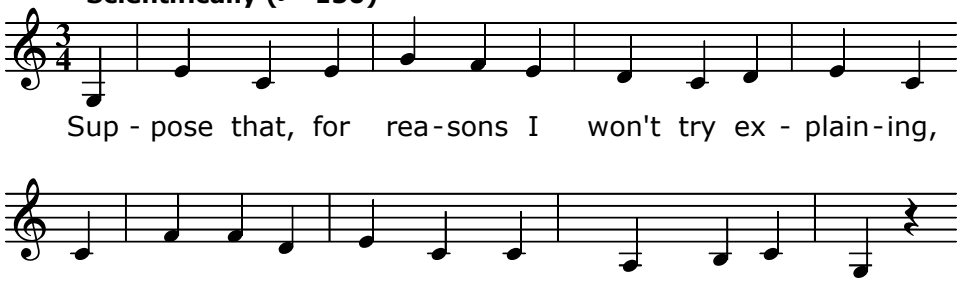
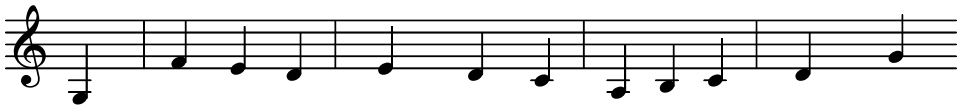
The Taylor and Creelman Procedure PEST: Parameter Estimation by Sequential Testing

Scientifically (♩ =150)

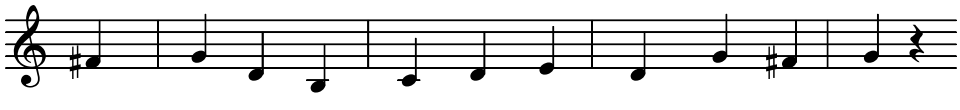


Sup - pose that, for rea-sons I won't try ex - plain-ing,

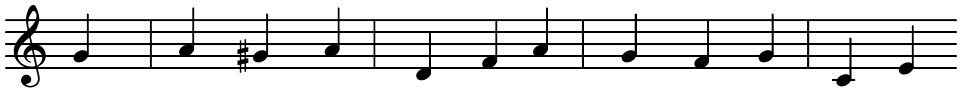
We wish to de - ter-mine the strength of a tone



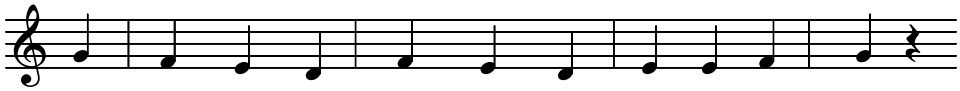
Which, ad-ded to white noise of lim - i - ted band-width,



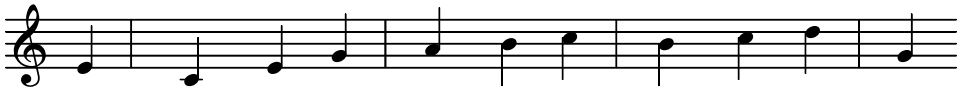
Sounds bare-ly more tone-like than noise does a - lone.



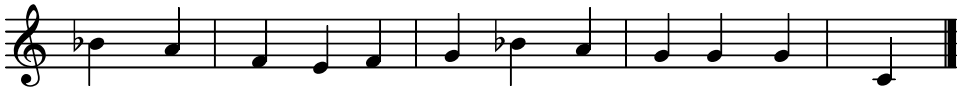
Though we could en - quire af-ter each pre-sen - ta-tion,



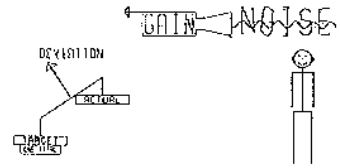
"Did you hear the noise with tone ad-ded or not?",

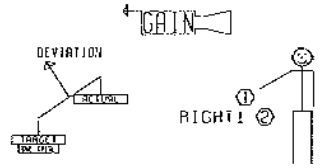


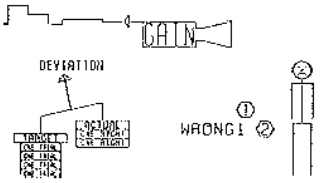
In - stead, we pre - sent one of each and we ask,



"Was the tone in the se-cond or in the first spot?"







I first performed this song at a party on 22 May, 1999, honouring C. Douglas Creelman's retirement from the Department of Psychology at the University of Toronto. The images above are frames from a 1999 digitization of a computer-animated film, circa 1971, which I created to illustrate the PEST procedure while I was Doug Creelman's graduate student.

Howard

Complete lyrics overleaf

The Taylor and Creelman Procedure PEST: Parameter Estimation by Sequential Testing

Suppose that, for reasons I won't try explaining,
We wish to determine the strength of a tone
Which, added to white noise of limited bandwidth,
Sounds barely more tonelike than noise does alone.
Though we could enquire after each presentation,
"Did you hear the noise with tone added or not?",
Instead, we present one of each, and we ask,
"Was the tone in the second or in the first spot?"

A tone that's so weak that it can't be detected
Results in performance no better than chance,
Or fifty percent of the pairs judged correctly,
While using a loud enough tone will enhance
Performance enough to result in perfection,
Or all of the trials correct. We're content
To use the term loosely, and speak of "the threshold"
As yielding a target like eighty per cent.

Now, one way to measure this threshold begins with
A credible guess as to where it might lie,
And lots of trials run in the general neighbourhood,
Some with the volume too low, some too high.
Using non-linear interpolation —
The probit technique — one can thereby deduce
The threshold from tones of near-target performance,
Though more remote values are of little use.

And therefore, instead of preplanning the series
Of signal intensities used in a test
And risking a lot of irrelevant trials,
Two smart psychophysicists came up with PEST.
Taylor and Creelman said, "Start testing somewhere
And track the performance rate trial to trial:
And, if it is not at the target, change signals;
If it's at the target, just stay there a while."

"Each time you change signal strength, reset the counters
And keep running track of the total correct;
See how that compares to the fractional number
Which, if this were threshold, you ought to expect.
Now. don't change the signal for small deviations
In delta, expected right minus what's found,
But, when there's a difference of one or more trials,
Adjust the intensity of the next sound."

This rule for deciding when someone's performance
Is lower or higher than target is called
The Wald test, because the decision rule's based
On *Sequential Analysis*, Abraham Wald.
Once we have decided to change the intensity
Of the next signal, and thus to improve
Our rate of presenting the relevant stimuli,
What rule determines how far we must move?

Here, Taylor and Creelman said, "Every new step should
Be half, same, or double of one step before,
When measured, of course, in a logarithmic scale,
Or decibel units. Our rules will explore
Efficiently if the consecutive steps in
A single direction, beyond just a few,
Are double the previous step, while reversals
Cut step size in half, or, a factor of two."

"And when, from a sequence of recent reversals,
A half of the current size step is too small
To have psychophysical meaning, just stop then,
And do not continue the testing at all.
But take the next level at which you'd be testing
And call that the threshold. The error you make
Is in rough proportion to how large a step
You, because of this rule, were not able to take."

So this, then, in short, is the classic procedure
Called PEST, for deciding, as each trial's done,
If we ought to terminate testing, repeat the same level
Or, choosing another to test at, which one.
This scheme marked a technical paradigm shift
Of a sort that began at mid-century dates,
A time when small labs were first able to purchase
The minicomputers like PDP-8s.

Here is the original reference to PEST:

Taylor MM, Creelman CD. PEST: Efficient estimates on probability functions. Journal of the Acoustical Society of America, 41, 782-787.

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