On the foundations of rhythm-based methods in Speech Therapy

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Abstract

Speech-Language Pathologists (SLPs) use a variety of rhythm-based methods for speech and language rehabilitation, but their theoretical foundations remain imprecise. In order to investigate what “rhythm” refers to in speech therapy, we conducted an online survey among French-speaking SLPs, exploring their representations and practices involving rhythm.

398 French-speaking SLPs completed the survey. Results are in part puzzling. While SLPs frequently use rhythm-based interventions for oral language disorders, and intuitively consider rhythm as “a prerequisite for oral language development,” they do not primarily link rhythm to a linguistic function. This is probably due to the historical psychomotor anchoring of French speech therapy, integrating mainly physto-cognitive aspects of rhythm. It may also explain why they relate rhythm deficits to widely different disorders: those where speech rhythm is noticeably impaired (prosodic disfluencies), and certain disorders showing no such impairment. Finally, SLPs reckon lacking insight on the underlying concepts and uses of rhythm.

We argue that reconciling linguistic, psychological and motor concepts of rhythm brings coherence to SLPs’ practices, and gives credit to rhythm-based interventions. It also opens the way to the development of relevant assessment tools integrating all aspects of rhythm—which, as reported by our participants, are still cruelly lacking.

Index Terms: Speech-Language Pathologists, speech & language disorders, speech rehabilitation, motor rhythm, prosody

1. Introduction

In recent years, rhythm has come to be a core research topic in several scientific disciplines (linguistics, cognitive psychology, developmental psychology, motor behavior science, neuroscience…), progressively establishing itself as a fundamental human function. However, the concept of rhythm is still hard to define, and there is no consensus between or even within disciplines as to its definition. For example, there are disagreements on whether it should be defined by temporal measures of the signal (and whether it implies isochrony or not), by temporal processing abilities (perception of sequentiality, duration), or by the cognitive role of prominence (hierarchization, grouping); see \cite{1} for a discussion. The latter meaning lies at the heart of prosodic theories \cite{2, 3, 1}. Stress patterns structuring speech allow for its decoding and prediction \cite{4}, as well as speech planning and programming \cite{4}. In this view, rhythm is the backbone of prosody, interfacing the different linguistic levels.

As a Speech-Language Pathologist (SLP), the first author of this article is aware that French SLPs frequently use rhythm for language rehabilitation, but without ever referring to its linguistic function. Moreover, the theoretical foundations for the use of rhythm in these interventions are not always clearly defined nor understood. We were thus interested to know what “rhythm” refers to in SLPs’ beliefs and practices, and how it relates to current scientific knowledge about rhythm. We hypothesize that their representations and practices will relate to the historical psychomotor anchoring of their profession \cite{5}.

We conducted a survey among French-speaking SLPs to investigate this question. The survey covers the subjects of SLPs’ representations of rhythm, as well as the assessment and intervention methods they use.

2. Material and methods

2.1. Survey

The survey was an online questionnaire using LimeSurvey, hosted on the website of the University of Toulouse II - Jean Jaurès. Answers were completely anonymous. The survey project received approval from the University of Toulouse’s research ethic’s comity (CER n°2021-357). The survey design was controlled so as to avoid participants’ abandonment and facilitate data processing, by combining closed questions (multiple or unique choice) with the possibility to complement them by free comments. Questions targeted language and communication disorders, whether idiopathic or secondary. The terminology designating disorders was the one commonly used by French SLPs in everyday practice.

2.2. Participants

Any French-speaking licensed SLP could answer the survey. The survey was relayed to all French-speaking SLP work unions and associations we could reach, and published on private SLP discussion groups on Facebook. It was also sent to a mailing list gathering French hospital SLPs, and to the French Speech Association (AFCP) mailing list. The questionnaire remained available for 3 months, from April 22 to June 22, 2021. Its diffusion was progressive and up to two reminders were posted on the social network groups.

2.3. Procedure

Participants were told that the survey was not an appraisal of their knowledge about rhythm. The survey consisted of two main thematic parts: one regarding SLPs’ conceptualization of rhythm in speech therapy and in language disorders, and the second concerning practices that involve rhythm in speech therapy (including assessment and interventions). Duration was estimated from 10 to 20 minutes depending on participants’ answers, since there were several conditional questions. A static version of the full survey can be found at:
2.4. Data Analysis

The data were analyzed quantitatively: graphical representations were obtained from answers’ frequency tables for each question, using RStudio. In this paper, we will report the main findings within each subcategory of the survey, focusing on aspects that can best shed light on how SLPs link rhythm to language disorders and their rehabilitation.

3. Results

3.1. Participants

The survey was completed by 398 participants. A large majority (77%) of the total sample worked in France, 8% in Switzerland and 4% respectively in Belgium, Canada and Lebanon.

3.2. SLPs’ representations of rhythm

The first part of the survey inquired about SLPs’ training about rhythm and their representations of the concept, as well as its place in their practice and in language disorders.

Most participants don’t remember coming across the topic of rhythm during their academic training (only 23.9%), let alone linguistic rhythm (16.6%). They may reinforce their training about the latter during professional training (up to 21.6%).

3.2.1. Definitions of rhythm relevant to speech therapy

Figure 1 shows the answers selected by SLPs when asked which definitions of rhythm were most relevant in speech therapy.

Rhythm is considered by SLPs to be mostly relevant as a “prerequisite for language development” (61.3%) of participants. They also predominantly think of rhythm as a “timing organization marker” (58.8%) and a “characteristic of music” (53.8%), followed by a “tool for language rehabilitation” (47%). Interestingly, rhythm is not predominantly considered as a linguistic function (20.1%; 8th rank out of 18).

3.2.2. Place of rhythm in SLPs’ practice

Four questions in the form of Likert scales inquired about SLPs’ representations of rhythm in their own practice: their answers are shown in Figure 2. Overall, SLPs believe that rhythm is important in language rehabilitation (choices ‘3-4-5’ represent 73.6% of answers, and ‘4-5’ 47.2%). At the same time, they don’t report using it very often for rehabilitation (choices ‘0-1-2’: 56%). They declare not having a clear understanding of the theoretical concept of rhythm (‘0-1-2’: 70%), and they feel negatively as to their proficiency in using rhythm as a tool for rehabilitation (‘0-1-2’: 73.6%).

3.2.3. Place of rhythm in language disorders

When asked which disorders imply a rhythm deficit, respondents selected a wide range of disorders (Figure 3).

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4.8
Disorders showing a clear rhythm deficit in speech production are widely selected: fluency disorders (stuttering, cluttering), dysarthria, motor disorders. Interestingly, two of the most selected disorders—specific language impairment (SLI, also referred to as developmental language disorder, DLD); 3rd position, and phonological disorder; 4th position—do not show obvious speech rhythm deficits.

3.3. Practices involving rhythm in speech therapy

The following section describes SLPs’ answers regarding their assessment and intervention practices involving rhythm.

3.3.1. Rhythm assessments

SLPs only occasionally assess rhythmic abilities: 35.9% said they never do, 27.1% rarely, 8.5% “most of the time”, and 0.8% always. Some of them only do it for “certain specific disorders” (15.8%) or “certain specific cases” (11.8%) (not detailed here). Qualitative analysis of written answers regarding assessment methods shows that most SLPs assess rhythm reproduction abilities using tapping (67%). Evaluation of speech rhythm was mentioned in 5.9% of answers—in these cases SLPs used either sound analysis software or only their ear and clinical sense. Use of songs and nursery rhymes was mentioned in 3.8% of answers (without further precision). Many responses (25.5%) specifically pointed out the lack of standardized batteries for rhythm assessment.

3.3.2. Rhythm-based rehabilitation methods

Nine rhythm-based rehabilitation methods (described in [6]) were presented to the participants (Figure 4), who had to indicate for each whether they used it or not. It should be noted that aside from rhythm perception exercises and auditory rhythmic speech cueing, all of these methods involve a strong motor component.

![Figure 4: Proportion of participants who declared using the presented rehabilitation methods.](image)

Most SLPs (76.9%) indicated that they used at least one of these methods frequently, very frequently or systematically. When asked why they don’t use a particular method, the most frequent answer is, by far, “I am not trained for this method but I wish I were”; followed by “I lack information on the relevance of this method” (as opposed to “I think this method is not efficient, or not the most efficient” and “I think this method does not apply to the disorders I treat”). The target population was mostly oral language impairments (78.1% across methods).

4. Discussion

This study’s objective was to understand what rhythm refers to for SLPs, in the hope to shed light on the foundations of the rhythm-based interventions they use. The results of the survey are quite interesting insofar as they uncover apparent discrepancies in SLPs’ answers.

SLPs define rhythm mainly as a prerequisite for oral language development (Fig. 1), indicating a perceived link between rhythm and language. Surprisingly, however, “linguistic function” only ranks 8th among all 18 proposed answers. Participants report a lack of academic training on the subject of rhythm, and reckon they don’t have a clear understanding of its theoretical concept (Fig. 2). SLPs don’t feel proficient using rhythm as an intervention tool either, even though they think it plays an important role in language rehabilitation (Fig. 2). SLPs believe that several disorders relate to rhythm deficits (Fig. 3), particularly those exhibiting obvious prosodic deficits in speech production (fluency disorders, dysarthria, motor disorders, non-fluent aphasia). Interestingly, the majority of respondents also selected “phonological disorder” and “specific language impairment”, even though these don’t display any patent speech rhythm alteration.

Despite this assumed connection, SLPs rarely assess patients’ rhythmic abilities. This can at least partly be explained by the lack of standardized assessment tools reported by many of them. The majority of respondents assess the ability to reproduce rhythmic sequences with movements, and few evaluate speech rhythm. Regarding interventions, 76.9% of participants frequently use at least one rhythm-based method, mostly to rehabilitate oral language disorders. Unsurprisingly, singing holds a special place, as it fully integrates linguistic content, speech gestures, musical rhythm, procedural memory and emotion (see also [7]). Rhythm production exercises (synchronization, continuation, rhythmic structure reproduction… using tapping) are also used by most SLPs (Fig. 4). Most participants who declared not using a method explained it by a lack of training or information, and not by informed choice.

Overall, these results show that SLPs intuitively observe a “language—rhythm” connection and use it in their rehabilitation interventions, but they reckon lacking theoretical background and assessment tools to bring coherence to their practices. These findings call for a detailed discussion on this intuitive understanding of rhythm, and how it can be reconciled with more recent scientific knowledge.

4.1. Origins of SLPs’ “rhythm—language” intuition

It is expected that SLPs relate rhythm deficits to speech disorders (stuttering, cluttering, dysarthria), as the rhythm of speech is audibly impaired. Here, the term “rhythm” could thus simply refer to the temporal organization of speech. For SLPs, “speech rhythm” can essentially be equated to “speech fluency”, i.e. mostly referring to speech rate and correct placement of pauses. Stress and boundary tones are not a subject of investigation, nor seen as bearing linguistic functions. Indeed, SLPs’ concept of rhythm developed at a time—mid 20th century—where research on prosody was scarce and mainly conceived in its paralinguistic functions [8]. And
to this day, in French SLPs’ practice, prosody is still most of the time reduced to the parameter of “intonation”, in turn only viewed as the conveyer of emotions and sentence modality [9].

The link between rhythm and other language disorders does not seem as straightforward. We reckon that the massive choice of “phonological disorder” and “specific language impairment” by SLPs in this survey is related to their choice of “prerequisite for oral language development” as the main definition of rhythm. This specific representation of rhythm dates back to the start of the SLP profession in France, where a link was established between children’s language impairments and deficits in several rhythmic abilities [10]. It was hypothesized that a set of basic perceptive (e.g., auditory, visual...) and production (e.g., motor behavior) skills were necessary to allow for proper cognitive and linguistic development [11]. This also included “rhythmic abilities”, supposed to reflect temporal processing – the ability to cognitively process the duration and sequentiality in time of perceived stimuli [12]. It was (and still is) thought important for language production and processing, since speech consists of ordered sequences of speech sounds [12, 13]. This representation prompted the development of rhythm assessments [14] and rehabilitation exercises based on rhythmic movements [5] (often with musical accompaniment [5]), which are still widely used to this day and mostly unchanged [13, 15]. The use of motor behavior in these exercises and assessments is pervasive, but scarcely commented, as if considered as obvious and inextricably linked to rhythm processing. It is only recently that large-scale studies have confirmed that several rhythmic abilities (sensorimotor synchronization, rhythm patterns discrimination) are linked to, and sometimes even predictive of, several linguistic skills [16, 17, 18, 19]. However, the mechanisms at play are yet to be fully explained.

The links that SLPs intuitively establish between rhythm, temporal processing, motor behavior, and language, need to be investigated and scientifically grounded. We believe that these representations could be unified in light of recent scientific knowledge.

4.2. Establishing links between “rhythms” in the light of recent scientific findings

Drawing on a more comprehensive concept of prosody might be a key to establish clearer links between SLPs’ representations of rhythm, language impairments, and their rehabilitation. Prosodic impairments in speech production, which can be caused by motor or other neurological impairments, hinder intelligibility [20, 21]. Underlying rhythm processing deficits (whose causes are poorly understood to this day) might challenge the temporal processing of speech’s prosodic patterns [22], and make children at risk for developmental speech and language disorders [23].

In both cases, how would methods based on rhythmic stimuli and movements help? To understand this, we argue that reconciling all different concepts of rhythm – linguistic, psychological and motor – is necessary. This is allowed by endorsing a metrical conception of prosody, conceiving meter as an abstract representation, relying on the alternation of strong and weak elements [2] – and not only the search for temporal regularity and strict isochrony [1]. Metric rhythm allows for the division of continuous information streams into discrete, cognitively processable elements. In all perceptual modalities, the recurrence of prominent elements enables chunking, delimitation, highlighting... thus allowing enhanced attention and prediction [24, 4]. There is evidence that auditory, motor and linguistic rhythms operate in the same temporal window, around 1.5 Hz (~600ms intervals) [25, 26], and are subject to the same grouping bias [25, 27, 28], suggesting a common processing basis. It is possible that neural oscillations are the support for this supramodal rhythmic functioning, by entraining to all sorts of external stimuli [29]. It is thus plausible that these different modalities of rhythm exert influences on each other. Given that speech and prosody lie at the intersection of linguistic structure, motor production and auditory perception, they might be especially sensitive to these influences. Recent results allow to conjecture that linguistic meter can be influenced by non-linguistic cues, such as auditory or motor rhythm [30, 31]. There is also evidence that motor rhythm helps comprehend complex auditory rhythm sequences [32, 33].

And indeed, evidence has recently arisen that rhythm-based interventions could help remediate several speech and language disorders such as dysarthria and other motor-related speech disorders [34, 35, 36], stuttering [37], developmental dyslexia [38, 39], SLI/DLD [40], or difficulties related to pediatric hearing loss [41]. While this survey shows SLPs do not consider written language disorders to be related with rhythm deficits (Fig. 3), and do not use rhythm-based interventions in these cases, this scientific literature suggests that SLPs could expand their use of rhythm-based interventions to developmental dyslexia.

In sum, this account of the supramodal role of rhythm explains how entraining body movements to speech-compatible rhythm patterns could lead to better perception and production of language, by engaging and enhancing the prosodic dimension.

5. Conclusions

For decades, SLPs have been implementing their intuition about rhythm, movement and language in their interventions, even though these aspects have just only recently been explored by scientific research. Recent results highlight the central role of rhythm in language development, disorders and rehabilitation. Establishing clearer links between different aspects of rhythm and linguistics could help SLPs improve and extend their practices. The only way to investigate the underpinnings of SLPs’ practices and to bring solid evidence of their effects is to promote interconnection between disciplines, and between scientific research and clinical practice. There is also a need for terminological clarification around “rhythm” and its modalities. This will allow for the development of relevant assessment tools integrating all aspects of rhythm – which, as reported by our participants, are still cruelly lacking.

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7. References