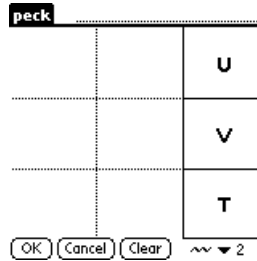


How to Peck – A Tutorial on Bird Song Shorthand

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1. Background

Before sonograms, bird song shorthand was a common approach to documenting bird songs. “A Guide to Bird Songs – Descriptions and Diagrams of the Songs and Singing Habits of the Land Birds of Northeastern United States” by Aretas A. Saunders in 1935 presents a detailed bird song shorthand method. He writes,

“In the method I use, the record of a song consists of a series of lines, chiefly horizontal. Each line represents one note of the song. Its horizontal length represents the period of time the note occupies. The vertical height, in relation to other notes in the song, represents the note’s pitch. Its heaviness represents its loudness or intensity.”

A review of Saunders’ book appeared in *Auk*, the American Ornithologists’ Union periodical.

“He has had many years’ experience as a teacher in trying out different methods for making a description of a song that will be identifiable when the real song is heard, by one who has never heard it before. He finds that while the syllabic method is good, it is best not to use actual words as they often induce the wrong accent or emphasis, and he therefore uses vowels or vowels and consonants in combinations which resemble no words in any language. To supplement this, and indeed more important than the syllables, he has devised a scheme of horizontal dashes, whose length represents the length of the note and the thickness of which indicates the volume. When notes are distinct so are the dashes, but when connect then the dashes are connected by vertical lines, and when slurred by curved lines. A study of the graphs which are presented for each species will show how readily one can grasp the method, while the syllables directly below show the character of the note – liquid, sibilant, etc. A letter at the left of each chart indicates the actual musical pitch at that point – A” etc., while each eighth of an inch in vertical height represents a half-tone and each half inch horizontally a second in time.

Accompanying each description of a song there is a very brief description of the bird, bringing out clearly its chief color characteristics, and at the beginning of the book an ingenious “Key” which leads one to one or other of the 26 groups into which bird songs are divided, while further keys bring us down to the species.

*Mr. Saunders does not consider musical notation at all, as he rightly claims that it is unsuited to bird song since birds make use of musical intervals not capable of indication in our system of music. He also omits any attempt at a scientific analysis of bird notes such as Mr. Brand has discussed recently (*Auk*, 1935, pp. 40-52) since the present work is intended wholly as a guide for the field student.*

Mr. Saunders has, we think, produced the best book on bird song from the popular point of view that has yet been published. It is a difficult subject to present and the attempts at representation by words from human speech or by musical notation have been, with the exception of a few striking songs, almost total failures.

We commend this little book to all bird students.”

As noted, the primary purpose of bird song shorthand is to assist with the task of identification. For documenting a bird song, sonograms are superior due to their increased precision. However, even after seven decades of technical advances, sonograms are not particularly helpful when it comes to identification, partly because of the problem of source separation, commonly referred to as “the cocktail party problem.” As described by Wikipedia, the cocktail party problem is

“where a number of people are talking simultaneously in a room (like at a cocktail party), and one is trying to follow one of the discussions. The human brain can handle this sort of auditory source separation problem, but it is a very tricky problem in digital signal processing. Several approaches have been proposed for the solution of this problem but

development is currently still very much in progress.”

The Peck bird song shorthand is a reincarnation of Aretas Saunders’ bird song shorthand. Still taking advantage of our brain’s ability to solve the source separation problem when multiple birds are singing, but updated to take advantage of today’s consumer electronics capabilities, such as

- touchscreens, and
- the processing power to execute advanced string matching algorithms, initially designed for the analysis of DNA strings.

2. Overview

When a problem is complex, it often is helpful to get a different perspective. For example, a sonogram helps with bird song analysis by offering a different perspective: the frequency domain perspective.

Similarly, the Peck bird song shorthand helps with bird song identification by offering a different perspective: shorthand text that is analyzed by string matching algorithms that properly handle variations. It is crucial to properly handle variations because they are significant and come from several sources:

- variations in song from a single bird,
- variations in song within a species,
- variations in user listening skills,
- variations in user rendition of bird song shorthand.

The result is extraordinary assistance in identifying very simple bird songs, and moderate assistance in identifying very complex bird songs. Of course, even moderate assistance with identification is extraordinary when the alternative is to listen to hours of recordings.

3. Introduction

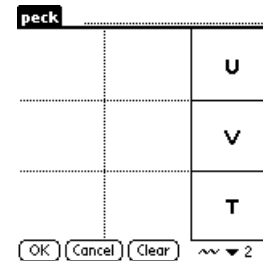


Figure 3-1. Pecking Form

Figure 3-1 shows the pecking form. To show it in the Peck application, tap the audio list’s pecking icon (i.e., the downward pointing beak).

The pecking area is the portion of the pecking form that looks like a tic-tac-toe board. When you peck bird song shorthand in the pecking area, the corresponding bird song shorthand text appears in the pecking form’s title bar.

As is the case for sonograms and Saunders’ bird song shorthand, the y-axis represents frequency: higher pitched notes are pecked higher in the pecking area. However, the x-axis does not represent time: an axis is not needed to represent time because time is automatically measured via the touchscreen.

4. Note Timing

The Peck application automatically times the rhythm of your bird song shorthand. The unit of timing is 0.1 seconds and appears after the note type in the shorthand text. So, for example, the shorthand text for a one second sustained note is “s10”.

After pecking the bird song shorthand in the pecking area, tap the ‘OK’ button. To simplify, the Peck application splits the entered shorthand at every rest¹ of at least 0.5 seconds and discards all but the longest segment of shorthand. This splitting of the bird song shorthand happens automatically when you tap the pecking form’s ‘OK’ button, but you can see the results of the splitting by selecting the pecking form’s ‘Select/Split’ menu item.

¹ A rest is any time not pecking (i.e., any time with the stylus not touching the pecking area).

5. Note Types

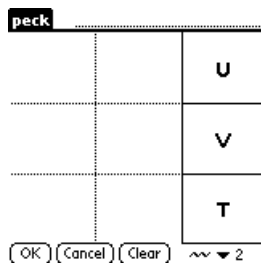


Figure 5-1. Pecking Form

The Peck bird song shorthand consists of just five types of notes.

- **sustained** ('s') – A note that is relatively steady (i.e., without undulation) and relatively consistent in duration and pitch in repetitions of the song. Because sustained notes are so common, all of the first two columns of the pecking area are for pecking sustained notes.
- **undulated** ('u') – A sequence that has a pronounced and periodical variation in volume or pitch that is too fast to peck.² The area to peck undulated notes is the right column's top rectangle. The undulation selector at the bottom right corner of the pecking form is for selecting the type of undulation. A value of 1 denotes that the undulation is on a single pitch (i.e., the undulation is in volume rather than pitch). A value of 2 denotes that the undulation alternates between two pitches, possibly slurring between the two. A value of 3 denotes that the undulation sequences through multiple (i.e., at least two) pitches within a repetition of at least three notes.
- **variable-pitch** ('v') – A note that is relatively predictable within a song except for its pitch. The area to peck variable-pitch notes is the right column's middle rectangle.
- **variable-rest** ('t') – A note that is relatively predictable within a song except for the rest intervals between adjacent

notes. The area to peck variable-rest notes is the right column's bottom rectangle.

- **erratic** ('e') – A note that is variable in pitch, variable in duration, and also variable in its rest intervals to adjacent notes. The area to peck erratic notes is the same as undulated notes (i.e., the right column's top rectangle) but the undulation selector at the bottom right corner of the pecking form must be set to 0.

6. Note Dynamics

It is common for bird song notes to change (e.g., rise in pitch). In the Peck bird song shorthand, these changes are handled by three types of note dynamics.

- **pitch slur** – A change in pitch that occurs continuously. To slur up (i.e., represent a rising pitch by adding 'r' to the note's shorthand text), drag your stylus up. To slur down (i.e., represent a falling pitch by adding 'f' to the note's shorthand text), drag your stylus down.
- **pitch shift** – A change in pitch that occurs discontinuously. To shift up (i.e., represent a jump to a higher pitch by adding 'h' to the note's shorthand text), peck higher in the pecking area. To shift down (i.e., represent a jump to a lower pitch by adding 'l' to the note's shorthand text), peck lower in the pecking area.
- **undulation rate change** – A continuous change in the undulation rate. To increase the undulation rate, drag your stylus to the right in the rectangle for pecking undulated notes. To decrease the undulation rate, drag your stylus to the left.

² I've yet to see anyone capable of pecking more than six pecks per second, but birds commonly sing notes faster than that.

7. Tips

With the five types of notes and the three types of dynamics, you are ready to start pecking. To improve your pecking skill, here are some miscellaneous tips.

- **Don't fret: make your best guess.**
Think of your pecking as a rough hint to the string matching algorithms rather than as precise documentation of the bird song.
- **Don't overuse erratic notes.** When first listening to an unknown and complex bird song, it is tempting to label the notes as erratic. Before representing the notes as erratic, carefully listen again. Often what may initially sound erratic may actually be an undulation between three or more notes, or a sequence of variable-pitch notes.
- **Estimate the musical quality of notes.**
Estimate whether each note is more musical (e.g., clear as a whistle) or more percussive (e.g., hoarse or rattling). If the note is more musical than percussive, peck in the left half of the area designated for that type of note. Otherwise, peck in the right half of the area designated for that type of note. In the Peck bird song shorthand text, the text representing musical notes is lower case.
- **Estimate the overall pitch of the song.**
If the overall song is extremely high, start pecking in the upper third of the area designated for that type of note. If the overall song is extremely low, start pecking in the lower third of the area designated for that type of note. Otherwise, start pecking in the middle of the area designated for that type of note.
- **Estimate the size of pitch changes.**
Although not strictly necessary, your pecking will lead to more accurate search results if you include information about the size of pitch changes. In the Peck bird song shorthand, pitch changes are either small or large, with the cutoff at the minor third interval. Pitch changes are small if they cover a minor third or less, and pitch changes are large if they cover more than a minor third.

For those familiar with the chromatic scale, the minor third is three half steps. Even if you have no musical training, you are certainly familiar with the minor third as it is an innate preference in humans. Lois Choksy in 'The Kodály Method' states that the minor third is "*the most natural interval for young children to sing in tune.*" And the preference appears to be worldwide rather than cultural: "... *children seem to develop in the same musical pattern the world over. Young children's games and chants based on these two or three notes are found from the United States to Hungary to Japan.*" Just think of the chants you've heard as a child such as "Come out and pla-ay" or "Hey, batter batter batter batter." Those were minor third intervals.

To peck a large pitch change, cover at least a third of the vertical range of the area designated for the note being pecked. For example, if an undulation has a large pitch rise, drag the stylus up by more than a third of the height of the area in which you are pecking the undulation (i.e., the top rectangle in the right column). In the Peck bird song shorthand text, small pitch changes appear in lower case text and large pitch changes appear as upper case text.

- **Practice.** One way to practice is to play a recording from the audio list and then select the 'View/Shorthand Text' menu item to see the shorthand text that has been archived for that recording. Although reading the Peck bird song shorthand text becomes trivial with practice, you may initially need to refer to Appendices B and C.

A more interactive, and probably more effective, way to practice pecking is by using the Peck trainer documented in [peckdoc_trainer.pdf](#).

8. Logic of Where to Peck

Figure 8-1. Pecking Form

As a succinct summary, here are some pseudo-code rules about where to peck.

```

If notes are too fast to peck {
  Peck in the 'U' rectangle:
  upper third if notes are extremely high,
  lower third if notes are extremely low,
  middle third if notes are not extremely high or low,
  left half if notes are more musical than percussive,
  right half if notes are more percussive than musical.
}
Else notes are not too fast to peck {
  If pitch and timing are relatively predictable {
    Peck in the first two columns:
    top row if notes are extremely high,
    bottom row if notes are extremely low,
    middle row if notes are not extremely high or low,
    column 1 if song is more musical than percussive,
    column 2 if song is more percussive than musical.
  }
  Else if timing is predictable but pitch is variable {
    Peck in the 'V' rectangle:
    upper third if notes are extremely high,
    lower third if notes are extremely low,
    middle third if notes are not extremely high or low,
    left half if notes are more musical than percussive,
    right half if notes are more percussive than musical.
  }
  Else if pitch is predictable but timing is variable {
    Peck in the 'T' rectangle:
    upper third if notes are extremely high,
    lower third if notes are extremely low,
    middle third if notes are not extremely high or low,
    left half if notes are more musical than percussive,
    right half if notes are more percussive than musical.
  }
  Else pitch and timing are both unpredictable {
    Set undulation type 0 and peck in the 'U' rectangle.
  }
}

```

9. Improvement Process

If you encounter a bird song that is difficult to identify, report it to the Peck user group at <http://groups.google.com/group/peckpalm>

Appendix A. Glossary

TERM	DEFINITION
bird song	any bird vocalization (i.e., includes calls but not wing whirs)
bird song shorthand	what you peck (i.e., draw in the pecking form's pecking area)
bird song shorthand text	the text that appears at the top of the pecking form that is used to compare your rendition of bird song shorthand with each recording's archived rendition
clear	a description of notes that are generally more musical (e.g., a pure toned whistle) than percussive
minor third interval	three half steps in the chromatic scale
noisy	a description of notes that are generally more percussive (i.e., buzzy or hoarse) than musical
peck icon	In the audio list, the icon of a downward pointing beak. Tap it to display the pecking form.
pecking	rendering a particular bird song by drawing bird song shorthand in the pecking form's pecking area
pecking form	The form for your pecking. To display it, tap the peck icon.
pecking order	The resulting order of the audio list when it is sorted according to how well the recordings match your pecking.
pitch shift	an abrupt change in pitch from the previous note
pitch slur	a continuous change (i.e., glide) in pitch within a note
rapid	too fast to peck (mere humans can tap the touch screen just 5 or 6 times per second)
rectangle 1	row 1, column 1 of the pecking area – for higher pitched and clear sustained notes
rectangle 2	row 1, column 2 of the pecking area – for higher pitched and noisy sustained notes
rectangle 3	row 1, column 3 of the pecking area – for undulated notes
rectangle 4	row 2, column 1 of the pecking area – for medium pitched and clear sustained notes
rectangle 5	row 2, column 2 of the pecking area – for medium pitched and noisy sustained notes
rectangle 6	row 2, column 3 of the pecking area – for variably pitched sequences of notes
rectangle 7	row 3, column 1 of the pecking area – for lower pitched and clear sustained notes
rectangle 8	row 3, column 2 of the pecking area – for lower pitched and noisy sustained notes
rectangle 9	row 3, column 3 of the pecking area – for unperiodic sequences of notes
rest	an absence of notes

Appendix B. Table of Note Types

NOTE TYPE	SYMBOL	DESCRIPTION	EXAMPLE	HOW TO PECK
sustained (clear)	s	a single clear note, continuous in duration and pitch	Northern Cardinal	peck anywhere in first column (i.e., rectangles 1, 4, 7)
sustained (noisy)	S	a single noisy note, continuous in duration and pitch	American Black Duck	peck anywhere in second column (i.e., rectangles 2, 5, 8)
undulated – single pitch (clear)	u	a rapid succession of clear notes with same pitch	Red-whiskered Bulbul	select undulation type 1 and peck in left half of rectangle 3
undulated – single pitch (noisy)	U	a rapid succession of noisy notes with same pitch	Belted Kingfisher	select undulation type 1 and peck in right half of rectangle 3
undulated – two pitches (clear)	uu	a rapid succession of clear notes alternating between two pitches	Pine Warbler	select undulation type 2 and peck in left half of rectangle 3
undulated – two pitches (noisy)	UU	a rapid succession of noisy notes alternating between two pitches	Timberline Wren	select undulation type 2 and peck in right half of rectangle 3
undulated – three or more pitches (clear)	uuu	a rapid succession of clear notes alternating between three or more pitches	Carolina Wren	select undulation type 3 and peck in left half of rectangle 3
undulated – three or more pitches (noisy)	UUU	a rapid succession of noisy notes alternating between three or more pitches	Bell's Vireo	select undulation type 3 and peck in right half of rectangle 3
erratic sequence (clear)	e	a rapid cascade of seemingly random clear notes that vary in pitch and also in duration	Gray-breasted Wood-wren	select undulation type 0 and peck in left half of rectangle 3
erratic sequence (noisy)	E	a rapid cascade of seemingly random noisy notes that vary in pitch and also in duration	Brown-headed Nuthatch	select undulation type 0 and peck in right half of rectangle 3
variable-pitched sequence (clear)	v	a succession of clear notes that vary a lot in pitch but not much in duration	Nightingale Wren	peck in left half of rectangle 6
variable-pitched sequence (noisy)	V	a succession of noisy notes that vary a lot in pitch but not much in duration	California Thrasher	peck in right half of rectangle 6
variable-rest sequence (clear)	t	a succession of clear notes of the same pitch and duration and dynamics but seemingly random intervals	Northern Pygmy-owl	peck in left half of rectangle 9
variable-rest sequence (noisy)	T	a succession of noisy notes of the same pitch and duration and dynamics but seemingly random intervals	Evening Grosbeak	peck in right half of rectangle 9

Appendix C. Table of Note Dynamics

NOTE DYNAMIC	SYMBOL	DESCRIPTION	EXAMPLE	HOW TO PECK
decrease in undulation rate	d	undulation gets slower	Clapper Rail	peck in rectangle 3 and drag to the left by at least 1/3 of rectangle
small pitch slur falling	f	a slur down in pitch of a minor third or less	Yellow-bellied Sapsucker	In columns 1 or 2, drag down less than 1/3 of a column. In column 3, drag down less than 1/3 of a rectangle.
large pitch slur falling	F	a slur down in pitch of more than a minor third	Hutton's Vireo	In columns 1 or 2, drag down more than 1/3 of a column. In column 3, drag down more than 1/3 of a rectangle.
small pitch shift higher	h	a shift up in pitch of a minor third or less	Altamira Oriole	In columns 1 or 2, shift up less than 1/3 of a column. In column 3, shift up less than 1/3 of a rectangle.
large pitch shift higher	H (in midst of peck search string)	a shift up in pitch of more than a minor third	Sandhill Crane	In columns 1 or 2, shift up more than 1/3 of a column. In column 3, shift up more than 1/3 of a rectangle.
very high	H (at beginning of peck search string)	the whole song is very high	Black-and-white Warbler	In columns 1 or 2, start in the top rectangle. In column 3, start in the top 1/3 of the rectangle.
increase in undulation rate	i	undulation gets faster	Black-chinned Sparrow	peck in rectangle 3 and drag to the right by at least 1/3 of rectangle
small pitch shift lower	l	a shift down in pitch of a minor third or less	Band-tailed Pigeon	In columns 1 or 2, shift down less than 1/3 of a column. In column 3, shift down less than 1/3 of a rectangle.
large pitch shift lower	L (in midst of peck search string)	a shift down in pitch of more than a minor third	Black Rail	In columns 1 or 2, shift down more than 1/3 of a column. In column 3, shift down more than 1/3 of a rectangle.
very low	L (at beginning of peck search string)	the whole song is very low	Whooping Crane (call)	In columns 1 or 2, start in the bottom rectangle. In column 3, start in the bottom 1/3 of the rectangle.
small pitch slur rising	r	a slur up in pitch of a minor third or less	Wood Duck	In columns 1 or 2, drag up less than 1/3 of a column. In column 3, drag up less than 1/3 of a rectangle.
large pitch slur rising	R	a slur up in pitch of more than a minor third	Northern Cardinal	In columns 1 or 2, drag up more than 1/3 of a column. In column 3, drag up more than 1/3 of a rectangle.

Appendix D. Change Log

2008 January 11

- Throughout document, updated figures.
- Added section '8. Logic of Where to Peck'.

2007 December 18

- Changed symbols to letters (i.e., U, V, T) on pecking form.

2007 November 24

- Created.