and Money's Road Map Test. She had some difficulty with finger gnosis when performed on the examiner (21/35).

R.W.'s resting PET scan was most notable for a superior parietal defect involving supplementary motor cortex more on the left than the right. Otherwise, she exhibited inferior parietal, superior temporal, and middle temporal hypoperfusion more prominently on the left, which resembles the cortical defects seen in Alzheimer's patients.

Discussion. Cases of apractic agraphia are of interest since they provide an opportunity to study in detail the mechanisms underlying the performance of complex learned movements. R.W. had disproportionate difficulty forming, copying, and tracing the letters that constitute her writing. Since her reading and oral spelling were relatively accurate, there appears to be a separate store for written letter expression. She was also impaired at expressing novel material such as freehand drawings and she traced letters in an unusual fashion, suggesting that her impairment is not limited to the execution of a motor template for letters. Moreover, she demonstrated an ideomotor apraxia that was manifested primarily as difficulty using instruments. We hypothesize that the profile of writing impairment in R.W., in the context of her impairments for other motor skills, is due in part to difficulty planning complex, coordinated, instrument-mediated motor acts. Confirming the observations of other investigators, we believe that this performance pattern is related to a defect in supplementary motor cortex.

17. Grammatical Deficits in Patients without Agrammatism: Detection of Agreement Errors by Italian Aphasics and Controls

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Purpose. The first purpose of this study was to investigate the sparing of grammaticality judgment in aphasic patients, with emphasis on agreement morphology. If Broca's aphasics suffer from a selective and unique grammatical deficit (cf. Grodzinsky, 1993), then we should expect their performance on these materials to be demonstrably worse than that of fluent patients who do not demonstrate deficits in expressive or receptive grammar on most clinical tests.

A second purpose of this study was to investigate the temporal dynamics of grammaticality judgment in Italian aphasics and controls, within an interactive activation model (MacWhinney & Bates, 1989) in which such judgments are viewed as a probabilistic, "goodness-of-fit" process.

TABLE 16

Subject–verb errors		
loro *they* quei due ragazzi *those two boys*	corre *is running* corre *is running*	Low predictability–low violation High predictability–low violation
loro *they* quei due ragazzi *those two boys*	corro *am running* corro *am running*	Low predictability–high violation High predictability–high violation
Noun–adjective errors		
Maria *Maria (fem. sing.)* la bella ragazza *the-f.s. pretty-f.s. girl-f.s.*	stanco *tired (masc. sing.)* stanco *tired (m.s.)*	Low predictability–low violation High predictability–low violation
Maria *Maria (fem. sing.)* la bella ragazza *the-f.s. pretty-f.s. girl-f.s.*	stanchi *tired (masc. plural)* stanchi *tired (m.p.)*	Low predictability–high violation Low predictability–high violation

Stimuli varied in degree of grammaticality, on two dimensions: (1) *predictability* (number of cues to the target form), and (2) *violation size* (number of dimensions violated), as shown in Table 16.

The model assumes that error detection involves a form of perceptual match or mismatch between the expected and the observed outcome. In research with aphasics, predictions vary depending upon the nature of the deficit. If patients suffer from a deficit in activation and/or maintenance of inflected forms, then high predictability should facilitate response. If patients suffer from under inhibition and/or a deficit in integration of forms, then high predictability may inhibit response.

Subjects. Subjects (all monolingual native speakers of Italian) included 13 elderly controls matched in age, sex, and social class to the aphasic patients, 9 Broca's aphasics, 5 Wernicke's aphasics, and 4 anomics. Aphasia classifications were based on performance on the Italian version of the Aachen Aphasia Battery.

Materials and Procedures. To construct sentence stimuli, we began with a pool of 96 grammatical sentences, 7–10 words in length, half with a target subject–verb and half with target noun–adjective pairs, together with 54 grammatical fillers from 3–12 words in length. Experimental items were randomly split into grammatical/ungrammatical; ungrammatical items were randomly subdivided into the above high/low predictability and violation conditions. Randomly split fillers were modified to contain errors of omission, movement, and/or other forms of agreement. Sentences were recorded by a native speaker, digitized, and presented auditorally in randomized order at a MacIntosh workstation within the PsyScope experimental control shell. After an initial training period, subjects responded by pressing a "happy face" button on correct sentences and a "frowning face" button for items containing a violation. Accuracy was assessed using A' scores, a nonparametric variant of the d' score, which corrects for response bias. Reaction times were calculated from the beginning of the word that contains the agreement violation.

Results. Elderly controls: A' scores for elderly controls were close to ceiling (.9841), only slightly lower than those of college controls in a separate study (.9893), and did not differ significantly across the various linguistic conditions. Nevertheless, RT analyses showed that elderly controls take substantially longer than college students to reach their decision (2172 vs 803 ms.). The RT anova yielded a main effect of predictability, with *faster* RTs overall under high predictability conditions (2242 for low vs 2101 for high), a form of *grammatical facilitation* that we have not observed in young Italians. A significant three-way interaction of predictability, violation size, and type means that facilitation is observed in all cells except low-violation adjectives.

Aphasics: A group by predictability by violation size by type analysis was conducted on accuracy and RT scores for the three aphasic groups (Broca's, Wernicke's, anomics). All aphasic patients performed above chance (mean A' = .8623, range = .59–.98), and there were no group differences in accuracy; e.g., performance by agrammatic Broca's aphasics was no worse than that of anomics whose impairment is supposedly restricted to lexical access in production. Hence there is no support for the idea that Broca's aphasics are uniquely impaired in the detection of agreement errors. Predictability and violation size had no effect on accuracy.

By contrast, the RT analysis did yield a significant interaction of group by predictability (Fig. 15): Broca's and Wernicke's aphasics both showed an *increase* in reaction times under high predictability, i.e., *grammatical inhibition,* and did not differ from one another (Broca's: Low = 2076, High = 2277; Wernicke's: Low = 2179, High = 2587); anomic aphasics showed a *decrease* in reaction times (Low = 2559, High = 2179) under high predictability, significantly more *grammatical facilitation* than we saw in elderly controls. There were no other effects on RT.

Summary. We have shown that sensitivity to agreement is preserved in Italian Broca's aphasics, at levels equal to other aphasic groups. However, RT data suggest that groups may differ in the temporal dynamics and activation functions associated with real-time sentence processing. We hypothesize that elderly controls and anomics exploit grammatical redundancy to overcome a decrement in activation or maintenance of forms, while Broca's and Wernicke's both suffer from under inhibition and/or deficits in integration that make "extra" grammatical cues difficult to use.

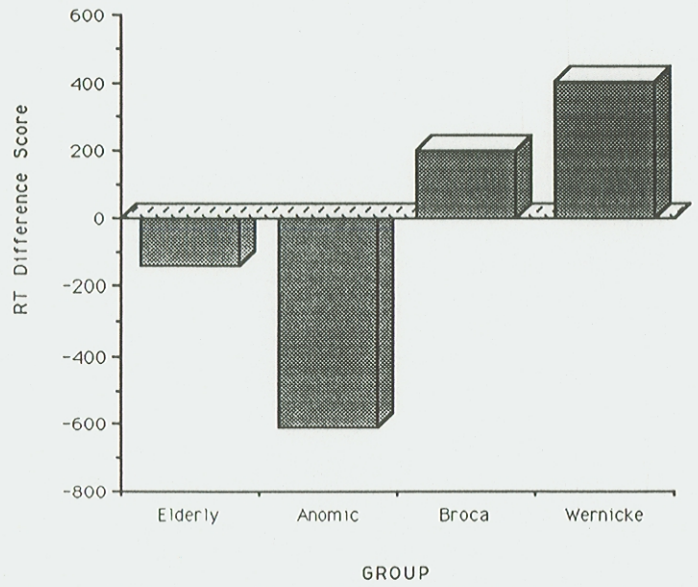

FIG. 15. Grammatical context effects (high–low predictability) in Italian aphasics and elderly controls.

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18. Progressive Aphasia: Impairment of Syntactic Processing in a Fluent Patient

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In 1982, Mesulam coined the term "primary progressive aphasia" to describe patients with a language impairment which progressively worsened over time but whose cognitive abilities were relatively spared. Since then, two subtypes of progressive aphasia have been identified.