP	5.26	34.21	23.68	7.89	23.68	5.26	86.83
AJ	0.00	0.00	0.00	15.00	78.75	6.25	85.00
ML	2.70	0.00	5.41	13.51	70.27	8.11	83.79
HK	10.81	48.65	24.32	13.51	2.70	0.00	75.67
RK	3.33	0.00	6.67	23.33	63.33	3.33	73.33
JP	1.61	4.84	29.03	25.81	32.26	6.45	72.58
PO	0.00	14.63	12.20	29.27	41.46	2.44	70.73
AH	4.26	6.38	19.15	25.53	40.43	4.26	70.22
TW	3.13	0.00	3.13	53.13	37.50	3.13	43.76
WR	5.08	0.00	8.47	55.93	25.42	5.08	38.97
M	3.55	15.32	16.22	22.58	38.38	3.96	73.83
SD	3.15	18.77	11.97	17.16	22.50	2.47	17.24

improvement, preventive speakers were included in the present study as well. This was done for two reasons. Firstly, we wanted to evaluate treatment outcome for a more or less representative sample of the clinical population. Secondly, REST may help preventive speakers to automatise the production of ellipses. As a result, ellipses can be produced more fluently as well as increased in length and complexity.

Further subject characteristics

We expected that there would be individual differences in the efficacy of REST. With several tasks and tests listed below, we investigated the subjects' characteristics that we hypothesised to have an effect on the treatment outcome.

Executive functioning. A psychological assistant measured the participants' executive functioning with three tests: (1) The Dutch version of the Stroop-Color-Word Test (Hammes, 1971). The outcome measure of the Stroop Test was the percentage of times the word was named instead of the colour of the ink in which that particular word was printed[7]. (2) The

[7]Since two of the 12 participants (i.e., GJ and EL) were unable to complete the Stroop test and none of the remaining 10 participants produced response times that came within the range of healthy controls, the interference effect could not be established from the norm data of Schmand, Houx, and De Koning (2002).

TABLE 3
Individual performance (in %) on the measurements used to establish inter-subject variability in the efficacy of REST (for explanation, see text)

Subj.	$Stroop_{M(T1-T3)}$	$TOL_{M(T1-T3)}$	$WCST_{M(T1-T3)}$	$CIAQ_{(T1)}$	$AESQ_{(T2)}$	$SOIT_{(T1)}$	$SOIT_{(T2)}$	$SOIT_{(T3)}$
GJ	md	7.41	70.30	41.67	83.00	15.00	20.00	30.00
EL	md	27.47	31.39	41.67	100.00	15.00	0.00	20.00
CP	2.33	28.79	32.36	33.33	50.00	12.50	17.24	16.07
AJ	0.00	21.06	31.81	83.33	83.00	0.00	0.00	0.00
ML	1.00	16.30	26.62	41.67	md	26.79	7.55	12.07
HK	25.33	14.65	37.27	25.00	md	25.00	24.56	19.64
RK	81.67	25.45	35.72	58.33	100.00	5.00	0.00	0.00
JP	0.67	34.24	31.41	8.33	100.00	22.41	20.00	22.03
PO	4.67	30.83	49.93	33.33	100.00	66.10	51.67	46.67
AH	1.33	6.11	37.64	25.00	50.00	46.55	49.12	30.51
TW	4.00	16.67	39.61	50.00	50.00	0.00	0.00	0.00
WR	84.67	25.15	72.92	0.00	0.00	0.00	5.00	0.00
M	20.57	21.18	41.41	38.81	71.60	19.53	16.25	16.42
SD	33.82	9.04	15.26	22.04	33.35	20.08	18.32	14.92

Six participants (GJ, EL, AJ, RK, TW, and WR) were not able to complete the SOIT because of problems in reading; they were presented with a picture description task – the subtest Sentence Construction of the Dutch Werkwoorden- en Zinnentest (WEZT; Bastiaanse et al., 2000) – instead.

Wisconsin Card Sorting Test (WCST; Van Schijndel, 1994). In line with Keil and Kaszniak (2002) as well as Miyake et al. (2000), the percentage of perseverative errors (when compared to the total number of errors) was used as the outcome measure of the WCST. (3) The Tower of London Test (TOL; Shallice, 1982). The dependent measure for this task was the percentage of configurations that participants could correctly produce, although did not produce at a first attempt. Since the Stroop, the WCST, as well as the TOL were administered at each point in time at which the efficacy of REST was assessed, we averaged – for each and every participant – the scores obtained at T1, T2, and T3 (see Table 3).

Communicative Intellectual Awareness Questionnaire (CIAQ). The CIAQ was administered at T1 to test whether participants had *intellectual awareness* (Crosson et al., 1989). One of the conditions in order to initiate compensatory speech behaviour is the awareness that language production difficulties arise from time to time. The CIAQ, which is an adapted version of the Everyday Communicative Needs Assessment (ECNA; Worrall, 1992), contains 35 items in total. Twelve out of the 35 items are relevant, because they measure spoken language production. The other items are fillers as they related to other (non)verbal activities of everyday life (for details, see Ruiter, 2008). The dependent measure of the CIAQ is the percentage of relevant items on which the participant indicated to have at least some problems.

Acceptation of Elliptical Style Questionnaire (AESQ). Elliptical style may be a less rewarding option. However, in order to compensate their language disorder to a maximal degree, agrammatic speakers should not only opt for ellipses in informal communicative settings, but also in more formal settings in which sentences would be more appropriate. In order to construct the AESQ, we asked healthy control participants ($N = 10$) to label 20 communicative scenarios as formal or informal. All control participants were native speakers of Dutch. Their age ranged from 32.6–54.0 years ($M = 48.8$) and their level of education from 5–7 (Verhage, 1964). Six out of these 20 scenarios were considered formal by at least 80% of the control speakers.

At T2, the agrammatic speakers were presented with the AESQ. The dependent measure of the AESQ was the percentage of formal communicative scenarios in which an agrammatic speaker would opt for ellipses. Thus, the higher the percentage, the more the participant accepted elliptical style. An AESQ item that was labelled formal, for example, was, "Suppose you are engaged in conversation with an unknown person. When you answer the telephone an unknown person asks for Mr Pietersen. You have to indicate that he has got the wrong number. Would you opt for full sentences or for simplified utterances? It is important to note that you indicate which style of speech you would prefer, even if it would be really difficult to actually do so" (for further details on the AESQ and characteristics of the control participants, see Ruiter, 2008).

Treatment method

In the present study, a Dutch and adapted version of the Reduced Syntax Therapy (REST, Ruiter et al., 2003) was used. The Dutch version was prepared along the lines of the original German programme of Schlenck et al. (1995); however, the German programme was not literally translated into Dutch. New training items were constructed and we subdivided the five levels of the original REST approach into 10 (see Table 4). This subdivision allowed a more gradual increase in the complexity of the ellipses trained as well as the addition of two therapy levels (for a more detailed description of the Dutch REST, see Ruiter, 2008).

In applying the Dutch REST, we used the same training methods as were used in the original German version. Also in line with Schlenck et al. (1995), we selected pictorial material from the Photo Series of Everyday Life Activities (ELA; Stark, 1992).

A pilot study was conducted with five agrammatic participants, who were all in the sub-acute phase (i.e., 6 months post-onset at the most). The pilot results indicated that the treatment protocol did not sufficiently stimulate participants to generalise elliptical style to spontaneous speech. In order to stimulate participants to use ellipses regularly in free conversation as well,

TABLE 4
Therapy levels of the Dutch Reduced Syntax Therapy (REST)

Therapy level	*Dutch*	*English translation*
Isolated predicates		
1 V (Infinitive/past participle)		
Theme:	DOEN (GEDAAN)	DOING (DONE)
Examples:	Eten (gegeten)	Eating (eaten)
No items: 80	Lezen (gelezen)	Reading (read)
2 Object (NP/PP) + V		
Theme:	WAT – DOEN (GEDAAN)	DOING (DONE) – WHAT
Examples:	Koffie drinken	Drinking coffee
No items: 80	Op bus wachten	Waiting for bus
3 Adjunct (AdvP/PP) + V		
Theme:	WAAR/WANNEER – DOEN (GEDAAN)	DOING (DONE) – WHERE/WHEN
Examples:	Morgen winkelen	Shopping tomorrow
No items: 25	In zee zwemmen	Swimming in sea
4 Adjunct + object + V		
Theme:	WAAR/WANNEER – WAT DOEN (GEDAAN)	DOING (DONE) – WHAT WHERE/WHEN
Examples:	In auto koffie drinken	Drinking coffee in car
No items: 40	Gisteren kleren gekocht	Bought cloths yesterday
Subject + predicate connections		
5 Subject + nonverbal predicate (NP/AP/PP)		
Theme:	WIE – WAT/WAAR	WHO – WHAT/WHERE
Examples:	Man boos	Man angry
	Tim broer	Tim brother
No items: 60	Sam op school	Sam at school
6 Subject + V		
Theme:	WIE – DOEN (GEDAAN)	WHO – DOING (DONE)
Examples:	Man slapen	Man sleeping
No items: 40	Meisje gehuild	Girl cried
7 Subject + object + V		
Theme:	WIE – WAT – DOEN (GEDAAN)	WHO – DOING (DONE) – WHAT
Examples:	Man haar wassen	Man washing hair
No items: 40	Meisje brood snijden	Girl cutting bread
8 Adjunct (AdvP/PP) + subject + V		
Theme:	HOE/WAAR/WANNEER – WIE – DOEN (GEDAAN)	WHO – DOING (DONE) – HOW/WHERE/WHEN
Examples:	Lisa op stoep fietsen	Lisa cycling on sidewalk
No items: 40	Sam in Zweden kanoën	Sam canoeing in Sweden

(*Continued*)

TABLE 4
Continued

Therapy level	*Dutch*	*English translation*
9	Subject + indirect object + direct object + V	
Theme:	WIE – WIE – WAT – DOEN (GEDAAN)	WHO – DOING (DONE) – WHAT – TO WHOM
Examples:	Jongen man koekje geven	Boy giving cookie to man
No items: 60	Lisa Sam brief geschreven	Lisa written letter to Sam
10	Adjunct (AdvP/PP) + subject + object + V	
Theme:	HOE/WAAR/WANNEER – WIE – WAT – DOEN (GEDAAN)	WHO – DOING (DONE) – WHAT HOW/WHERE/WHEN
Examples:	Gisteren Lisa huis verkocht	Lisa sold house yesterday
No items: 60	Lisa 's nachts taart bakken	Lisa baking cake at night

NP = Noun Phrase; PP = Prepositional Phrase; AP = Adjectival Phrase; AdvP = Adverbial Phrase

we changed the treatment protocol by adding a withdrawal component (to be described below).

In the proper study, each chronically agrammatic participant ($N = 12$) was individually treated four times a week; each therapy session lasted one hour. The Dutch REST programme ended after 16 weeks, regardless. Whenever a participant successfully completed all 10 levels before the 16 weeks of therapy had expired, the treatment also ended. The treatment programme was conducted by the first author and was carried out according to a protocol. This protocol held literal instructions, criteria for starting a next therapy level, standardised cueing strategies for content word retrieval, and procedures for giving feedback. In line with Springer et al. (2000) the production of determiners was not encouraged; however, participants were not forced to omit them. In addition, prepositions could be omitted.

Each therapy level was practised until the participant could produce a well-formed ellipsis on at least 90% of the training items without the therapist's help. Each time two successive therapy levels had been completed, participants were presented with an intervening test in which they were instructed to describe 40 pictures independently. Instead of using the ELA Photo Series, 200 different pictures were used in these tests. Without the therapist helping them, the agrammatic participants had to produce ellipses on at least 90% of the test items. Each time the 90%-criterion was met, therapy would be withdrawn for a week. After therapy had been withdrawn for a week, participants were presented for a second time with an intervening test. Only if participants were able to meet the 90%-criterion again, would therapy continue with a new therapy level. This way, participants were stimulated to retain the continuous usage of elliptical style. If participants failed to

meet the 90%-criterion (i.e., could not retain the therapy effect for a week), therapy continued with the rehearsal of the preceding two levels.

Outcome measures

At T1, T2, and T3, spoken language performance was measured in several settings, because agrammatic symptoms are task-dependent. In none of the tasks was there any time constraint placed on the participants. Neither were they instructed or provided with feedback about their style of speech. An independent speech therapist investigated participants' grammatical output in two sessions that lasted 1 hr 30 min on average with the following tasks and tests:

- *Semi-standardised interview of Aachen Aphasia Test (AAT).* First of all, the agrammatic participants were presented with the semi-standardised interview of the Dutch version of the AAT (Graetz et al., 1992).
- *Picture Description Task with distracting environmental noise (PDT).* Secondly, the participants were instructed to describe 40 pictures in the presence of distracting environmental stimuli (e.g., an audiotape of a group of eight adults making conversation, played over loudspeakers at a comfortable listening level – approximately 65 dB). Testing participants' performance in applying elliptical style in the presence of distracting stimuli may give an indication of the amount of automaticity reached in using ellipses on a regular basis. The PDT is described in detail in Ruiter (2008).
- *Games of Happy Families (HF).* In the third communication condition, participants were engaged in conversation with a significant other, such as their husband or wife. To facilitate conversation, both the participant and the significant other played three games of *happy families* with line drawings. These 50 black and white drawings were – with the authors' permission – taken from Hofstede and Kolk (1994). As all cards bore a strong resemblance, the agrammatic participants were forced to describe the drawing in such a way that their significant other could select the matching picture (for literal instructions, procedure, and material, see Ruiter, 2008).

Connected speech was elicited with the AAT, the PDT, and the games of HF. Each speech sample was orthographically transcribed and timed. All time taken by the experimenter's (or significant other's) speech was subtracted. However, pauses that occurred prior to or within the boundaries of participant's turn of talk were included in the time for the participant's speech (Oelschlaeger & Thorne, 1999). Subsequently, the total number of words was counted. Dividing the words by the total time for participant's speech yielded a measure of speech rate in words per minutes.

After transcribing and timing, the speech samples were segmented into utterances. Similar to De Roo (1999) as well as Saffran, Berndt, and Schwartz (1989), we used three hierarchically ordered criteria for segmentation: (1) a syntactic, (2) a prosodic (i.e., falling intonation in declarative utterances), and (3) a semantic criterion. Utterances containing automatised or stereotypical elements were excluded. Direct responses to or repetitions of the experimenter's speech, unintelligible or non-interpretable utterances, and commentary on the task or participant's performance were discarded from analysis as well. Whenever possible, the narrative core remaining consisted of at least 300 words, which is in line with the protocol *Analyse voor Spontane Taal bij Afasie* (ASTA; Wijckmans & Zwaga, 2005; see also Brookshire & Nicholas, 1994).[8]

The following linguistic parameters were calculated over the speech samples elicited with the AAT, PDT and games of HF:

- *Percentage of ellipses.* Each utterance of the narrative cores was classified as either an ellipsis or a sentence, based on the criterion of *finiteness.* Whenever this criterion could not unambiguously differentiate between ellipses and sentences (as for example in *kinderen spelen*, "children playing") that utterance was labelled sentential. Subsequently, the percentage of ellipses was calculated.
- *Length of ellipses.* We used the number of constituents to calculate the length of the ellipses. This way we controlled for agrammatic speakers' tendency to leave out determiners, which may be even stronger after REST. Although this approach is much more conservative than using the number of words, it has a disadvantage as well: elaborations of constituents (e.g., *old man* versus *man*) are overlooked. However, the effect that the production of additional elements may have on functional communication is not neglected. This issue will be discussed below.
- *Percentage of ellipses containing a non-finite verb.* The percentage of ellipses containing a non-finite verb (in comparison to the ellipses without a verb) was calculated.

In addition to the linguistic parameters of grammatical output, the following parameters of functional communication were calculated over the speech samples elicited with the PDT and the games of HF:

[8]At T1, T2 as well as T3, all participants ($N = 12$) produced sufficient sample sizes in the HF and across conditions. Thus, these samples yielded reliable measures of language performance. However, since not all participants produced sufficient sample sizes in the AAT and PDT, the results obtained in these conditions have to be interpreted with caution (for details, see Ruiter, 2008). To give an indication of the percentage of material excluded from analysis, we provide for each participant the percentage of clauses excluded across conditions (i.e., AAT, PDT, and HF) and across points in time at which the effect of REST was assessed (i.e., pre, post, and follow-up): GJ: 33.23%, EL: 13.46%, CP: 6.20%, AJ: 7.30%, ML: 10.48%, HK: 8.93%, RK: 12.35%, JP: 5.99%, PO: 28.55%, AH: 12.04%, TW: 14.15%, and WR: 14.12%. The weighted mean was 18.07%.

- *Communicative efficacy*. In the present study, an objective and quantified measure of communicative efficacy was used, which is similar to the Correct Information Unit analysis (CIU; Brookshire & Nicholas, 1994; Nicholas & Brookshire, 1993).[9] In line with the plea to judge agrammatic speakers' communicative efficacy against external criteria (Ramsberger & Rende, 2002), reference was made to the efficacy of healthy controls ($N = 10$, described in detail in Ruiter, 2008). With the pictorial material in the HF and PDT we could establish reliably which information units the healthy controls did include in their messages. In line with Christiansen (1995) and Huber (1990), only those information units that were produced by at least 75% of the control participants were labelled *Essential Information Units* (*EIUs*). We counted the number of *EIUs* that each agrammatic participant expressed. Whenever comprehensible to the context, circumlocutions were counted as *EIUs*; however, semantic paraphasias were not.
- *Communicative efficiency*. Dividing the total number of *EIUs* by the time for speech yielded the average number of essential information units per minute (*EIU*/*min*).

Statistical analyses

At the individual level, one-tailed Mann-Whitney tests ($\alpha = .05$) were used to test whether the Dutch REST had significantly increased the length of the ellipses produced between T1 and T2 as well as between T1 and T3. The Mann-Whitney test, the nonparametric equivalent of the independent *t* test, was used because the Shapiro-Wilk test had revealed that the distribution of lengths differed significantly from the normal distribution. Since we compared the lengths of the ellipses produced in six narrative cores, the Holm method (e.g., Holm, 1979; Levin, 1996) was used to control for inflation of the Type I error. In addition, one-tailed Likelihood ratios ($\alpha = .05$) were calculated to test the difference in the percentage of ellipses produced over the various instants in time. The *LR* procedure was also used to test whether the percentage of essential information units (*EIUs*) had significantly increased.

The data were analysed at the group level as well. One-tailed Wilcoxon signed-ranks tests ($\alpha = .05$) were performed on the complete set of data ($N = 12$) to test whether the outcome measures had changed significantly over time. Again, the Holm method was used to control for inflation of the Type I error.

Pearson's correlation coefficient, *r*, was used as a measure of the strength and direction of linear dependence between two variables. The associated

[9]Participants were also presented with the Amsterdam-Nijmegen Everyday Language Test (ANELT; Blomert, Koster, & Kean, 1995). However, the test scores could not be used due to an experimental error.

p value of each Pearson correlation was obtained on the basis of randomisation tests, by means of the systematic permutation method, because the distribution of the variables did not meet the assumptions of significance testing of *r*s (Rietveld & Van Hout, 2005). In the current study, Pearson's correlation coefficient was also used to indicate the strength of an experimental effect. Importance of the effect was interpreted with the criteria of Cohen (1988, 1992, p.32, cited in Field, 2005).

RESULTS

The primary research question was divided into several sub-headings: (1) learning to use elliptical style on a regular basis, (2) effect of REST on grammatical output produced on untrained materials, (3) maintenance of the training effect over time, (4) differences between non-preventive and preventive speakers in the effects of REST on grammatical output, and (5) effects of REST on functional communication. The following sections will present the main results relating to these sub-headings.[10]

Learning to use elliptical style on a regular basis

The first subject matter to be discussed is the ability to learn to use elliptical style frequently in therapy. The agrammatic speakers ($N = 12$) successfully completed an average of 8 out of the 10 therapy levels within 16 weeks and needed 1.8 trials (range: 1.2–3.8) on average to meet the 90%-criterion for each therapy level. Eight participants (i.e., EL, CP, AJ, ML, HK, JP, AH, and TW) successfully completed the entire treatment programme within 16 weeks, while the other four participants completed only a part of the programme. It is important to note that the latter participants were able to meet the 90%-criterion on the therapy levels that they completed.

These results indicate that all agrammatic speakers were able to learn to apply elliptical style in therapy; however, between-subject variation in learning to do so was observed. By correlating the style of speech continuum with both learning parameters (i.e., highest therapy level reached and average number of trials to 90%-criterion), we sought to account for this variability; however, both correlations failed to reach significance, p values $>.05$.

Effect of REST on grammatical output and its maintenance

In discussing the effects of REST on grammatical output, a first question that arises is whether the results of Springer et al. (2000) could be reproduced. We

[10]There were no non-compliant participants. Secondly, we recall that none of the 12 participants produced significantly more well-formed sentences in the SOIT (all p values $>.05$). Thus, spontaneous recovery cannot explain possible improvements after therapy.

used their morpho-syntactic outcome measures to analyse the speech samples that were elicited in the present study with the AAT. For only one of the 12 Dutch participants could we replicate Springer et al.'s findings: WR significantly increased the percentage of closed class elements after REST, from 26.44 to 41.86% ($LR = 4.606$; $p = .024$). We delay interpreting this finding until the General Discussion. In the next paragraphs, the main results of the present study are presented.

Before being treated with REST, on average 58.13% of the utterances that the 12 agrammatic speakers produced across untrained communicative conditions (i.e., AAT, PDT, and HF) consisted of ellipses. At T2, this was 71.01%. This increase of 12.88% is significant, $z = -2.510$, $p = .025$, and represents quite a large effect ($r = -.51$). The group of agrammatic speakers could also maintain the effect of REST on the average percentage of ellipses produced quite well: At T3, they still produced significantly more ellipses ($M = 67.46\%$) across untrained conditions than at T1, $z = -2.510$, $p = .025$, $r = -.51$.

At the group level, the average length of the ellipses produced across untrained conditions also significantly increased from an average of 1.50 constituents at T1 to 1.79 at T2, $z = -2.934$, $p = .000$, $r = -.60$. However, this effect was no longer present 6 months after ending REST ($M = 1.67$), $p > .05$.

As to the individual effect sizes, 11 of the 12 participants significantly increased the overall percentage of ellipses, their length, or both from T1 to T2. An unexpected finding was that WR significantly decreased the overall percentage of ellipses from T1 (88.63%) to T2 (79.25%), $LR = 10.164$, $p = .005$. At T3, the effects of REST on participants' grammatical output were still present in 9 of the 11 participants (i.e., GJ, EL, CP, AJ, ML, RK, PO, AH, and TW). At T3, WR showed a small – but non-significant – increase on this variable (92.28%), $p > .05$.

Effects of training per condition

The data presented in the preceding paragraphs were obtained by taking all communicative settings together. Table 5 presents the training effects per condition. As Table 5 illustrates, in both the PDT and HF, the group of agrammatic speakers ($N = 12$) significantly increased the percentage of ellipses from T1 to T2. Only in the PDT, the participants, on average, produced significant lengthier ellipses at T2.

As to the individual participants, significant increases in both the percentage and length of the ellipses produced were obtained for the post-therapy PDT and HF (cf. Table 5). In none of the individual participants could significant effects of REST be established for the post-therapy AAT. Table 6 presents a few examples of the utterances that some participants produced

TABLE 5
Training effects of REST per condition

	Morphosyntactic variables	Group level ($N = 12$) T1	T2	T3	Δ		Wilcoxon sign. rank test	Effect size	Individual level [a]
AAT	% Pre–Post	64.91	70.04		5.13		$z = -1.490$, $p = .152$	$r = -.30$	ns
	Pre–FU	64.91		68.08	3.17		$z = -0.978$, $p = .366$	$r = -.20$	ns
	L Pre–Post	1.58	1.73		0.15		$z = -1.490$, $p = .099$	$r = -.30$	ns
	Pre–FU	1.58		1.60	0.02		$z = -0.275$, $p = .750$	$r = -.06$	ns
PDT	% Pre–Post	39.33	65.02		25.69	*	$z = -2.275$, $p = .040$	$r = -.46$	7/12 sign
	Pre–FU	39.33		55.95	16.62	*	$z = -2.510$, $p = .025$	$r = -.51$	4/7 sign
	L Pre–Post	1.81	2.33		0.52	**	$z = -2.824$, $p = .005$	$r = -.58$	5/12 sign
	Pre–FU	1.81		2.15	0.35		$z = -2.276$, $p = .050$	$r = -.46$	3/5 sign
HF	% Pre–Post	62.03	72.89		10.86	*	$z = -2.275$, $p = .040$	$r = -.46$	5/12 sign
	Pre–FU	62.03		70.79	8.76		$z = -1.883$, $p = .096$	$r = -.38$	3/5 sign
	L Pre–Post	1.43	1.59		0.16		$z = -1.844$, $p = .099$	$r = -.38$	6/12 sign
	Pre–FU	1.43		1.58	0.15		$z = -1.511$, $p = .222$	$r = -.31$	4/6 sign

% = percentage of ellipses produced; *L* = length of ellipses produced (in constituents).

[a] This column indicates how many participants showed a significant effect of REST on their grammatical output (i.e. increased the percentage and/or length of ellipses produced). In the rows labelled *Pre–FU* it is indicated how many of the participants who had shown a significant effect at T2, also did so at T3.

*$p < .05$ (one-tailed), **$p < .01$ (one-tailed).

TABLE 6
Examples of the effect of REST on participants' grammatical output produced in the PDT

Subject	*Pre-therapy*	*Post-therapy*
EL	*Eh hij ze zij is eh is ha.handen aan 't wassen* "Uh he she she is uh is washing ha.hands"	*Eh vrouw is eh . . . handen wassen* "Uh woman is uh . . . washing hands"
CP	*Eh . . . vrouw eh . . . wast d'r zijn handen in de v . . . eh wastafel* "Uh . . . woman uh . . . washes her his hands at the s. . . uh sink"	*Mevrouw handen wassen* "Lady washing hands"
RK	*Eh . . . is . . . een meisje . . . handen wassen . . . schoon . . . aan aanrecht* "Uh . . . is . . . a girl . . . washing hands . . . clean . . . at sink"	*Meisje handen wassen . . . aan aanrecht* "Girl washing hands . . . at sink"
TW	*De vrouw wassen handen* "The woman washing hands"	*Vrouw handen wassen* "Woman washing hands"
WR	*Eh . . . man vrouw, bedoel ik . . .. en de . . . handen schoonmaken* "Uh . . . man woman, I mean . . . and . . . cleaning the . . . hands"	*Een man de vrouw de handen schoonmaken* "A man the woman cleaning the hands"

before and after REST when describing a picture of a woman washing her hands at the sink. This is one of the items of the PDT. These examples illustrate the between-subject variability in grammatical output.

Six months after ending REST, the agrammatic speakers as a group still produced significantly more elliptical constructions in the PDT (cf. Table 5). However, the significant effect on the length of the ellipses produced that could be established in the PDT at T2, was no longer present. At T3, the group of agrammatic speakers also no longer showed a significant effect of REST on the percentage of ellipses produced in the games of HF. At T3, significant long-term maintenance effects could be established at the individual level in both the PDT and games of HF (details on the individual effect sizes are provided in Ruiter, 2008).

It is of some interest to look at the effects of training on the production of ellipses containing a verb separately, because 9 of the 10 therapy levels of the Dutch and adapted version of REST train ellipses that contain a verb (i.e., infinitive or past participle). For reasons of space, we present the results at the group level only. From T1 to T2, the agrammatic speakers ($N = 12$) significantly increased the overall percentage of ellipses containing a verb from 14.00 to 27.59%, $z = -3.059$, $p = .000$, $r = -.62$. At T3, the agrammatic speakers still produced significantly more ellipses with a non-finite verb (i.e., 21.49%) across untrained conditions, $z = -2.134$, $p = .016$, $r = -.44$. It is important to note that, although the percentage of ellipses with a non-finite verb significantly increased after REST, the agrammatic speakers for the greater part produced ellipses without a verb at T2 and T3 (i.e., 72.41% and 78.51%, respectively).

Individual differences: Preventive and non-preventive speakers

The style of speech continuum correlated positively and significantly with the percentage of ellipses produced across untrained communicative settings, $r = .645$, p (one-tailed) $= .011$. The continuum accounted for 41.6% of the variation in the change in the percentage of ellipses produced. Thus, the effect of REST on the percentage of ellipses produced across untrained conditions was larger for non-preventive than for preventive speakers.[11] Also in line with our expectations, the style of speech continuum correlated positively and significantly with the pre–post increment in the percentage of ellipses produced in the AAT ($r = .667$, $p = .006$) and the games of HF ($r = .580$, $p = .012$).

[11]As indicated before, we do not make a categorical distinction between *preventive* and *non-preventive speakers*. Instead, we opt for a continuum. For reasons of convenience, however, we will use these labels as an alternative for *the more preventive* and *the more non-preventive speakers*.

The non-preventive speakers were not better than preventive speakers in maintaining the therapy effect for the long term: The style of speech continuum could not explain individual differences in the effect of REST on the percentage of ellipses produced at T3; this was the case in individual conditions and across conditions. What is more, neither at T2 nor T3, could the style of speech continuum explain individual differences in the increase in the length of ellipses produced, all p values $>.05$. We delay interpreting the latter finding until the General Discussion.

Functional communication

As described above, functional communication measures were only applied to the PDT and HF. In both the PDT and HF, the group of agrammatic speakers ($N = 12$) showed significant pre–post increases in communicative efficiency. At T2, the group showed significant gains in communicative efficacy in the HF only. As expected, almost all participants who significantly enhanced elliptical style also improved communicative efficiency: eight out of nine participants in the PDT and all participants ($n = 8$) in the HF. At the individual level, gains in communicative efficacy were observed, however, only for a small number of participants (one out of nine in the PDT and three out of eight in the HF, cf. Table 7).

At T3, the group of agrammatic speakers still produced significantly more essential information units (i.e., *%EIU*) in the HF. The effects on communicative efficiency, which could be established at T2, were also long lasting: At T3, the participants ($N = 12$) still showed significant gains in communicative efficiency in both the PDT and HF. At the individual level, maintenance of the gains in communicative efficacy and efficiency could be observed for both the PDT and HF (cf. Table 7).

Possible disturbing and facilitating factors

Since we used the style of speech continuum to investigate individual differences in the effects of REST on grammatical output, we sought to specify the cognitive mechanisms that underlie this continuum by correlating it with: (1) acceptance of elliptical style (AESQ), (2) communicative awareness (CIAQ), and (3) executive performance (Stroop, TOL, and WCST). Of these neuropsychological factors, only acceptance of elliptical style correlated positively and significantly with the style of speech continuum, $r = .648$, p (one-tailed) $= .023$. This finding indicates that non-preventive speakers accept elliptical style significantly better than the preventive speakers. In line with our expectations, non-preventive speakers seem to be more aware of their difficulties in spoken language production and have somewhat better executive functioning than preventive speakers; however, the correlations between the style of speech continuum and the two neuropsychological factors failed to

TABLE 7
Effects of REST on functional communication

	Morphosyntactic variables		Group level ($N = 12$) T1	T2	T3	Δ		Wilcoxon sign. rank test	Effect size	Individual level [a]
PDT	*%EIU*	Pre–Post	77.54	76.32		−1.22		$z = -0.311$, $p = .392$	$r = -.06$	1/9 sign
		Pre–FU	77.54		78.26	0.72		$z = -0.589$, $p = .291$	$r = -.12$	1/1 sign
	EIU/min	Pre–Post	8.79	12.10		3.30	*	$z = -2.275$, $p = .010$	$r = -.46$	8/9 EOR >1
		Pre–FU	8.79		12.11	3.32	*	$z = -1.961$, $p = .026$	$r = -.40$	5/8 EOR >1
HF	*%EIU*	Pre–Post	73.67	78.55		4.88	**	$z = -2.511$, $p = .005$	$r = -.51$	3/8 sign
		Pre–FU	73.67		79.06	5.38	**	$z = -2.589$, $p = .003$	$r = -.53$	1/3 sign
	EIU/min	Pre–Post	9.03	13.11		4.08	*	$z = -2.275$, $p = .010$	$r = -.46$	8/8 EOR > 1
		Pre–FU	9.03		14.15	5.12	**	$z = -2.510$, $p = .005$	$r = -.51$	4/8 EOR > 1

%EIU = percentage of essential information units (communicative efficacy); *EIU/min* = number of essential information units produced per minute (communicative efficiency). *EOR = efficiency odds ratio*, which indicates the change in *EIU/min*. Since the EOR is a ratio, an EOR over 1 indicates an increase.

[a] The rows labelled Pre–Post indicate how many participants who showed a significant effect of REST on their grammatical output in the PDT ($n = 9$) and the HF ($n = 8$), also increased functional communication. The rows Pre–FU indicate how many participants still showed such an effect at T3.

* $p < .05$ (one-tailed), ** $p < .01$ (one-tailed).

meet significance, both p values $>.05$ (maximum level of power achieved was 54.98%).[12]

GENERAL DISCUSSION AND CONCLUSION

The primary goal of the present study was to investigate whether a Dutch and adapted version of Reduced Syntax Therapy (REST) could stimulate and automatise the production of ellipses in Dutch-speaking, chronically

[12]Correlating the neuropsychological factors with the outcome measures of grammatical output across conditions at T2 yielded the same trends. That is, the more agrammatic speakers accept ellipses and the more they are aware of their language difficulties, the larger the effect of REST on their grammatical output. Also in line with our predictions, the effects on grammatical output were larger in participants with good executive functioning. However, none of the correlations were significant, all p values $>.05$.

agrammatic speakers. The second goal was to investigate whether functional communication improves after REST. Regarding the first main goal, the results of the present study indicate that all agrammatic speakers ($N = 12$) were able to learn to apply elliptical style frequently during the period of therapy. After REST, 11 of the 12 participants showed a significant increase in elliptical style across untrained communicative settings. Even 6 months after ending the therapy programme, significant effects on grammatical output could be established in 9 of these 11 participants. Gains in communicative efficiency could be established in almost all participants who applied elliptical style significantly more often after REST. With respect to communicative efficacy, significant improvements were observed as well; however, only in a small number of participants.

Although we are aware of the fact that the results of the current study will have to be confirmed using a stronger design (e.g., a randomised control trial), we will nevertheless reflect on the results obtained with the present study. We failed to reproduce most of the findings obtained by Springer et al. (2000). As has been discussed in the Introduction, this may relate to differences in the outcome measures used to assess the effect of REST on grammatical output. Whereas Springer et al. (2000) calculated linguistic outcome measures over ellipses and sentences together, we clearly separated both types of utterances. More specifically, in investigating the effect of REST on grammatical output, we analysed the ellipses only.

We did, however, partly replicate the effects of REST on functional communication, found by Van den Berg and Kolk (1996). In their study, chronically agrammatic speakers ($N = 2$) significantly increased both elliptical style and communicative efficacy as measured with the Amsterdam-Nijmegen Everyday Language Test (ANELT; Blomert, Koster, & Kean, 1995). In the current study, significant gains in communicative efficacy were observed as well; however, only for a small number of participants who significantly increased elliptical style. In the ANELT, scoring is based on the experimenter's judgement. In the present study, however, we derived a quantitative score of efficacy by referring to the amount of information conveyed by healthy controls. Although we think that a quantified scoring – because of its objectivity – holds great promise, using this measure made it difficult to compare the results obtained in the present study with those obtained by Van den Berg and Kolk.

Between-subject variability

In the present study, we sought to account for between-subject variability in effects of REST on grammatical output. It was hypothesised that non-preventive speakers typically show larger effects of REST than preventive speakers, because the former have more room for improvement in producing ellipses.

In support of this hypothesis, the *style of speech continuum* correlated positively and significantly with the individual differences in the pre–post increment in the percentage of ellipses produced (across untrained conditions, and in both the AAT and HF). Thus, compared to preventive speakers, non-preventive speakers showed larger effects of REST with respect to the percentage of ellipses produced across untrained conditions, in the AAT and HF. However, the style of speech continuum could not explain individual differences in the increment in the length of ellipses produced. This may be due to the fact that we calculated the percentage and length of ellipses produced separately, which is in line with the studies conducted so far (Saffran et al., 1989; Van den Berg & Kolk, 1996). However, the problem is that participants may compensate for an increase in the length of ellipses by decreasing the percentage of ellipses and vice versa (cf. De Roo, Kolk, & Hofstede, 2003). An interesting alternative for future research might be to calculate the combined effects of an increase in the percentage of ellipses produced and their length first. A possible approach to do this would be to calculate the percentage of words produced in ellipses (in comparison to the number of words in sentences).

A paradox

In summarising the results, it appears that non-preventive speakers – when compared to preventive speakers – not only show significantly larger effects of REST, but also seem to have somewhat better skills to apply elliptical style. That is, non-preventive speakers accept elliptical style significantly more; they seem somewhat more aware of the fact that difficulties arise from time to time in getting across their message (n.s.), and they have somewhat better executive function (n.s.). This leads to the question why the non-preventive speakers, who should want and are able to use elliptical style more, need REST to actually do so. There seem to be two neuropsychological factors in this paradox: acceptance of elliptical style and executive function.

To start with acceptance of elliptical style, it seems quite possible that REST provided non-preventive speakers with an efficient style of speech, which they may have been unaware of before. The fact that non-preventive speakers could learn to use ellipses on a regular basis with relative ease may have increased their acceptance of this style of speech. It may also explain why they applied it more often after therapy.

A second aspect of the paradox relates to executive functioning. It is surprising that preventive speakers, who seem to be more limited in executive functioning than non-preventive speakers, already initiated elliptical style frequently before proceeding into therapy. Two explanations suggest themselves. A first explanation is that preventive speakers have already learned

to suppress the prepotent response to produce a sentence, whereas non-preventive speakers have not. Although preventive speakers' executive performance may be sufficient to automatise the production of ellipses, the finding that they did not increase the length of their ellipses may indicate that this cognitive function is hampered.

An alternative explanation is that preventive speakers need less executive functioning than non-preventive speakers to apply elliptical style frequently. With increasing difficulty in sentence production, the prepotent response to produce sentences may be more easily suppressed. That is, there is less response competition between ellipses and sentences if sentence production is hampered. Hypothesising that preventive speakers are more seriously hampered in sentence production than non-preventive speakers, the former may meet the goal of employing ellipses regularly with less effort.

Our finding that non-preventive speakers seem to have somewhat better executive function than preventive speakers is in line with the results obtained in other studies (e.g., Hinckley & Carr, 2001, 2005; Hinckley, Patterson, & Carr, 2001). The fact that we did not investigate all aspects of executive functioning may have prevented us from finding significant differences between both types of speakers. The participants were presented with neuropsychological tests that tap on *inhibition* and *shifting* (cf. Miyake et al., 2000); however, the test battery did not include any tests on *updating and monitoring*. The latter executive function seems to play an important role in corrective adaptation, which is often employed by non-preventive speakers. For the restart-strategy to be effective, non-preventive speakers have to monitor their overt and covert speech production. Therefore, the absence of significant correlations with executive functioning could be due to the fact that we did not apply the appropriate executive tests. Finally, the lack of significant correlations could be due to a lack of statistical power.

A question that remains is how it is possible that agrammatic speakers accept elliptical style without being fully aware of their speech difficulties. We hypothesise that awareness of spoken language difficulties is a necessary condition for the development and acceptance of elliptical speech; however, it is not a sufficient condition: something extra is needed. As we argued above, non-preventive speakers, as the result of therapy, have become aware of the possibility and the advantage of elliptical speech. For this reason, the CIAQ, which was administered before treatment, was not correlated with elliptical style, while the AESQ, administered after REST, was.

How compensation takes form

Although we are aware of the fact that the results obtained in the current study cannot be considered decisive, they do provide insight into the way compensation takes form.

First of all, the outcomes of the current study provide further evidence for the adaptation theory (e.g., Kolk, 1995; Kolk & Van Grunsven, 1985; Kolk et al., 1984). According to this theory agrammatic symptoms not only reflect a syntactic disorder but also compensatory speech behaviour. The fact that REST could bring chronically agrammatic speakers who applied non-preventive adaptation predominantly before therapy to use preventive adaptation far more regularly, suggests that compensation accounts – at least in part – for the variability in agrammatic symptoms.

Secondly, although compensation typically stems from rarely used cognitive mechanisms, using these cognitive operations more frequently brings about new behaviour. As discussed above, our results suggest that two neuropsychological factors underlie compensatory behaviour: executive functioning and acceptance of ellipses.

To start with executive functioning, it is important to note that the adaptation mechanism requires executive control. That is, using elliptical constructions on a regular basis results from *goal setting* (e.g., Roelofs, 2003). Before constructing an utterance, speakers are in control of message formulation (Levelt, 1989). At the conceptual level, speakers set several goals, for example, to give an answer right to the point (instead of elaborating on the topic) or to convey the message in a formal style (instead of being informal in talking to others). Relevant for the discussion here is that there is also a goal with regard to the degree of elaboration. This holds for any speaker, including speakers who are not aphasic and probably even more so for speakers with sentence production problems. Thus, in order to produce ellipses regularly, agrammatic speakers must explicitly set the goal to simplify the message. Although the results obtained with the present study cannot be considered decisive, they are in line with the studies by Purdy, Duffy, and Coelho (1994) as well as Purdy and Koch (2006), which we described in the Introduction. These studies provided some support for the role of executive functioning in compensatory behaviour.

Next to executive functioning, the degree to which agrammatic speakers accept elliptical style seems to explain their style of speech. They may not be willing to apply elliptical style on a regular basis because it a less common style and sounds childish to the listener. In addition, in overusing ellipses agrammatic speakers may feel they have lost their aphasic distinctiveness. Instead of being recognised as an aphasic speaker whose sentences are produced slowly, with effort, and sometimes incorrectly, the same speaker may be labelled as being incompetent.

In conclusion, if agrammatic speakers do not opt for elliptical style, there could be two reasons. Firstly, there could be a deficit in executive control, which prevents them from suppressing the tendency to speak in complete sentences, even if they are incapable of actually producing complete sentences. Secondly, agrammatic speakers may not choose this option because it is less

rewarding. Further research is warranted to determine the specific contribution of executive functioning and acceptance to compensatory speech behaviour.

Style of speech continuum

As has been discussed in the Introduction, the fact that between-subject variability is a characteristic of agrammatic speech (e.g., Goodglass et al., 1993; Hofstede, 1992) has methodological implications for evaluating the effects of compensation therapy. Group means can be misleading. In focusing on just one or two single cases, there is the danger of concentrating on the extreme cases of the distribution only. By constructing a continuum of participants' language performance, we sought to take the middle between a group and a case study. Since this continuum could be used to explain between-subject variability in the effect of REST on the percentage of ellipses produced across untrained conditions, as well as in the AAT and HF, it provided to be a useful tool to do so. It allowed us to evaluate therapy outcome at the group level and – at the same time – to explore strategic differences between chronically agrammatic speakers. That is, with the continuum, we could identify *preventive* and *non-preventive* speakers. Nevertheless, it is important to recall that, although both kinds of speakers appear to be very different, they still belong to the same group: the group of chronically agrammatic speakers.

Implications for clinical practice

The data of the present study suggest that a Dutch and adapted version of REST improves functional efficiency in almost all chronically agrammatic speakers who significantly enhance elliptical style. Therefore, it may be an effective therapy to help agrammatic speakers for whom restoration therapy is not profitable. It is important to emphasise that the style of speech continuum allowed us to define a subgroup of speakers who seem to profit from REST most. That is, the more paragrammatic errors and non-fluencies a chronically agrammatic speaker shows, the more likely REST will be profitable. This provides those who are involved in the remediation of people with chronic agrammatism a straightforward guideline for selecting possible candidates for REST. Using the semi-standardised interview of the Aachen Aphasia Test, speech therapists can, with relatively ease, calculate the percentage of non-fluently or incorrectly produced utterances.

The second clinical implication of this study has to do with the therapy programme itself. The results of the present study indicate that, although the agrammatic speakers were able to produce ellipses containing a verb in therapy, they omitted verbs in ellipses most of the time after therapy. It is quite possible that the Dutch agrammatic participants leave out verbs in ellipses to reduce processing load to a maximum degree. That is, the study of Indefrey et al. (2001) suggests that ellipses require less linguistic processing than full

sentences. However, within the elliptical repertoire, an agrammatic speaker can adapt even further by producing no verb at all instead of a non-finite one. In line with De Roo et al. (2003), we hypothesise that agrammatic speakers do so to increase the length or complexity of the ellipses produced. The clinical implication is that REST should focus more strongly on the production of elliptical constructions containing no verb. The inclusion criterion with respect to verb retrieval could also be applied less stringently.

Conclusion

After a Dutch and adapted version of Reduced Syntax Therapy (REST), 11 of the 12 participants showed a significant increase in elliptical style across untrained communicative settings. Even 6 months after ending REST, significant effects on grammatical output could be established in the 9 of the 11 participants, which suggest long-lasting effects resulting from time-limited therapy. Functional efficiency improved in almost all chronically agrammatic speakers who produced significantly more or lengthier ellipses after REST. Both preventive and non-preventive speakers showed an effect of therapy; however, the present study typically yielded the largest effects in non-preventive speakers. The results seem plausible and clinically valuable as they offered both linguistic and cognitive accounts as to how REST worked, for whom and why.

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Manuscript received April 2009
Revised manuscript received October 2009
First published online February 2010