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## Limb Apraxia: reorganizing the action

Patients' who have difficulty in organizing voluntary movements is a frequent problem in clinical practice. It is common after left brain damage in right-handed patients, predominantly those with lesions to the parietal and prefrontal lobes. This difficulty is known as apraxia.

The apraxia is not the result of the loss of sensitivity or motion, or caused by not understanding the task; although many apraxic patients are also aphasic.

Patients exhibit difficulties performing skilled movements in both, the right and left limbs.

The outcome of this disturbance is the "inability to do", thus to properly perform actions such as:

1) Imitation, 2) understanding and performing communicative gestures, and / or 3) the use of objects and tools; all actions that hamper therapeutic intervention.

Apraxic patients perform better in the ecological environment than during the therapy because the latter is a more artificial context. An ecofriendly environment facilitates the recovery of the motor programs. Although there is in the literature a significant correlation between apraxia and loss of autonomy in everyday life activities (Hanna-Pladdy et al., 2003; Foundas et al., 1995).

The clinical observation of this kind of patients starts from how they perform into daily life activities, for example

when eating or during personal hygiene. A reduction in the left arm gestuality could be observed as well in the ecological context.

The aphasic and apraxic patients may not understand the therapists' language (both verbal and non-verbal) and may have difficulty using gestures to answer their requests or communicate their needs.

These difficulties would limit the therapists' assessment, so they should make use of alternative contexts, including, for example, a choice of cards or photographs that represent the main content of the assessment. Then, the patient could use the "healthy" limb to point to the right answer (Figure 1).



Figure 1

On the other hand, the apraxic patients preserve their visual-spatial abilities that allow them to explore the graphic material, since that ability is right hemispheric dominance. The same occurs for the patients' facial mimicry, which represents a preserved channel to convey meanings (e.g. mood states or yes / no responses).

A good clinical practice would require assessing the patients' remaining ability to understand gestures for communicative purposes, not just reproducing them, as required by classical imitative tests. Usually, an imitative test requires the patient to copy gestures made by the examiner without care if it is known by the patient (e.g. test by De Renzi et al., 1980).

De Renzi's test is the most common test to assess ideomotor apraxia, this is used to learn how the patient translates the idea of the gesture observed into the correct spatial-temporal pattern. For that, the patient is asked to use the

"healthy" upper limb to copy the examiner's gesture. The examiner usually is sitting in front of the patient.

This test includes a list of meaningful/familiar and meaningless/novel gestures mixed in a same list. Cubelli and colleagues in 2006 have shown how separating gestures into different lists (a list with meaningful/familiar and another list with meaningless/novel gestures) leads to activate different imitative pathways.

The cognitive approach for interpreting apraxia uses the theoretical framework of Rothi and college (1991, 1997) and subsequent elaborations (Cubelli et al., 2000; Buxbaum, 2001; Rumiati & Tessari, 2002) as illustrated in Figure 2. This cognitive model identifies, as in the verbal language's model, a dual route for gestures processing. After a visual analysis of the gesture proposed by the examiner, depending on the familiarity, would go through two different pathways: 1) a sublexic or direct route (Fig. 2, in red) for imitation of meaningless/novel gestures or 2) a lexical-semantic route (Fig. 2, in green) for meaningful/familiar gestures.

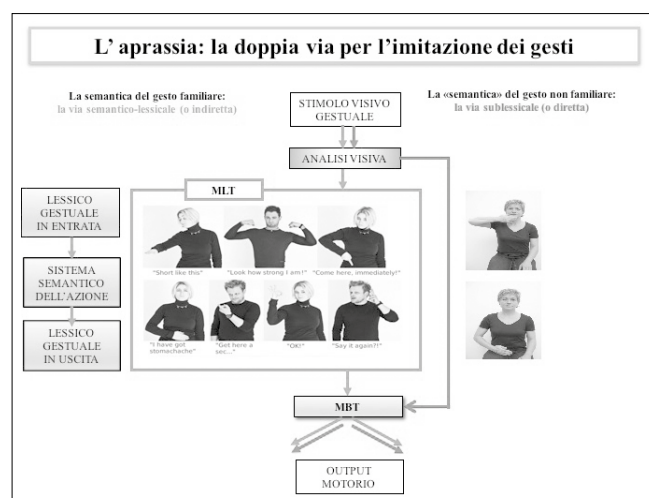


Figure 2

The latter route would go to the Action Input Lexicon module where the gesture is or is not recognized (test of lexical decision), and then if recognized as familiar it would access to the Semantic Action System where the gesture is contextualized (Figure 3).

In the end, it would relay to the Action Output Lexicon module that contains the space-time (s/t) representations of the gesture. The s/t representations would be transformed into innervative patterns to activate the primary motor system.



Figure 3

Therefore, knowing if the s/t representations or cinesthetic memories of the gesture (long-term memories) are still active in the patient can help the therapist to determine the rehabilitative program: a) define the residual non-verbal language skills on both levels: understanding and preforming (it helps to know how to communicate with the patient during the treatment) and b) identify any dissociation according to the type of gesture used (meaningful vs meaningless).

The patient could make fewer s/t errors (parapraxies) performing meaningful rather than meaningless gestures. In that case, the cinesthetic memories should be preserved and used for neurorehabilitation purposes.

The sublexic or direct route loads the patients' memory much more than the lexical-semantic route (Rumiati and Tessari, 2002). It is recommended that the therapist maintains the gesture until the patient copies it.

A meaningless gesture is a new one, the patient after observing the new gesture try to segment it in a limited number of elements and then combines them in a set of spatial relationships. So the patient draws on a dynamic representation, that is, less standard and more actual. This allows the therapist to understand the patient's ability to represent and implement new spatio-temporal configurations. It means built new motor skills.

Tessari and colleagues, in 2011, created a new tool for assessing ideomotor apraxia called "STIMA: a short screening test for ideomotor apraxia, selective for action meaning and bodily district". This test reflects the evoluti-

on of the last updated of apraxia cognitive model. Instead, the De Renzi's test (1980) were made up under the light of a the cognitive model proposed by Liepmann in the early nineteenth hundreds.

STIMA test allows the therapist to identify further dissociations, in addition to the dissociations between meaningful and meaningless gestures, even dissociations between gestures performed with proximal and distal districts. The latter element guides the therapist to choose the district to work with during the exercises. It is a pretty good tool for rehabilitation purposes.

The apraxic patient could be labeled as the patient who shows deficiency acting into the body space, whether it is their own body or anothers' body. Goldenberg in 1995 demonstrated the difficulty of apraxic patients imitating gestures on their own body as well as on the anothers' body (e.g. mannequin).

Further preliminary studies showed a fewer impairment imitating on the mannequin. This hypothesized the difficulty of these patients to transfer the s/t representation into the personal space more than into the peripersonal space (mannequin). It could be because the personal space is mediated predominantly by proprioception rather than by visual cues.

The mannequin may be a potential tool for neurorehabilitation in ideomotor apraxia, It allows the patient to focus on the joint movement coordination even if on the another's body (Polanco and colleagues, 2015).

Until now we have referred only to intransitive gestures (e.g. hunger), placing them in the first order in the evaluation process. It is advisable to first evaluate intransitive gestures for its high familiarity and because, by not referring to the object, they evaluate more the intra-bodily relationships that the patient can build. The pantomimes, like pretending to drink from a glass, are referring to an object.

In conclusion, we can say that evaluate apraxia by imitation remains a good clinical practice, which in addition to reducing the use of verbal code, reflects the way the patient thinks and performs the movement.

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## Besuch in der Clinica Hildebrand in Brissago

Auf Einladung der Clinica Hildebrand fand Anfang Oktober ein Treffen dort in Brissago statt.

Hier konnten wir die gesamte Klinik und die großen Umbaumaßnahmen besichtigen. Auch bei der "Robotik", dem Projekt der Klinik mit der TH Zürich, wurden wir über den aktuellen Stand informiert.

Im Rahmen unseres Treffens konnte Birgit Rauchfuß in einer kleinen Konferenz Therapeuten der Einrichtung den VFCR und seine Arbeit vorstellen.

Von Seiten der Klinik hielt Antonella Califfi als Koordinatorin für neurokognitive Rehabilitation einen sehr interessanten Vortrag, in dem sie einen Überblick über das enorme Leistungsspektrum der Klinik gab.

Die anschließend stattfindende Diskussion im Sinne eines gemeinsamen "Brainstormings" ergaben einige interessante Aspekte, die wir weiter verfolgen werden.

Auch für das nächste Jahr wurde ein Treffen mit unserem Kooperationspartner Clinica Hildebrand vereinbart.

Besonderer Dank gilt hier nochmal Dr. Fabio M. Conti, der uns während dem Treffen fachlich aber auch privat begleitet (umsorgt) hat. (MH)

