- MENU
- PRINTABLE VERSION
- HELP & FAQS

An Intuitive Visual Code for Intonation, Stress, and Rhythm of Language?

Markus Rude

Dokkyo University

Inaccurate pronunciation - in particular misplaced stress or inappropriate intonation - is a major source of misunderstanding. A remedy for this problem could be to create and implement a visual code, which presents intonation, stress, and rhythm of spoken utterances in an intuitive way to L2 students. This paper introduces a visual code with such potential, Prosodic Writing. Prosodic writing is a non-linear writing style, which encodes the three prosodic features of intonation, stress, and rhythm in three geometrical features. Next, I summarize the opinions of 200 L2 and L3 students who have been using this code in class. About 80% presumably had learned to perceive intonation and stress implicitly, i.e., from examples only. Finally, a reading experiment is described in which six L2 students read aloud a sample of Prosodic Writing without prior explanation or exposure. Two out of the six students could perceive and reproduce some of the encoded prosodic features intuitively.

不適切な発音，特に強勢位置およびイントネーションの誤りは，発話の理解を妨げる大きな原因となる。この問題の解決策のひとつとして，Ｌ２学習者向けに発話のイントネーション／強勢／リズムを直観的方法で提示する視覚的コードの作成があげられよう。本稿では，まず，そのようなポテンシャルを持つ視覚的コードである「プロソディック・ライティング」を提示する。このプロソディック・ライティングは，「イントネーション」「強勢」「リズム」という３つの韻律特性を３つの幾何学的特性にエンコードする非線状的なシステムである。次に，プロソディック・ライティングを授業で使用したことのあるＬ２・Ｌ３学習者２００名のアンケート結果をまとめる。約８０％という大多数の学生が，複数の例を見ただけで－知らず知らずのうちに－「イントネーション」と「強勢」の読み取り方を習得した。最後に読み上げ実験の結果を示す。事前に説明も提示もせず，Ｌ２学習者６名にプロソディック・ライティングの１例を声に出して読んでもらったところ，２名の学生がエンコードされた韻律特性のいくつかを直観的に知覚し，再現することができた。

Introduction

L2 learners themselves identify segmental problems such as (1) unreduced vowels, (2) substitutions (e.g., /l/ and /r/), and (3) loss of endings (e.g., –ed and –(e)s) as pronunciation aspects needing attention (Pennington, 1996, p. 257). However, out of the three most serious pronunciation errors: (1) stress placed on wrong words or syllables of words, (2) misleading intonation (e.g., high pitched intonation on old information), and (3) loss of one or more final consonants (Pennington, 1996, p. 256), the former two belong to the suprasegmental domain. Many current L2 textbooks cover both, segmental and suprasegmental pronunciation problems, but most of them do not handle the interconnected suprasegmental features of intonation, stress, and rhythm as a whole.

Hinkelman and Halvorsen (1998, p. 89-91) suggest adapting textbooks for top-down pronunciation instruction, e.g. by ending-pitch marking (intonation), focus-word marking (stress), and pause marking (timing). While these activities seem to be well suited for developing students' phonological awareness at different points in lessons over the year, the decoding of these marks might require a considerable amount of conscious reasoning if shown simultaneously in one piece of text. An assembly of marks falls short in showing the holistic aspect of prosody - the interconnected phenomenon of intonation, stress, and rhythm - which native speakers are able to perceive and non-native speakers can be trained to perceive.

The question is raised in this paper of whether a visual code or representation can be created from which L2 learners can *intuitively* perceive intonation, stress, and rhythm of spoken utterances, and which thus helps them to develop a better pronunciation. In this paper, the term *intuitive* is defined as *immediate* and *without the conscious use of reasoning*. The weaker formulation *in an intuitive way* shall denote quickly and without formal instruction to the students.

This research is still in an exploratory stage since it involves many subjective steps and used only a small number of subjects in the reading experiment.

A Brief Explanation of the Theory of Prosodic Writing

Prosodic Writing is defined as a visual code (a writing style or type face with meaningful deformations), hereafter also referred to as *the code*. The graphemes of this code represent not only the letters of the alphabet but also suprasegmental features. How the three prosodic elements (intonation, stress, and rhythm) are encoded in the three geometrical features (grapheme-string-curvature, grapheme-size-variation, and horizontal-grapheme-arrangement) is explained in this section.

Prosody

Kent and Read (1992, p. 149) define prosody as the suprasegmental features of speech that are conveyed by the parameters of fundamental frequency (perceived primarily as vocal pitch), intensity (perceived primarily as loudness), and duration (perceived primarily as length). Prosody is more than merely the melodic and rhythmic decoration of language; Kent and Read (1992, p. 152) regard it as the fabric of speech, within which segments are the individual stitches of fibers, and Pennington (1996, p. 256) lists mainly prosodic pronunciation errors (e.g., a very soft or monotonous voice, incorrect stress or intonation) among the pronunciation errors with major impact on performance.

Prosodic Writing is a geometrical encoding…

Visualization of prosodic elements (auditory information) can be done by encoding them in the geometry of the grapheme string (visual information). Each sound of an utterance shall be represented by a grapheme in a three-dimensional space, the shape of which expresses a letter of the usual alphabet, however, the horizontal, vertical, and depth positions of which additionally express time, pitch, and loudness, respectively. This means we can directly *see* an utterance's intonation (pitch movement) from the vertical letters' positions, dynamic stress (maximum loudness) from letters' depths, and rhythm (temporal pattern of stress) from the horizontal pattern of protruding letters.

…which is similar to musical notation

This writing style—termed *Prosodic Writing* (Rude, 1998, p. 4-10)—is very similar to musical notation of songs, in which notes, represented by ellipses, are shown on a two-dimensional plane, the horizontal and vertical dimension of which express approximate time and accurate pitch, respectively. Such a two-dimensional representation was already successfully used by Kushida et. al., (1995, p. 39-51) in a Japanese language pronunciation class at Sendai University. The students were trained to follow the presented time-pitch patterns in the so-called "Prosodic Graph" (expressing both time and pitch accurately), and developed better intonation than those from the control group.

…but which also has depth!

What about the third dimension, the depth dimension? Unfortunately, there are only two dimensions on a piece of paper or on an affordable computer display. However, the laws of perspective can be used to show the three-dimensional letter string in just two dimensions. In this case, a letter's horizontal and vertical position on the paper will express the corresponding sound's production time and pitch, while the letter's size will express this sound's loudness (the *nearer* a letter appears to the reader, the *stronger* is its loudness, henceforth, the *nearest* ones express sentence stress).

By using the third dimension as well, prosodic writing has the potential to express dynamic stress of certain sounds or syllables, which is essential for stress-timed languages such as English or German. At the same time, the deformed, unequally-sized grapheme strings should be as visually similar as possible to conventional straight, equally-sized letter strings, for easy readability (Fig. 1).

From theory to application

The theory is the conceptual basis and does not imply a way to generate prosodic writing or how to apply it in the classroom. Though I am working on a computerized version (Fig. 1), samples of prosodic writing have, up to now, been solely generated by hand; I transcribed the auditory sources - mainly spoken by native speakers – according to my perception of intonation, stress, and timing to approximate samples of prosodic writing (Fig. 2b). How these samples were applied in the classroom is the topic of the next section.

Application and Feedback of 200 Students from a Questionnaire

At Rissho University, Tokyo (Business English Conversation at the Faculty of Business and Management) 146 L2 students and

also, 54 L3 students at Dokkyo University, Soka, Saitama (German at the Faculty of Foreign Languages) had been using prosodic writing for one academic year. No prior explicit introduction was given in order to stimulate spontaneous reaction rather than conscious reasoning. At the end of the year a questionnaire was given to the students. This section is about how prosodic writing was used and what the students thought of it.

How prosodic writing was used

At Rissho University, in almost every lesson, handouts with model dialogs in prosodic writing were used. The students, while standing, repeated verbatim the original dialog from tape, or echoed the lecturer's voice. At Dokkyo University, the frequency of usage was lower due to the broader goal of the curriculum (all four language skills), however, the application of prosodic writing was similar.

In no class was an explicit introduction of the three dimensions of the code given. Instead, particular prosodic elements were corrected while referring to the corresponding visual elements on the paper.

Some numerical results from the questionnaire…

The questionnaire was comprised of eleven general questions and 13 questions related specifically to prosodic writing (Rude 2002, p. 178-180). Essential for this paper were the results of the following four statements, which were rated by the students:

S1. I think prosodic writing is easy to read.
S2. Reading silently, I can recognize the intonation well.
S3. Reading silently, I can recognize the sentence stress well.
S4. Reading silently, I can recognize the rhythm of speech well.

The table below shows the students' selections of the four ratings for each of the statements.

In the following we assume that students who had marked either very or pretty confirmed a given statement. About 80% of the students stated they were able to recognize sentence stress very well or pretty well (S3: 39% + 41%). In the case of intonation, 79% stated very good or pretty good recognition ability (S2: 37% + 42%). A good perception of rhythm was confirmed by 65% of the students (S4: 22% + 43%). Easy readability of prosodic writing in general received a confirmation by 58% (S1: 24% + 35%; deviation due to rounding).

…and some students' opinions

The questionnaire also revealed the students' general opinion on prosodic writing and thus gave some insight into extreme attitudes, both positive and negative:

> "I can read sentences at once, even if I see them for the first time. Therefore it's good, I think…" / "Epoch-making." / "It should be introduced in the compulsory education [EFL at High Schools]." / "It's much simpler to understand than the usual symbols for stress. It's easy to produce the flow…"

> "Principally difficult to read." /"I have my own rhythm. Prosodic writing will destroy this rhythm." / "The small letters are difficult to read." /

Table 1: Effectiveness of prosodic writing according to a questionnaire

	very	pretty	not very	not at all	no
	(totemo)	(kanari)	(amari)	(zenzen)	comment
S1. Easy to read ?	24%	35%	35%	6%	1%
S2. Intonation ?	37%	42%	16%	3%	3%
S3. Stress ?	39%	41%	17%	1%	3%
S4. Rhythm ?	22%	43%	29%	3%	4%

Conclusions from the questionnaire

The overall response of students was positive. Though many students got confused at the beginning by the unfamiliar letter shapes, most got used to the code quickly and learned to identify encoded prosodic features implicitly, just from visual and auditory examples. Specifically the decoding of intonation and stress (S2 and S3) seemed to be quite obvious to most students.

On the contrary, it seems that the timing aspect—rhythm (S4)—was less perceivable. Of the four statements, the overall readability (S1) was criticized by most students and therefore needs improvement. It is also worth mentioning that a minority of students had a strong aversion towards prosodic writing.

The questionnaire reflected the students' opinions after one academic year of exposure to the code. We do not know whether some students could understand the meaning of the letter deformations at first glance; such response is the subject of the following.

A Reading Experiment with Students without Prior Experience

A reading experiment was performed with six L2 students at EES/Hitachi, Ibaraki (English Education Study Inc., a private English language school) who saw prosodic writing for the first time. The goal of this reading experiment was to observe the students' initial reaction to prosodic writing and their immediate performance. This section describes the experiment and some pertinent results.

How the experiment was performed

The students were asked to read aloud a dialog presented in two different forms: written conventionally (Fig. 2a: Dialog 1) and written in prosodic writing (Fig. 2b: Dialog 2), both on A4-size paper. The dialog was new to the students. The students came in pairs (female/female, female/male, male/male) and could read Dialog 1 silently

until they felt comfortable enough having their voices recorded. Without having heard the original dialog before, and without having received any explanation of prosodic writing, the students were simply asked to read the dialog aloud. After having read Dialog 1, the students received and immediately read aloud Dialog 2.

Some of my observations from listening to the recordings…

The female/female pair had obviously used the prosodic cues from Dialog 2. Sentence stress when reading Dialog 2 was much audibly more clear than when reading Dialog 1. One appropriate pause was produced in dialog 2 (lower case is signifying the auditory version, opposed to upper case signifying the visual version, e.g., Dialog 2) while it had been missing in dialog 1. The magnitude of pitch movement was clearly higher in dialog 2 compared to dialog 1. The final contour of the sentence switched from rising to falling in one instance according to the pitch cue of Dialog 2 ("How about yourself?", dialog 1: rising; depicted in Dialog 2: falling; appropriately realized in dialog 2: falling). In two other instances these cues were ignored ("… how long are you gonna stay?" and "… what do you think about flying?", dialog 1: both rising; depicted in Dialog 2: both falling; inappropriately realized in dialog 2: both rising).The male/female pair and the male/male pair seemed to ignore the prosodic cues of Dialog 2: The productions from reading Dialog 1 and from reading Dialog 2 did not differ in a clearly perceivable way.

…and some opinions from a broader audience

At the beginning of this paper's presentation at the JALT 2002 Annual International Conference, dialog 1 and dialog 2 from the female/female pair (above) were presented to the audience. The audience was asked to comment on perceived differences of dialog 2 compared to dialog 1. My notes of audience comments were:

> "More stress" / "Slightly better intonation" / "Pausing was better" / "More emotion" / "There was laughter"

Conclusions from the experiment

The question about the intuitive nature of prosodic writing cannot be answered in an unequivocal way. Two students (the female/female pair) seemed to intuitively understand and use the visual stress cues from Dialog 2. They also made some use of the visual intonation cues, however, not always correctly. The other four students did not show a remarkably different response to prosodic writing in comparison with the conventionally written Dialog 1.

Final Discussion

The main weaknesses of this study are that it relies only on subjective answers in the questionnaire and on a very small number of subjects in the reading experiment. Therefore, we can only conclude tentatively and state the need for further research in this section.

Tentative conclusion

Prosodic writing seems to be intuitive for only a small number of students who are able to make immediate use of the visual cues in the code. For a majority of students it seems that its meaning can be learned, though not immediately, but in an

implicit way through examples, in particular the encoded elements intonation and stress. This learning process can involve conscious reasoning processes, subconscious intuitive processes, or both; however, this has yet to be found out. Nevertheless, it seems that this code is heading towards prosody visualization *in an intuitive way*, since a majority of students learnt how to decode it rather quickly (within a year) and without explicit, elaborate instruction.

It is important to state that a minority of students seems to require explicit instruction, an explicit explanation of the theory—the three dimensions—of this code. As a consequence, in the following academic year such explicit introduction was given to the students at the very beginning. Other possible reasons for negative attitudes towards prosodic writing should also be explored.

Future research

In the future, the research aims to make the code intuitively perceivable to more students (e.g., by improving the cues representing pauses or by emphasizing the sentence final contour) and at improving the code for all students (e.g., by increasing the minimum letter size or by introducing computerized and thus standardized letter shapes).

Finally, the effectiveness of the method for improving pronunciation should also be verified through an empirical performance analysis in order to complement the subjective judgments made by students and listeners.

References

Hinkelman, D. & Halvorsen, J. (1998). Discourse-oriented Activities For Pronunciation Teaching. *The Proceedings of the JALT 24th Annual International Conference on Language Teaching/Learning & Educational Materials Expo*, 88-92.

Kent, R. D. & Read, C. (1992). *The acoustic analysis of speech.* Singular Publishing Group, San Diego, 149-152.

Kushida M. et.al. (1995). An Effective Approach to Achieve a Natural Japanese Voice (title translation by Mr. Kushida during a discussion). *Journal on Japanese Language Education*, Vol. 86, 39-51. (in Japanese)

Pennington, Martha C. (1996). *Phonology in English language teaching: an international approach.* Addison Wesley Longman, New York, 256-257.

Rude, M. (2002). Sprecherziehung mit Prosodischer Schrift: Studentenmeinungen zur Anwendung eines neuartigen Konzepts. Dokkyo University. *Germanistische Forschungsbeitraege* Nr.48. German Department of the Faculty of Foreign Languages, Dokkyo University, 145-184. (in German)

Rude, M. (1998). A Proposal for Making Intonation Visible Through “Prosodic Writing”. *The Newsletter of the JALT Ibaraki Chapter*, Vol. 3 No. 9, 4-10.

Figure 1: Prosodic writing is the representation of utterances in a pitch/loudness/time-space and thus visualizes intonation/stress/rhythm of spoken language.

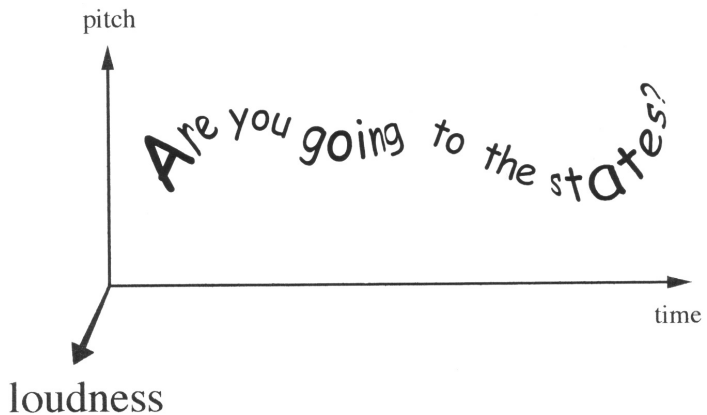

Figure 2a: Dialog 1

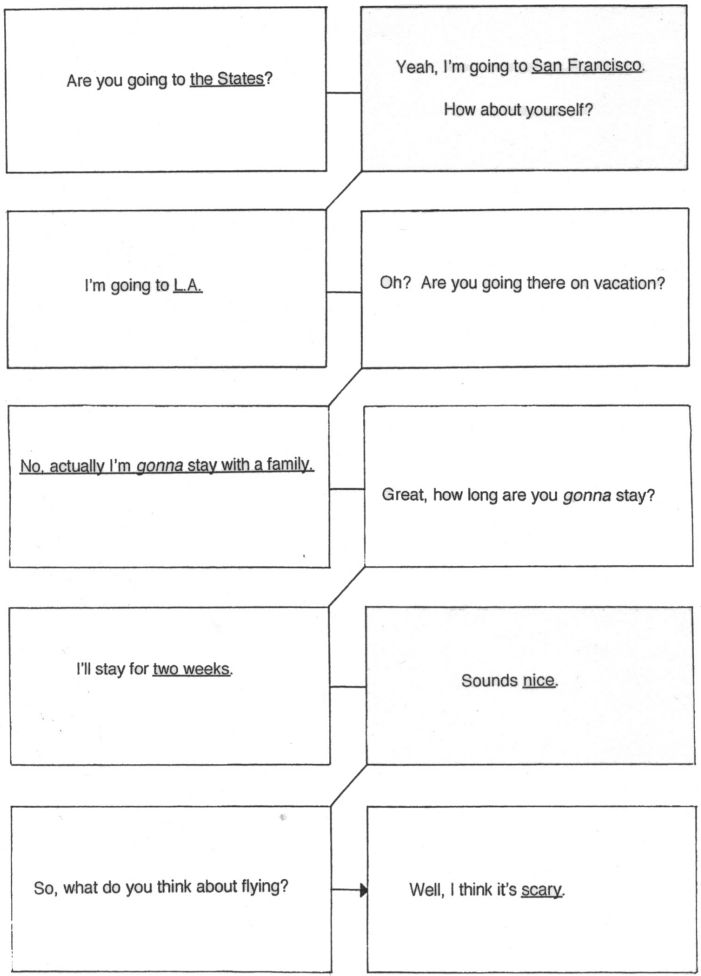

Figure 2b: Dialog 2