Computer-supported Individualised Therapy of Non-fluent Speech

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The therapy of stuttering people is a time-consuming and long-lasting process which requires a great effort both from the logopaedist and patient. The process can be divided into three parts: recording of patient's utterances (reading, telling, conversation), 20-minute corrective exercises with the echo (reading, telling) and individual work of the stuttering person with difficult words. All of these tasks may be performed with the use of a computer, controlled by a special program elaborated for that purpose. The computer system for the logopaedic diagnosis and therapy (DTL) allows for recording and saving utterances as sound files, practice with acoustical or visual echo and performance of automatically generated tasks adjusted to individual difficulties of particular speakers. Examples of analyses performed at various periods of therapy, i.e. at the beginning, during and after the therapy, supply information concerning e.g. the stuttering intensity and types of the occurring errors. The results presented in this work concern the control recordings performed at 1–1.5-month periods of time for twelve patients.

Keywords: computer therapy, diagnosis, nonfluency, stuttering, speech

1. Introduction

Personal computers, due to their common use and great possibilities, are nowadays widely used in many various areas of life and science, among other things in therapy and diagnosis of stuttering people’s speech disfluencies. Within the recent years, many applications were created to serve that purpose [3]. The authors of the present article have elaborated a new method of stuttering therapy supported by a computer programme, which is characterised by automatic adjustment to

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individual patient’s needs [4, 5, 8, 9]. The method is original in the world scale. The aim of the present work was to verify it.

2. Computer Method of Stuttering Therapy

2.1. Course of Therapy

Speech therapy are held once a week. During the meetings computer recordings of various utterances of particular people (reading, monologue) are made. The therapy was carried out with the use of the computer programme for logopaedic diagnosis and therapy elaborated by the authors — DTL. The sound files are recorded automatically in the computer database, which is created by DTL. After each therapy meeting, the person who is in charge of the therapy using DTL programme marks the words which were uttered in a non-fluent way on the computer screen. They are automatically recorded as sound files in appropriate catalogues with the name of the person undergoing therapy and the date of the meeting. After the non-fluent word has been recorded, a window is activated by the therapist for recording of the word in a fluent way. The DTL programme records the fluent words as sound files in an appropriate database, out of which they are chosen for practice in the next therapy meeting [4].

Each therapeutic session lasted approximately 1 hour. It involved DTL programme-generated exercises containing words which were difficult for the stuttering person in connection with the application of artificial computer-generated echo of delay time app. 0.1s, as well as a monologue, reading and talk with the therapist with the use of echo and the so-called “remembered echo” (the practising person was asked to imitate the way of speaking with the echo) [1, 6, 7, 10].

2.2. Characterisation of Therapy Participants

The group of the speech therapy study consisted of 12 subjects, age 12–30 year, with 8 adults among them. Information about these people, along with the stuttering severity assessments before and after the therapy and evaluation of the subject’s diligence in performing the tasks, are presented in Table 1. The stuttering severity was assessed independently by two logopaedists (one of them being the therapist) on the basis of long utterances of the examined subjects before and after therapy. As the next step, the common assessment was established. The logopaedist, who carried out the therapy, based on the attendance and quality of performance evaluated the diligence in task performance.

In the beginning of the therapy, in six subjects stuttering was assessed as very severe (1, 3, 4, 6, 8, 12), in two of them — as severe (7, 9), in three of them — as moderate (5, 10, 11) and in one — mild (2). After the therapy the speech of these patients was assessed in majority as almost fluent.
Five patients participated in the therapy for 18 months, and the others between 7 and 12 months. The attendance of the sessions varied, which resulted in the number of the therapeutic sessions, that were held. One of the patients (2) discontinued the therapy to resume it 4 months later. It should be noted that, as it follows from over 30-year experience of the authors of the present work, stuttering deletion is a long-lasting process, particularly as far as adult patients with its consolidated form and related fears are concerned. That is why experienced therapists inform their patients about it and warn them against the frequently advertised “wonderful couple-of-weeks methods” that can result in temporary fluent speech, however their effect is impermanent.

**Table 1.** Characterisation of patients participating in the therapy

<table>
<thead>
<tr>
<th>No</th>
<th>Age [years]</th>
<th>Sex</th>
<th>Stuttering severity before therapy</th>
<th>Therapy duration [months]</th>
<th>Diligence</th>
<th>The number of therapeutic sessions</th>
<th>Stuttering severity after therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24</td>
<td>M</td>
<td>very severe</td>
<td>18</td>
<td>high</td>
<td>50</td>
<td>fluent</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>F</td>
<td>mild</td>
<td>7</td>
<td>low</td>
<td>17</td>
<td>almost fluent</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>F</td>
<td>very severe</td>
<td>18</td>
<td>high</td>
<td>60</td>
<td>fluent</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>M</td>
<td>very severe</td>
<td>18</td>
<td>low</td>
<td>45</td>
<td>almost fluent</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>M</td>
<td>moderate</td>
<td>7</td>
<td>average</td>
<td>26</td>
<td>almost fluent</td>
</tr>
<tr>
<td>6</td>
<td>26</td>
<td>M</td>
<td>very severe</td>
<td>7</td>
<td>low</td>
<td>22</td>
<td>mild</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
<td>M</td>
<td>severe</td>
<td>18</td>
<td>high</td>
<td>65</td>
<td>almost fluent</td>
</tr>
<tr>
<td>8</td>
<td>24</td>
<td>M</td>
<td>very severe</td>
<td>12</td>
<td>high</td>
<td>42</td>
<td>almost fluent</td>
</tr>
<tr>
<td>9</td>
<td>19</td>
<td>M</td>
<td>very severe</td>
<td>12</td>
<td>low</td>
<td>26</td>
<td>mild</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>M</td>
<td>moderate</td>
<td>8</td>
<td>average</td>
<td>26</td>
<td>almost fluent</td>
</tr>
<tr>
<td>11</td>
<td>21</td>
<td>M</td>
<td>moderate</td>
<td>10</td>
<td>low</td>
<td>20</td>
<td>almost fluent</td>
</tr>
<tr>
<td>12</td>
<td>22</td>
<td>F</td>
<td>very severe</td>
<td>18</td>
<td>high</td>
<td>60</td>
<td>almost fluent</td>
</tr>
</tbody>
</table>

### 2.3. The Consistency Effect

At present the disfluency database consists of over 3000 words, chosen in several periods of therapy. On the basis of the records, the so-called consistency effect has been defined, that is the percentage of repetitious non-fluent realisations of the same words in particular patients [2,11–13].

The consistency effect, or the occurrence of stuttering in the same words, characteristic of particular speakers, was observed in all the patients undergoing therapy. Fig. 1 presents the percentage of the disfluencies concerning the same words in the control recordings in various periods in therapy.
The repeating non-fluent words made up approximately 40% of all the disfluencies in the examined group. As a result of the therapy, the problems related to uttering the “difficult” words were gradually eliminated. This is a process which requires a long-lasting therapy in connection with the current diagnosis, as it frequently happened that further problematic utterances occurred as the therapy progressed. The effects of the speech fluency improvement vary according to the time of therapy, type of stuttering, diligence in attending the meetings. In the subjects who had practised for a year, there was an almost absolute reduction of stuttering, while in the others a significant part of the episodes were eliminated or partly softened. However, if the episodes do occur (in a shortened or changed form), they occur in particular words, characteristic of a given person. It justifies the need for directing special therapeutic efforts to them, which is possible due to the exercise set modified up to date in the DTL programme, the exercises being adapted to the current difficulties of each person. It is also very important for the consolidation of therapy results.

2.4. Therapy Results

Figure 2 presents the result of reduction of all the non-fluent episodes in all the 12 patients when reading, and Fig. 3 presents the results in spontaneous speech. The y-axis of the Figure represents the stuttering frequency measured as the percentage of words uttered non-fluently. In all the examined patients the therapy resulted in a distinct improvement of the speech fluency. As it was previously mentioned, it is a vital, however, not the only indicator of the effectiveness of the therapy. Due to the therapy, the structure and duration times of the non-fluent episodes have also changed.
Fig. 2. Stuttering frequency (% of non-fluent word realisations) registered when 12 patients were reading at subsequent therapy sessions.

Fig. 3. Stuttering frequency (% of non-fluent word realisations) registered when 12 patients were telling a story at subsequent therapy sessions.
Figure 4 presents graphs that illustrate the changes in the frequency of occurrence of the dominating disfluency types in spontaneous speech of particular patients during the therapy. The following main classes of non-fluent episodes were distinguished: blockades, prolongations, repetitions (of sound combinations, syllables and parts of words) and intrusions [2]. In four patients the most frequently occurring disfluencies were repetitions, in two — blockades, in one — prolongations, and in the majority — five people — there occurred the highest number of intrusions.

3. Conclusion

The results presented in the form of graphs illustrate the course of changes in the stuttering intensity and structure of the non-fluent episodes during the subsequent periods in the therapy for the whole examined group. In all the patients a noticeable improvement as a result of the therapy was noted. The main aim of the present work has thus been achieved. Moreover, the following conclusions fallow from the course of therapy:

1. In all the patients the consistency effect has been noticed. It justifies of application of an individualised therapy metod. The application of the DTL programme in
stuttering patient’s therapy individualises the process and links it with visual-auditory speech correction [6].

2. The DTL facilitates the diagnosing of the registered utterances thanks to the created possibilities of simultaneous visual and auditory analysis of the occurring errors. It has been observed that logoapedists identify the disfluencies and determine their borders much better on the basis of graphic representation of the registered recording.

References