# Delicate Computations

PHILIP CORNER (with LARRY POLANSKY)

## Come to Computer!

Was never able before. Had to get simple enough.

A superhuman performer requires a superhuman listener . . . for, as the limits are reached and surpassed of what our poor bodies can perform, so they are for what our poor brains can appreciate. (So wire two machines to each other, one to generate and the other taking dictation.) Years ago, Jim Tenney got a few of us together—a FORTRAN class right out of Bell Labs brought Downtown (and Alison Knowles, for one, made extraordinary use of that), but i kept finding that whatever i wanted i could figure out myself; and whatever i wanted to listen to i'd prefer the living kind of players for. (Human improvisation remains the superior infinity process.) Jim even showed me that my particular way of formulating indeterminacy—in pieces for piano, string instruments, etc.—often resembled the way one programmed information in any case. The major problem seemed to me be *timbre*. (I mean, how often have you heard a synthesized piece whose sound you *liked*?)

Actually, synthetic is sterile—has to be.

It contrasts with the inexhaustible richness of life, of the world as given.

So, by artificially creating ever more virtuosic displays of complication which begin to approach nature, the contrast becomes ever more evident. A simulacrum can never be "the real thing" (even when perfect!).

On the other hand, if you were to go in the opposite direction, really desiring a simplification of sound so pure that it is a projection from the realm of mental essences . . .

Actually, i'd learned this years ago, from a tape loop made by Jon Child with staccato sine tones as a realization of my "open structure": *Gamelan VOX*—where a beat is divided into progressively smaller regular divisions. (I can execute this as a vocal mnemonic up to six. But the electronic loop took it to seven. And of course could easily go on from there. Most importantly, it sounded good. It was allowed into a performance.)

This made me think of the early Electronic Music Studies, as well as much subsequent production. It seems to me that the reason i find them almost unlistenable is that there is a contradiction between their simplicity of material and the complexity of pitch and time parameters. (Although i do wish to acknowledge the special beauty of Tenney's *Ergodos* and *Stochastic Studies,* which seem to strike the right balance.)

With the connivance of Larry Polansky, i have just been lured into a studio.

The "meta-score" of *Delicate Computations* (also from my "Gamelan"[1] series) had been made several years before. And it needs the computer.

A development from an earlier and simpler piece: *pulse,* it makes incredibly subtle precision serve an immediately graspable idea.

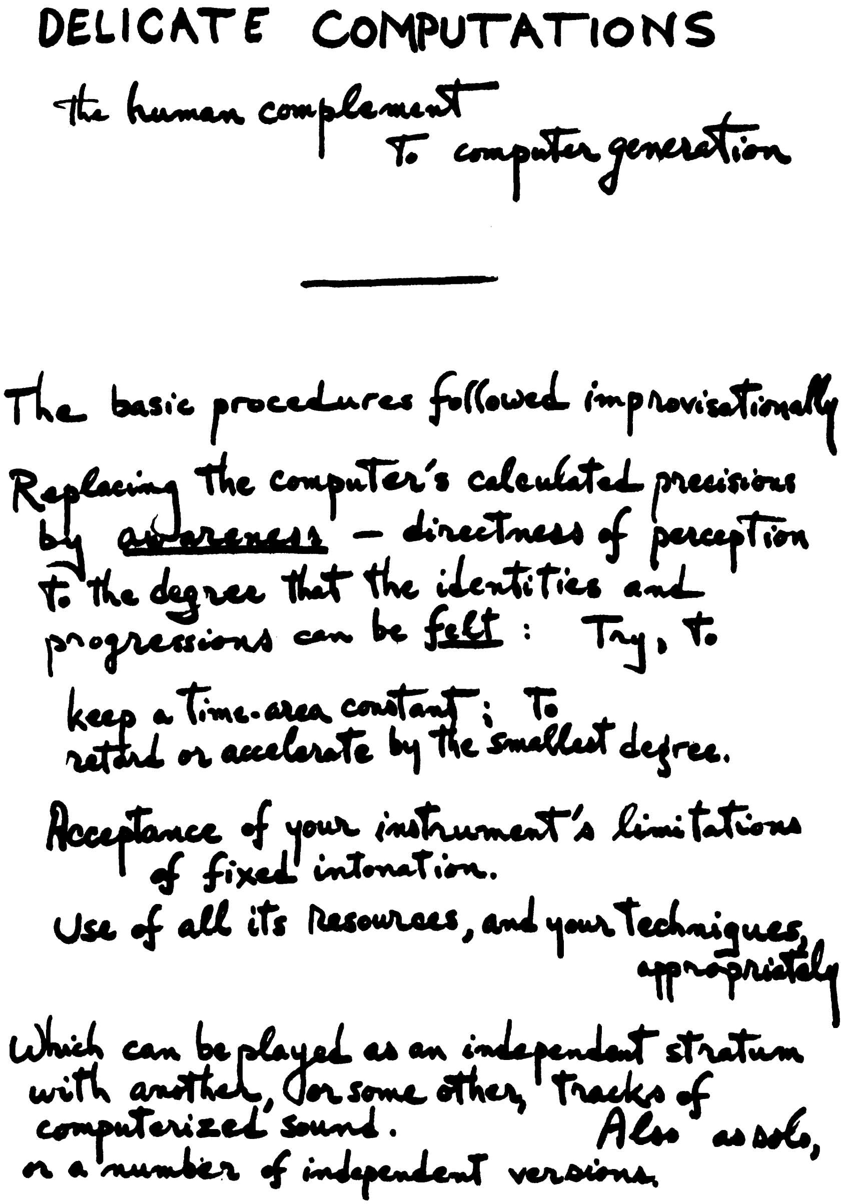
An eleven-phrase, approximately forty-minute version was typed into the computer by Larry from my dictation. This "performance" was practically in real time—although the program for it occupied him the better part of three days.

If the computer itself were to be brought into the concert, it could decide its own variations, endlessly. We are planning such an evening.

And now, i can see how to bring a specifically human sensibility back into the act.

## Notes

[1] Cf. Jody Diamond, "Interview: Philip Corner: You Can Only Be Who You Are," *Balungan* 2, no. 3 December 1986: 23–32.



# DELICATE COMPUTATIONS

the human complement
to computer generation

The basic procedures followed improvisationally

Replacing the computer's calculated precisions
by awareness — directness of perception
to the degree that the identities and
progressions can be felt: Try, to

keep a time-area constant; to
retard or accelerate by the smallest degree.

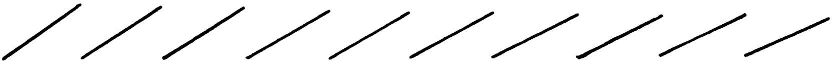
Acceptance of your instrument's limitations
of fixed intonation.
Use of all its resources, and your techniques,
appropriately

Which can be played as an independent stratum
with another, (or some other, tracks of
computerized sound. Also as solo,
or a number of independent versions.

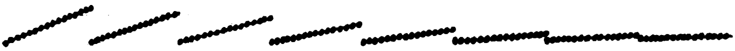
— 2 —

Examples of "delicate computations"

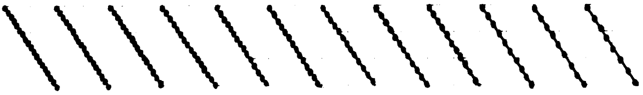
Line of same length bent so as to expand time:



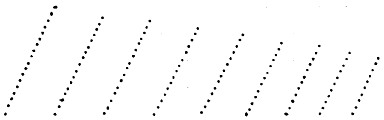
Same line continued with even-spaced pulsations, thus contracting interval scale:



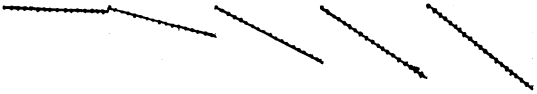
Line constant in length and direction containing decreasing number (hence slowing rhythm) of notes:



Decreasing number of notes at constant tempo thus contracting the line



Increase of interval size and number of notes in constant tempo at constant speed



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Philip Corner

# (g a m e l a n) DELICATE COMPUTATIONS

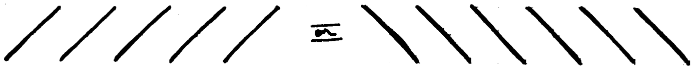
Groups of patterns forming systematic subtle progressions in various musical ways.

Form

each, of these
a contained entity —
separated by silence.
Must have a (noticeable)
change-of-color;
May be a different instrument & spacial location.

These canbe expressed as lines (diagonal)
giving the scalar (melody) aspect.
(which can be played up or down)

EXAMPLES



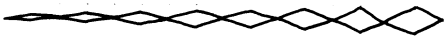
– – – – – – i.e.: constancy repeating – – – – – – – – –

THIS

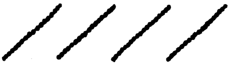
can only be permitted when the progression occurs in the remaining dimension: intensity

( pppp ppp pp p mp m mf f ff fff ffff ) — or the retrograde.

further subtlety : —pp <p <mp<mf<f <ff ,etc.



These melody-shape lines are translatable either into pure gliss (precisely!)
or
pulsations, evenly timed ...... on evenly-spaced minutely-distanced interval tones.



, — etc.

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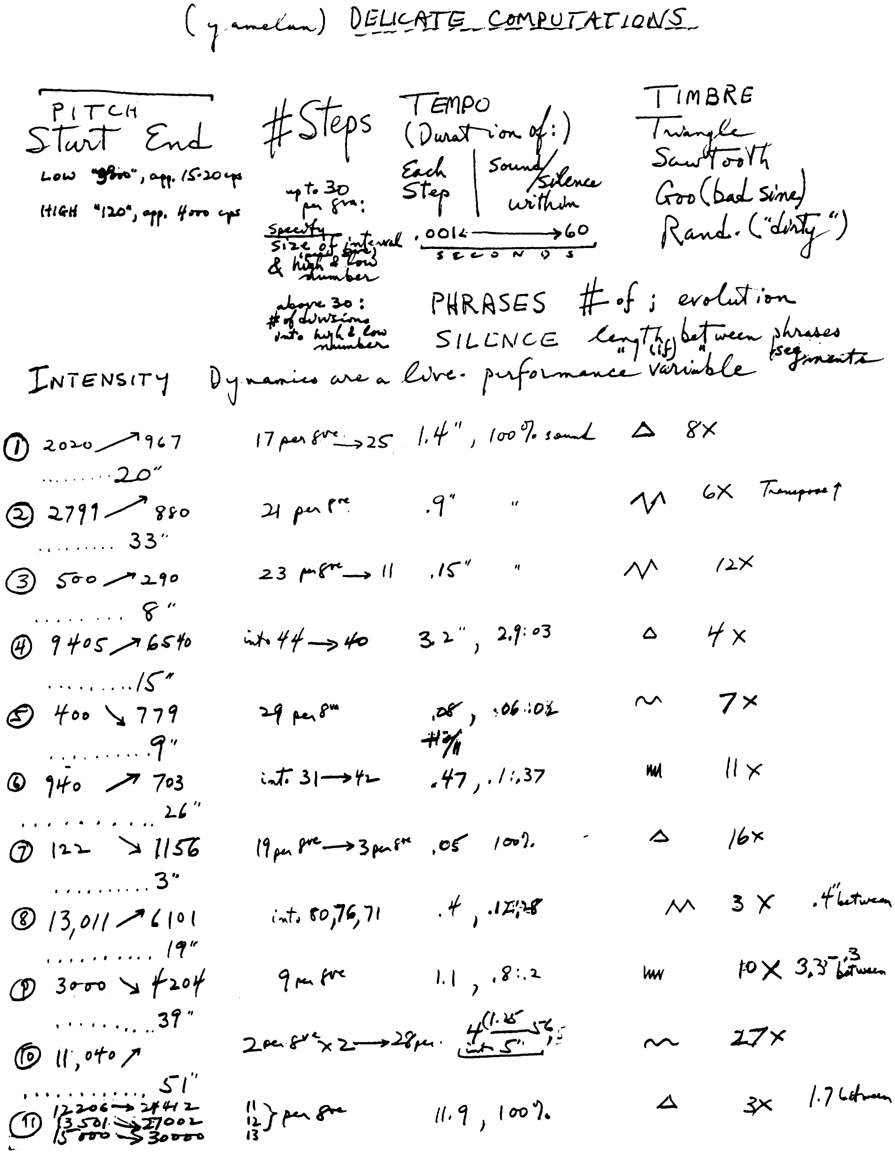


(gamelan) DELICATE COMPUTATIONS

PITCH
Start End
LOW "~~8vo~~", app. 15-20 cps
HIGH "120", app. 4000 cps

#Steps
up to 30 per 8va:
Specify size of interval (per 8va) & high & low number
above 30: # of divisions into high & low number

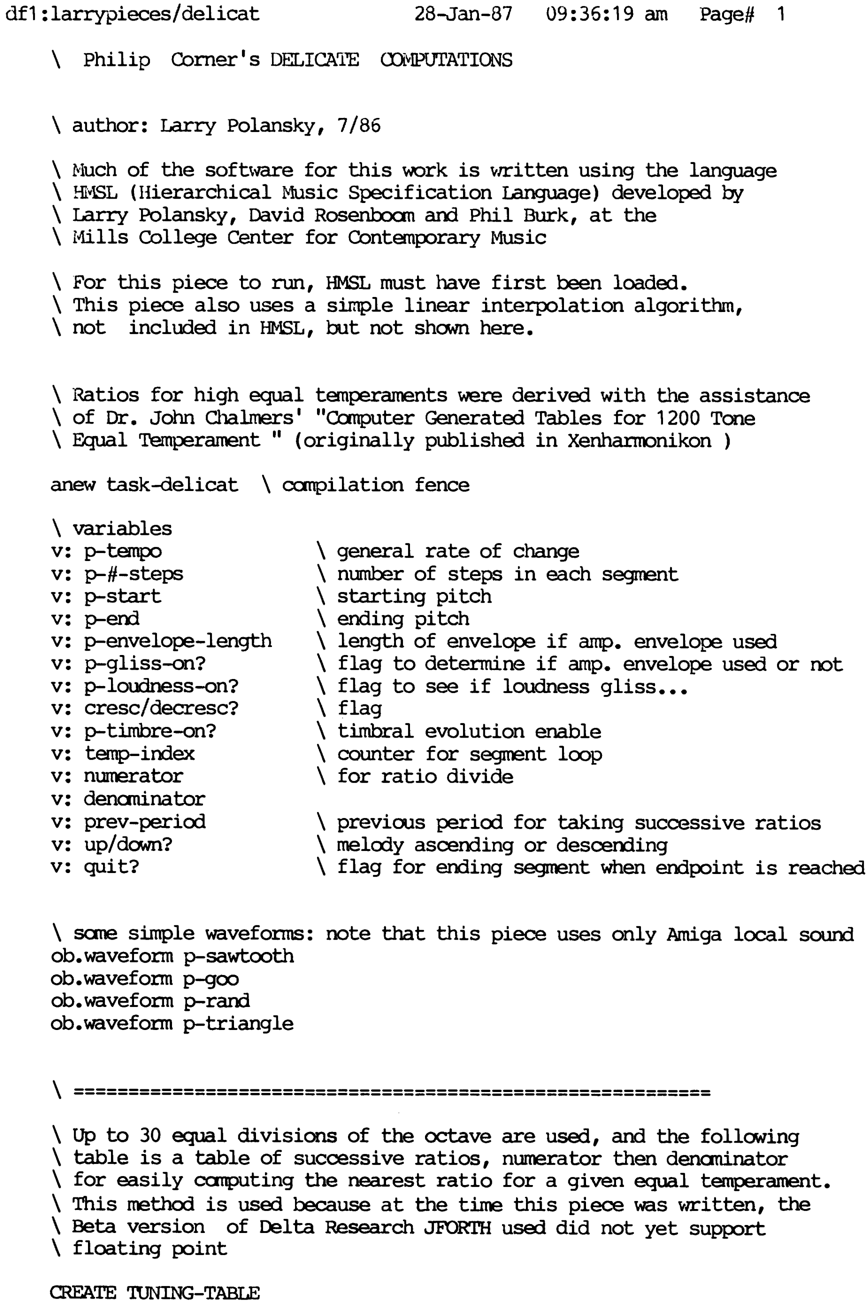
TEMPO
(Duration of:)
Each Step | Sound/Silence within
.0016 → 60
SECONDS

TIMBRE
Triangle
SawTooth
Goo (bad sine)
Rand. ("dirty")

PHRASES # of ; evolution
SILENCE length (if) between phrases/segments
" " "

INTENSITY Dynamics are a live-performance variable

| | | | | | |
|---|---|---|---|---|---|
| ① 2020 ↗ 967 | 17 per 8ve → 25 | 1.4", 100% sound | △ | 8X | |
| ........ 20" | | | | | |
| ② 2791 ↗ 880 | 21 per 8ve | .9" " | ʌʌ | 6X | Transpose ↑ |
| ........ 33" | | | | | |
| ③ 500 ↗ 290 | 23 per 8ve → 11 | .15" " | ʌʌ | 12X | |
| ........ 8" | | | | | |
| ④ 9405 ↗ 6540 | int. 44 → 40 | 3.2", 2.9:.03 | △ | 4X | |
| ........ 15" | | | | | |
| ⑤ 400 ↘ 779 | 29 per 8ve | .08, .06:.02<br>#%/11 | ∿ | 7X | |
| ........ 9" | | | | | |
| ⑥ 940 ↗ 703 | int. 31 → 42 | .47, .1:.37 | ɯɯ | 11X | |
| ........ 26" | | | | | |
| ⑦ 122 ↘ 1156 | 19 per 8ve → 3 per 8ve | .05 100% | △ | 16X | |
| ........ 3" | | | | | |
| ⑧ 13,011 ↗ 6101 | int. 80, 76, 71 | .4, .12:.28 | ʌʌ | 3X | .4" between |
| ........ 19" | | | | | |
| ⑨ 3000 ↘ 4204 | 9 per 8ve | 1.1, .8:.2 | ww | 10X | 3.3"-.3 between |
| ........ 39" | | | | | |
| ⑩ 11,040 ↗ | 2 per 8ve x 2 → 28 per | 4 (1.25 / int 5" ,56 | ∿ | 27X | |
| ........ 51" | | | | | |
| ⑪ 12206 → 24412<br>13501 → 27002<br>15000 → 30000 | 11<br>12 } per 8ve<br>13 | 11.9, 100% | △ | 3X | 1.7 between |



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df1:larrypieces/delicat            28-Jan-87   09:36:19 am   Page# 1

    \ Philip  Corner's DELICATE  COMPUTATIONS


    \ author: Larry Polansky, 7/86

    \ Much of the software for this work is written using the language
    \ HMSL (Hierarchical Music Specification Language) developed by
    \ Larry Polansky, David Rosenboom and Phil Burk, at the
    \ Mills College Center for Contemporary Music

    \ For this piece to run, HMSL must have first been loaded.
    \ This piece also uses a simple linear interpolation algorithm,
    \ not  included in HMSL, but not shown here.


    \ Ratios for high equal temperaments were derived with the assistance
    \ of Dr. John Chalmers' "Computer Generated Tables for 1200 Tone
    \ Equal Temperament " (originally published in Xenharmonikon )

    anew task-delicat  \ compilation fence

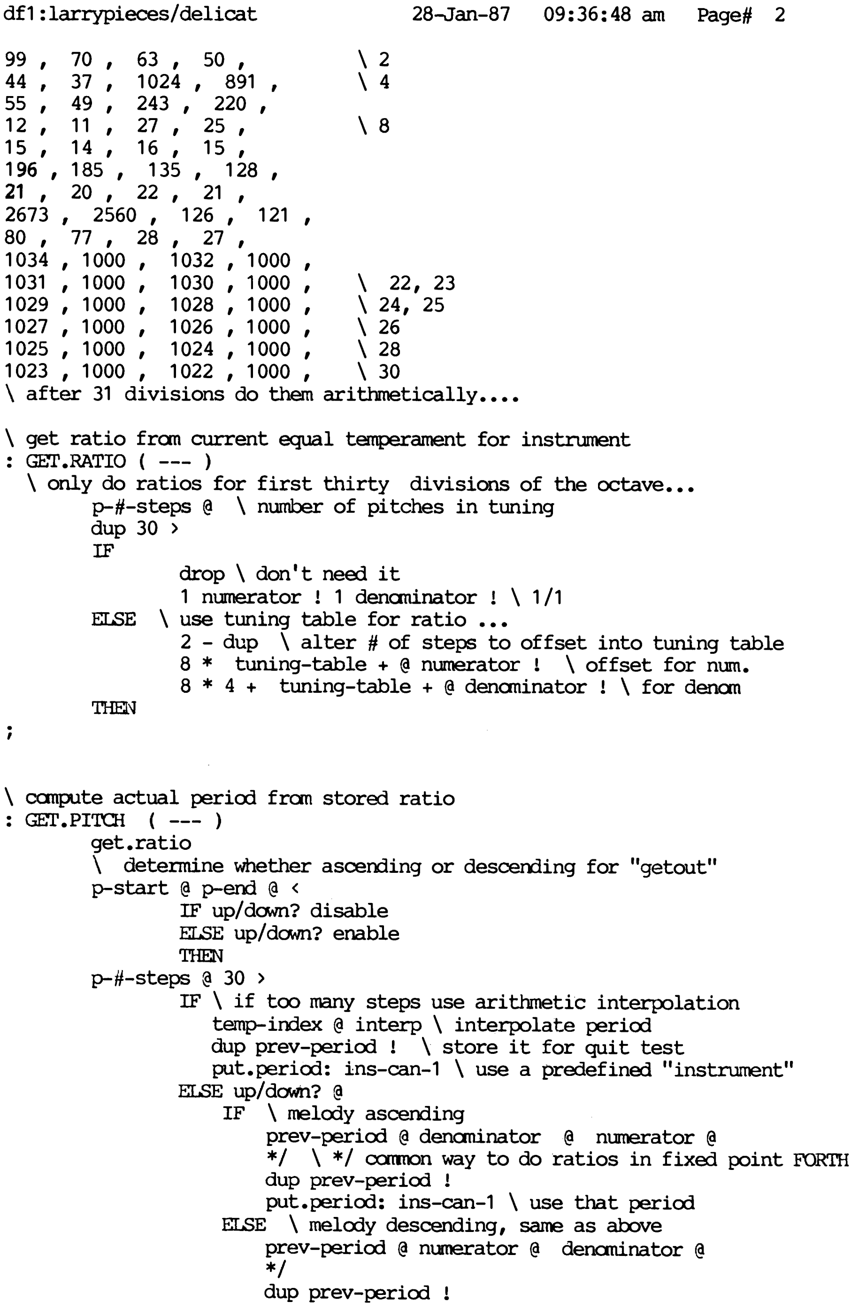
    \ variables
    v: p-tempo              \ general rate of change
    v: p-#-steps            \ number of steps in each segment
    v: p-start              \ starting pitch
    v: p-end                \ ending pitch
    v: p-envelope-length    \ length of envelope if amp. envelope used
    v: p-gliss-on?          \ flag to determine if amp. envelope used or not
    v: p-loudness-on?       \ flag to see if loudness gliss...
    v: cresc/decresc?       \ flag
    v: p-timbre-on?         \ timbral evolution enable
    v: temp-index           \ counter for segment loop
    v: numerator            \ for ratio divide
    v: denominator
    v: prev-period          \ previous period for taking successive ratios
    v: up/down?             \ melody ascending or descending
    v: quit?                \ flag for ending segment when endpoint is reached


    \ some simple waveforms: note that this piece uses only Amiga local sound
    ob.waveform p-sawtooth
    ob.waveform p-goo
    ob.waveform p-rand
    ob.waveform p-triangle


    \ ==========================================================

    \ Up to 30 equal divisions of the octave are used, and the following
    \ table is a table of successive ratios, numerator then denominator
    \ for easily computing the nearest ratio for a given equal temperament.
    \ This method is used because at the time this piece was written, the
    \ Beta version  of Delta Research JFORTH used did not yet support
    \ floating point

    CREATE TUNING-TABLE
```



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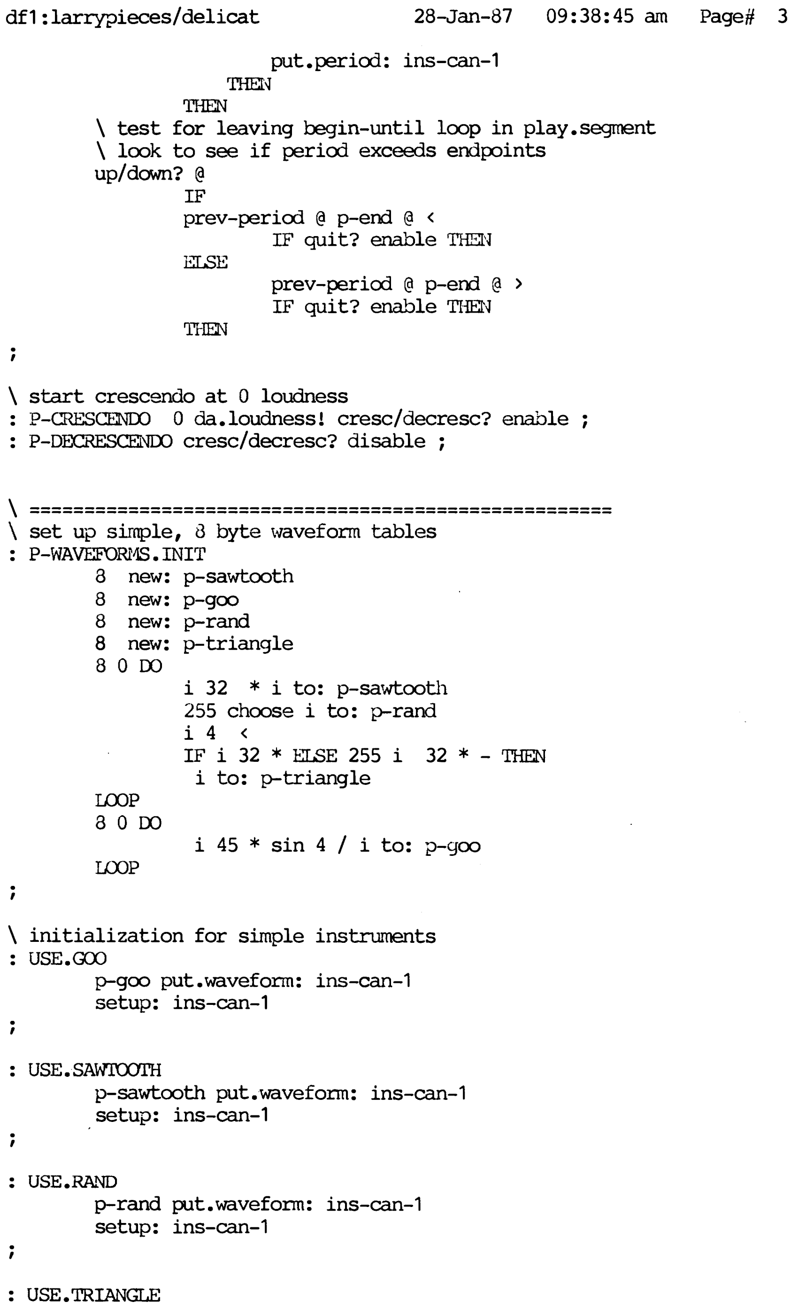
df1:larrypieces/delicat            28-Jan-87   09:36:48 am   Page# 2

99 ,  70 ,  63 ,  50 ,         \ 2
44 ,  37 ,  1024 ,  891 ,      \ 4
55 ,  49 ,  243 ,  220 ,
12 ,  11 ,  27 ,  25 ,         \ 8
15 ,  14 ,  16 ,  15 ,
196 , 185 ,  135 ,  128 ,
21 ,  20 ,  22 ,  21 ,
2673 ,  2560 ,  126 ,  121 ,
80 ,  77 ,  28 ,  27 ,
1034 , 1000 ,  1032 , 1000 ,
1031 , 1000 ,  1030 , 1000 ,    \  22, 23
1029 , 1000 ,  1028 , 1000 ,    \ 24, 25
1027 , 1000 ,  1026 , 1000 ,    \ 26
1025 , 1000 ,  1024 , 1000 ,    \ 28
1023 , 1000 ,  1022 , 1000 ,    \ 30
\ after 31 divisions do them arithmetically....

\ get ratio from current equal temperament for instrument
: GET.RATIO ( --- )
  \ only do ratios for first thirty  divisions of the octave...
        p-#-steps @  \ number of pitches in tuning
        dup 30 >
        IF
                drop \ don't need it
                1 numerator ! 1 denominator ! \ 1/1
        ELSE  \ use tuning table for ratio ...
                2 - dup  \ alter # of steps to offset into tuning table
                8 *  tuning-table + @ numerator !  \ offset for num.
                8 * 4 +  tuning-table + @ denominator ! \ for denom
        THEN
;


\ compute actual period from stored ratio
: GET.PITCH  ( --- )
        get.ratio
        \  determine whether ascending or descending for "getout"
        p-start @ p-end @ <
                IF up/down? disable
                ELSE up/down? enable
                THEN
        p-#-steps @ 30 >
                IF \ if too many steps use arithmetic interpolation
                   temp-index @ interp \ interpolate period
                   dup prev-period !  \ store it for quit test
                   put.period: ins-can-1 \ use a predefined "instrument"
                ELSE up/down? @
                    IF  \ melody ascending
                        prev-period @ denominator  @  numerator @
                        */  \ */ common way to do ratios in fixed point FORTH
                        dup prev-period !
                        put.period: ins-can-1 \ use that period
                    ELSE  \ melody descending, same as above
                        prev-period @ numerator @  denominator @
                        */
                        dup prev-period !
```



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df1:larrypieces/delicat              28-Jan-87   09:38:45 am   Page#  3
                        put.period: ins-can-1
                    THEN
                THEN
        \ test for leaving begin-until loop in play.segment
        \ look to see if period exceeds endpoints
        up/down? @
                IF
                prev-period @ p-end @ <
                        IF quit? enable THEN
                ELSE
                        prev-period @ p-end @ >
                        IF quit? enable THEN
                THEN
;

\ start crescendo at 0 loudness
: P-CRESCENDO  0 da.loudness! cresc/decresc? enable ;
: P-DECRESCENDO cresc/decresc? disable ;

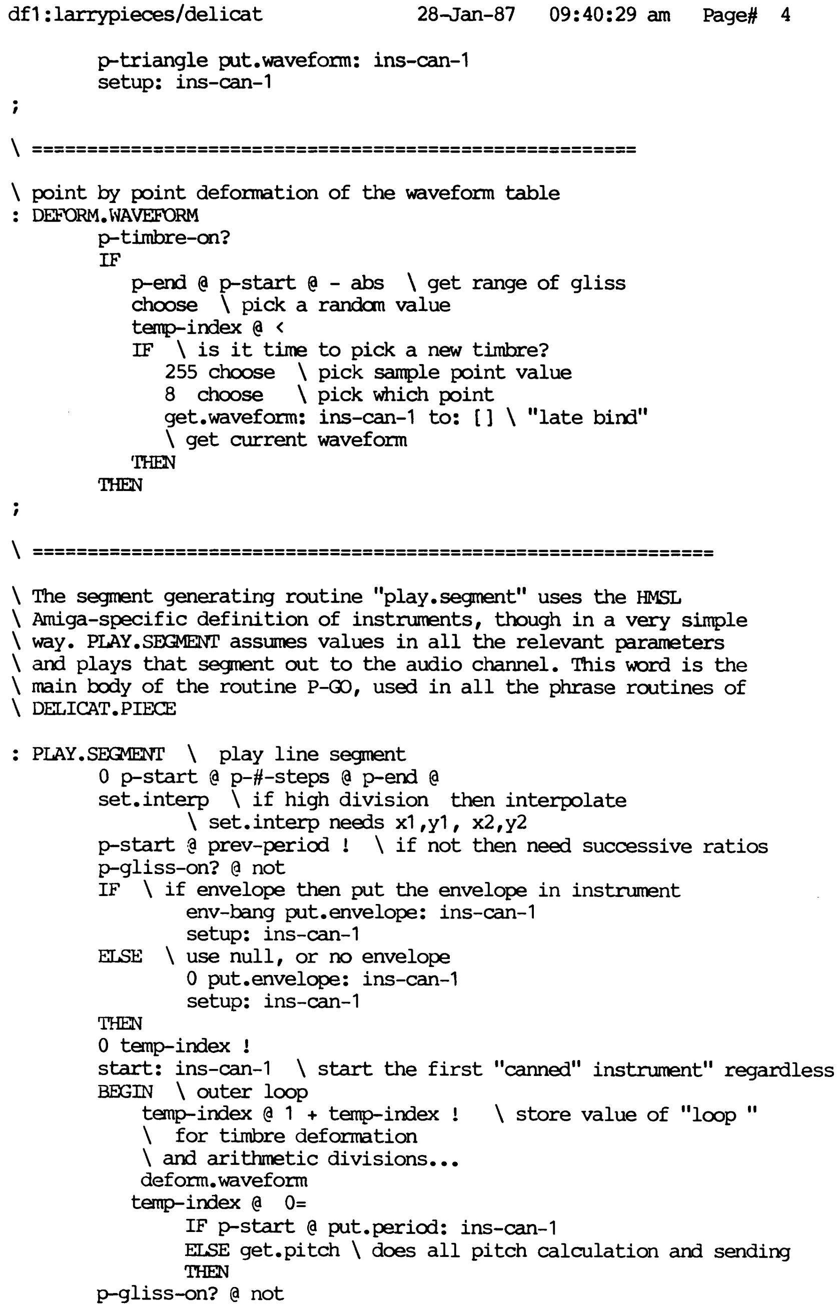

\ =====================================================
\ set up simple, 8 byte waveform tables
: P-WAVEFORMS.INIT
        8  new: p-sawtooth
        8  new: p-goo
        8  new: p-rand
        8  new: p-triangle
        8 0 DO
                i 32  * i to: p-sawtooth
                255 choose i to: p-rand
                i 4  <
                IF i 32 * ELSE 255 i  32 * - THEN
                 i to: p-triangle
        LOOP
        8 0 DO
                 i 45 * sin 4 / i to: p-goo
        LOOP
;

\ initialization for simple instruments
: USE.GOO
        p-goo put.waveform: ins-can-1
        setup: ins-can-1
;

: USE.SAWTOOTH
        p-sawtooth put.waveform: ins-can-1
        setup: ins-can-1
;

: USE.RAND
        p-rand put.waveform: ins-can-1
        setup: ins-can-1
;

: USE.TRIANGLE
```



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df1:larrypieces/delicat              28-Jan-87   09:40:29 am   Page# 4

        p-triangle put.waveform: ins-can-1
        setup: ins-can-1
;

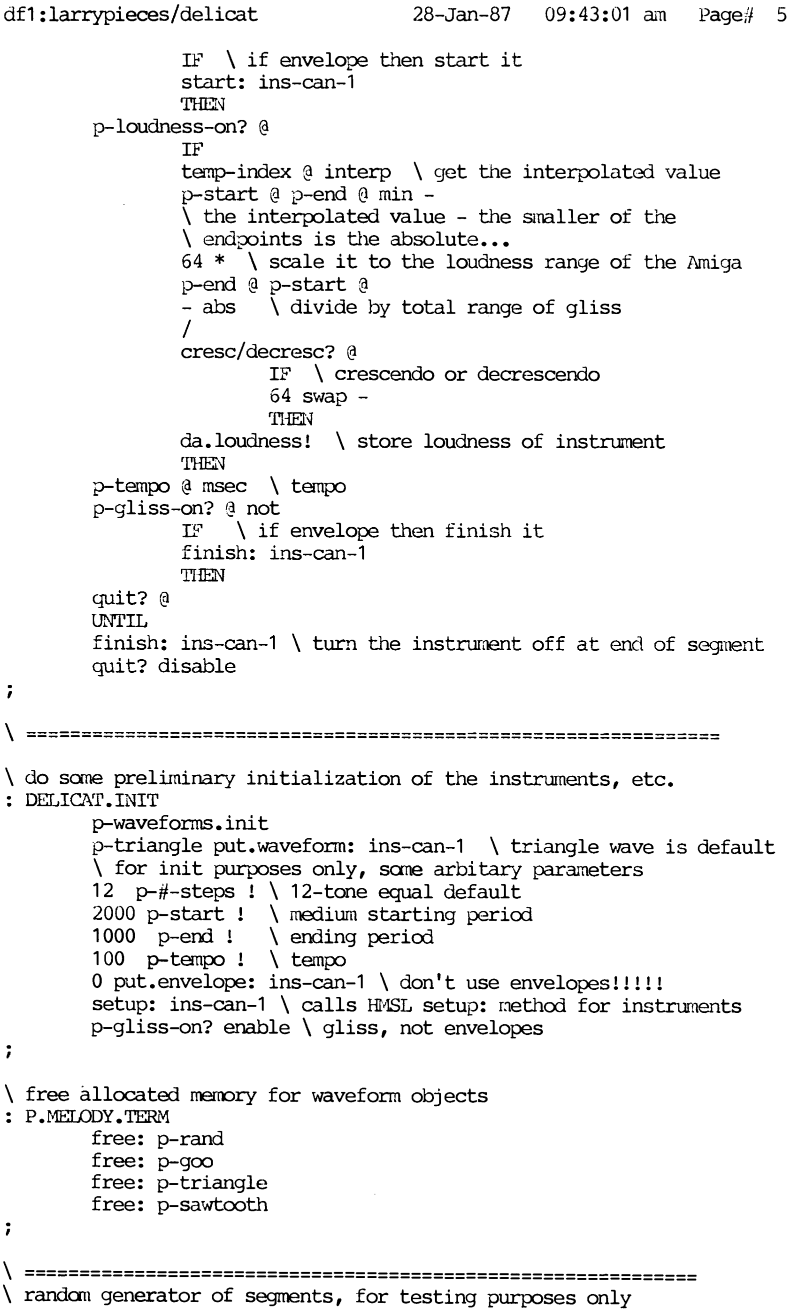
\ =====================================================

\ point by point deformation of the waveform table
: DEFORM.WAVEFORM
        p-timbre-on?
        IF
           p-end @ p-start @ - abs  \ get range of gliss
           choose  \ pick a random value
           temp-index @ <
           IF  \ is it time to pick a new timbre?
              255 choose  \ pick sample point value
              8  choose   \ pick which point
              get.waveform: ins-can-1 to: [] \ "late bind"
              \ get current waveform
           THEN
        THEN
;

\ ============================================================

\ The segment generating routine "play.segment" uses the HMSL
\ Amiga-specific definition of instruments, though in a very simple
\ way. PLAY.SEGMENT assumes values in all the relevant parameters
\ and plays that segment out to the audio channel. This word is the
\ main body of the routine P-GO, used in all the phrase routines of
\ DELICAT.PIECE

: PLAY.SEGMENT  \  play line segment
        0 p-start @ p-#-steps @ p-end @
        set.interp  \ if high division  then interpolate
                \ set.interp needs x1,y1, x2,y2
        p-start @ prev-period !  \ if not then need successive ratios
        p-gliss-on? @ not
        IF  \ if envelope then put the envelope in instrument
                env-bang put.envelope: ins-can-1
                setup: ins-can-1
        ELSE  \ use null, or no envelope
                0 put.envelope: ins-can-1
                setup: ins-can-1
        THEN
        0 temp-index !
        start: ins-can-1  \ start the first "canned" instrument" regardless
        BEGIN  \ outer loop
            temp-index @ 1 + temp-index !    \ store value of "loop "
            \  for timbre deformation
            \ and arithmetic divisions...
            deform.waveform
           temp-index @  0=
                IF p-start @ put.period: ins-can-1
                ELSE get.pitch \ does all pitch calculation and sending
                THEN
        p-gliss-on? @ not
```



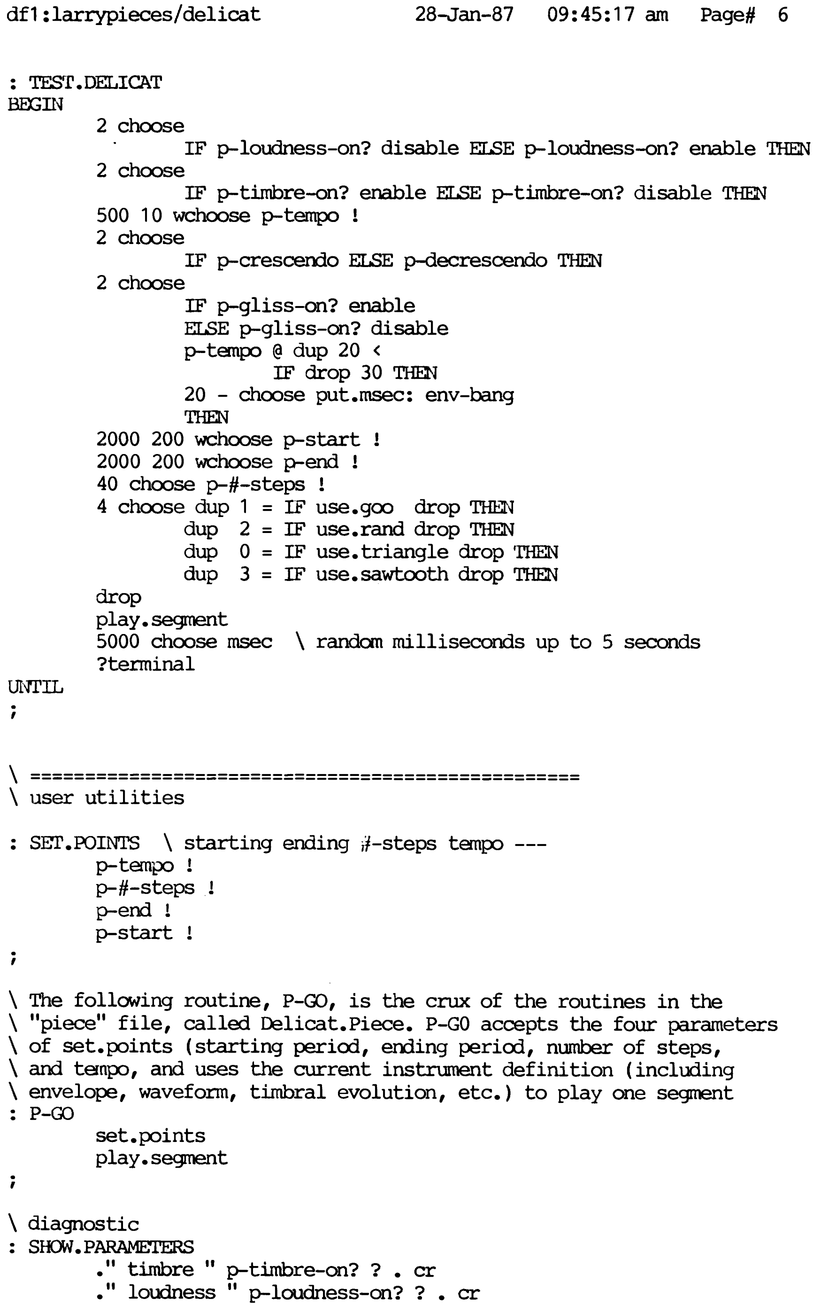
```
df1:larrypieces/delicat             28-Jan-87   09:43:01 am   Page# 5
                IF  \ if envelope then start it
                start: ins-can-1
                THEN
        p-loudness-on? @
                IF
                temp-index @ interp  \ get the interpolated value
                p-start @ p-end @ min -
                \ the interpolated value - the smaller of the
                \ endpoints is the absolute...
                64 *  \ scale it to the loudness range of the Amiga
                p-end @ p-start @
                - abs   \ divide by total range of gliss
                /
                cresc/decresc? @
                        IF  \ crescendo or decrescendo
                        64 swap -
                        THEN
                da.loudness!  \ store loudness of instrument
                THEN
        p-tempo @ msec  \ tempo
        p-gliss-on? @ not
                IF   \ if envelope then finish it
                finish: ins-can-1
                THEN
        quit? @
        UNTIL
        finish: ins-can-1 \ turn the instrument off at end of segment
        quit? disable
;

\ ===============================================================

\ do some preliminary initialization of the instruments, etc.
: DELICAT.INIT
        p-waveforms.init
        p-triangle put.waveform: ins-can-1  \ triangle wave is default
        \ for init purposes only, some arbitary parameters
        12  p-#-steps ! \ 12-tone equal default
        2000 p-start !  \ medium starting period
        1000  p-end !   \ ending period
        100  p-tempo !  \ tempo
        0 put.envelope: ins-can-1 \ don't use envelopes!!!!!
        setup: ins-can-1 \ calls HMSL setup: method for instruments
        p-gliss-on? enable \ gliss, not envelopes
;

\ free allocated memory for waveform objects
: P.MELODY.TERM
        free: p-rand
        free: p-goo
        free: p-triangle
        free: p-sawtooth
;

\ =============================================================
\ random generator of segments, for testing purposes only
```



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df1:larrypieces/delicat              28-Jan-87   09:45:17 am   Page# 6

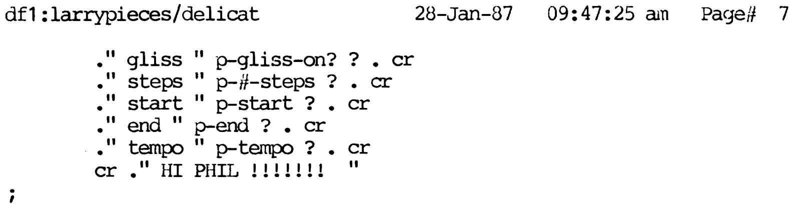

: TEST.DELICAT
BEGIN
        2 choose
                IF p-loudness-on? disable ELSE p-loudness-on? enable THEN
        2 choose
                IF p-timbre-on? enable ELSE p-timbre-on? disable THEN
        500 10 wchoose p-tempo !
        2 choose
                IF p-crescendo ELSE p-decrescendo THEN
        2 choose
                IF p-gliss-on? enable
                ELSE p-gliss-on? disable
                p-tempo @ dup 20 <
                        IF drop 30 THEN
                20 - choose put.msec: env-bang
                THEN
        2000 200 wchoose p-start !
        2000 200 wchoose p-end !
        40 choose p-#-steps !
        4 choose dup 1 = IF use.goo  drop THEN
                dup  2 = IF use.rand drop THEN
                dup  0 = IF use.triangle drop THEN
                dup  3 = IF use.sawtooth drop THEN
        drop
        play.segment
        5000 choose msec  \ random milliseconds up to 5 seconds
        ?terminal
UNTIL
;


\ ==================================================
\ user utilities

: SET.POINTS  \ starting ending #-steps tempo ---
        p-tempo !
        p-#-steps !
        p-end !
        p-start !
;

\ The following routine, P-GO, is the crux of the routines in the
\ "piece" file, called Delicat.Piece. P-GO accepts the four parameters
\ of set.points (starting period, ending period, number of steps,
\ and tempo, and uses the current instrument definition (including
\ envelope, waveform, timbral evolution, etc.) to play one segment
: P-GO
        set.points
        play.segment
;

\ diagnostic
: SHOW.PARAMETERS
        ." timbre " p-timbre-on? ? . cr
        ." loudness " p-loudness-on? ? . cr
```



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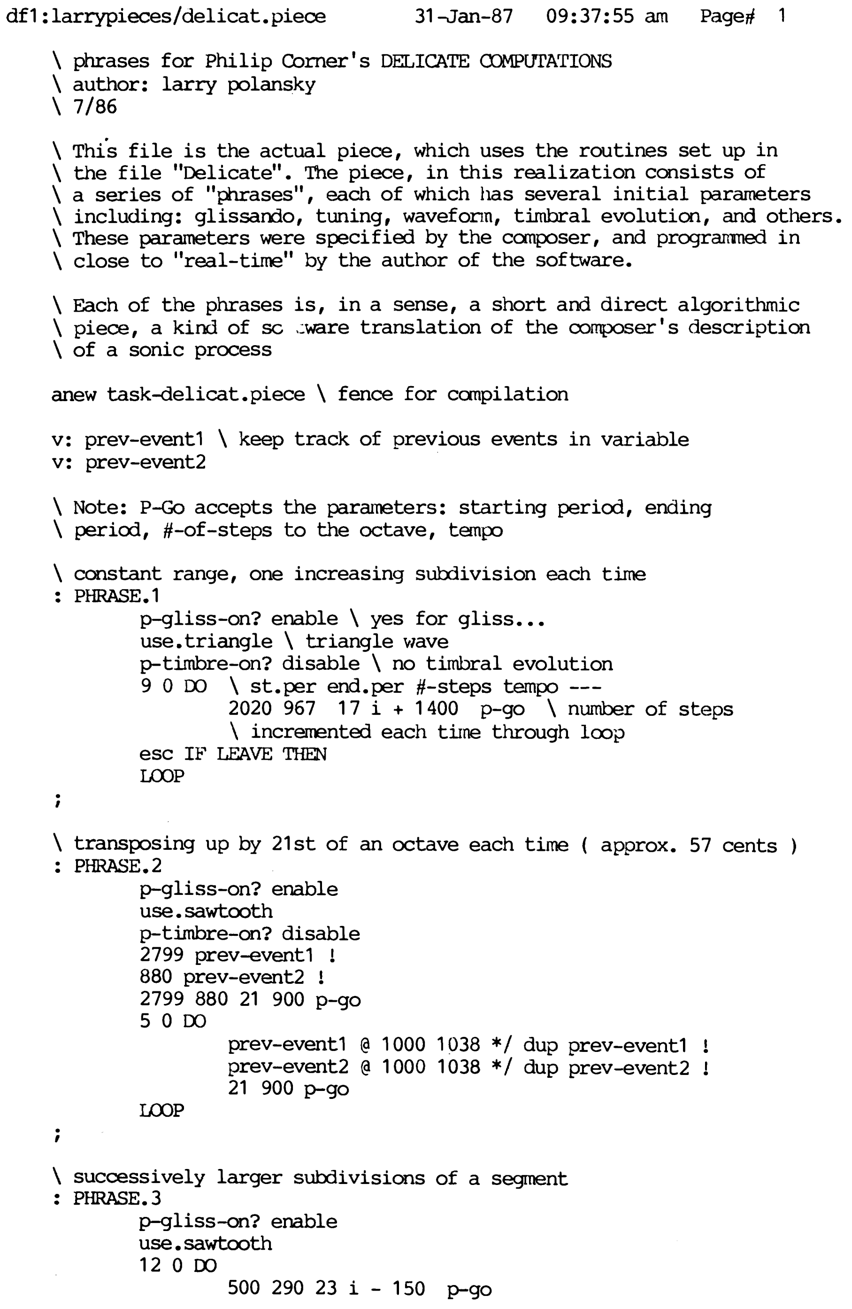
        ." gliss " p-gliss-on? ? . cr
        ." steps " p-#-steps ? . cr
        ." start " p-start ? . cr
        ." end " p-end ? . cr
        ." tempo " p-tempo ? . cr
        cr ." HI PHIL !!!!!!!  "
;
```



```
df1:larrypieces/delicat.piece        31-Jan-87   09:37:55 am    Page#  1

    \ phrases for Philip Corner's DELICATE COMPUTATIONS
    \ author: larry polansky
    \ 7/86

    \ This file is the actual piece, which uses the routines set up in
    \ the file "Delicate". The piece, in this realization consists of
    \ a series of "phrases", each of which has several initial parameters
    \ including: glissando, tuning, waveform, timbral evolution, and others.
    \ These parameters were specified by the composer, and programmed in
    \ close to "real-time" by the author of the software.

    \ Each of the phrases is, in a sense, a short and direct algorithmic
    \ piece, a kind of sc .ware translation of the composer's description
    \ of a sonic process

    anew task-delicat.piece \ fence for compilation

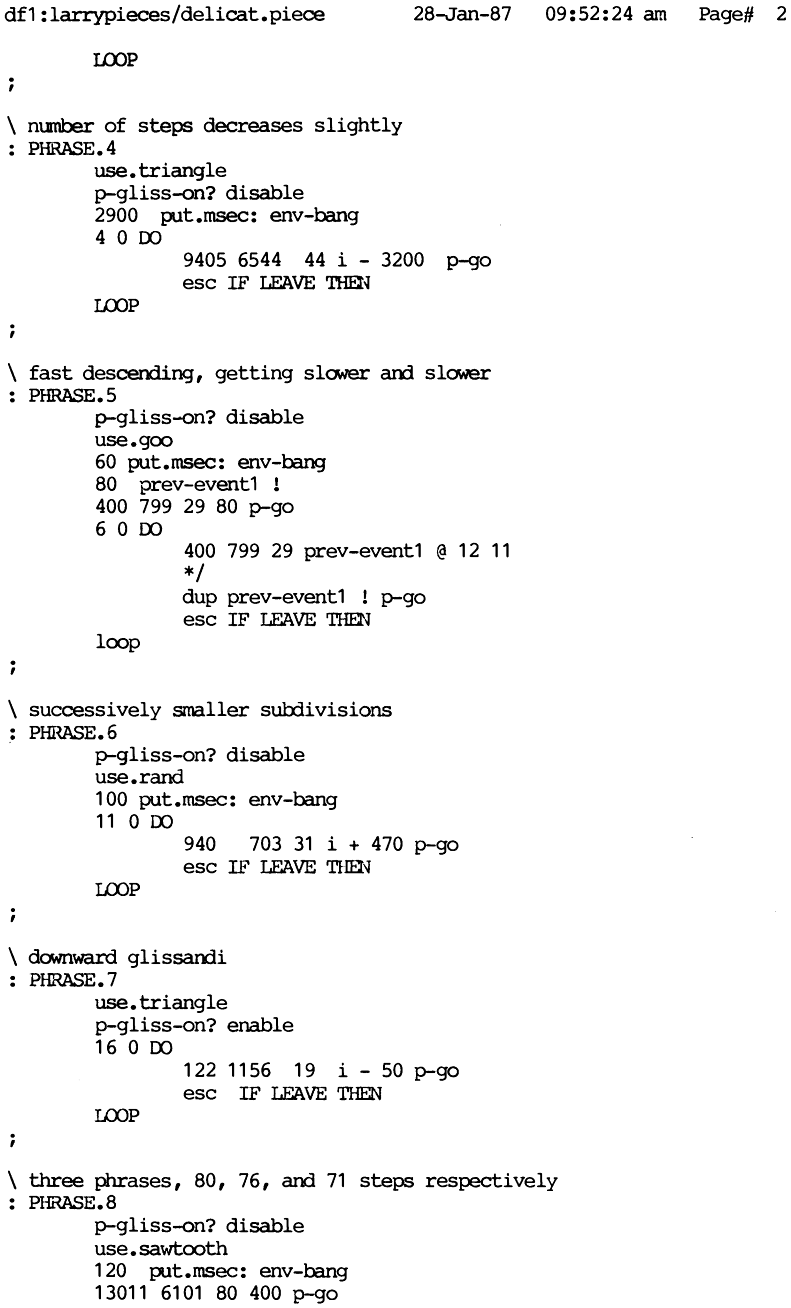
    v: prev-event1 \ keep track of previous events in variable
    v: prev-event2

    \ Note: P-Go accepts the parameters: starting period, ending
    \ period, #-of-steps to the octave, tempo

    \ constant range, one increasing subdivision each time
    : PHRASE.1
            p-gliss-on? enable \ yes for gliss...
            use.triangle \ triangle wave
            p-timbre-on? disable \ no timbral evolution
            9 0 DO  \ st.per end.per #-steps tempo ---
                    2020 967  17 i + 1400  p-go  \ number of steps
                    \ incremented each time through loop
            esc IF LEAVE THEN
            LOOP
    ;

    \ transposing up by 21st of an octave each time ( approx. 57 cents )
    : PHRASE.2
            p-gliss-on? enable
            use.sawtooth
            p-timbre-on? disable
            2799 prev-event1 !
            880 prev-event2 !
            2799 880 21 900 p-go
            5 0 DO
                    prev-event1 @ 1000 1038 */ dup prev-event1 !
                    prev-event2 @ 1000 1038 */ dup prev-event2 !
                    21 900 p-go
            LOOP
    ;

    \ successively larger subdivisions of a segment
    : PHRASE.3
            p-gliss-on? enable
            use.sawtooth
            12 0 DO
                    500 290 23 i - 150  p-go
```



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df1:larrypieces/delicat.piece       28-Jan-87   09:52:24 am   Page#  2

        LOOP
;

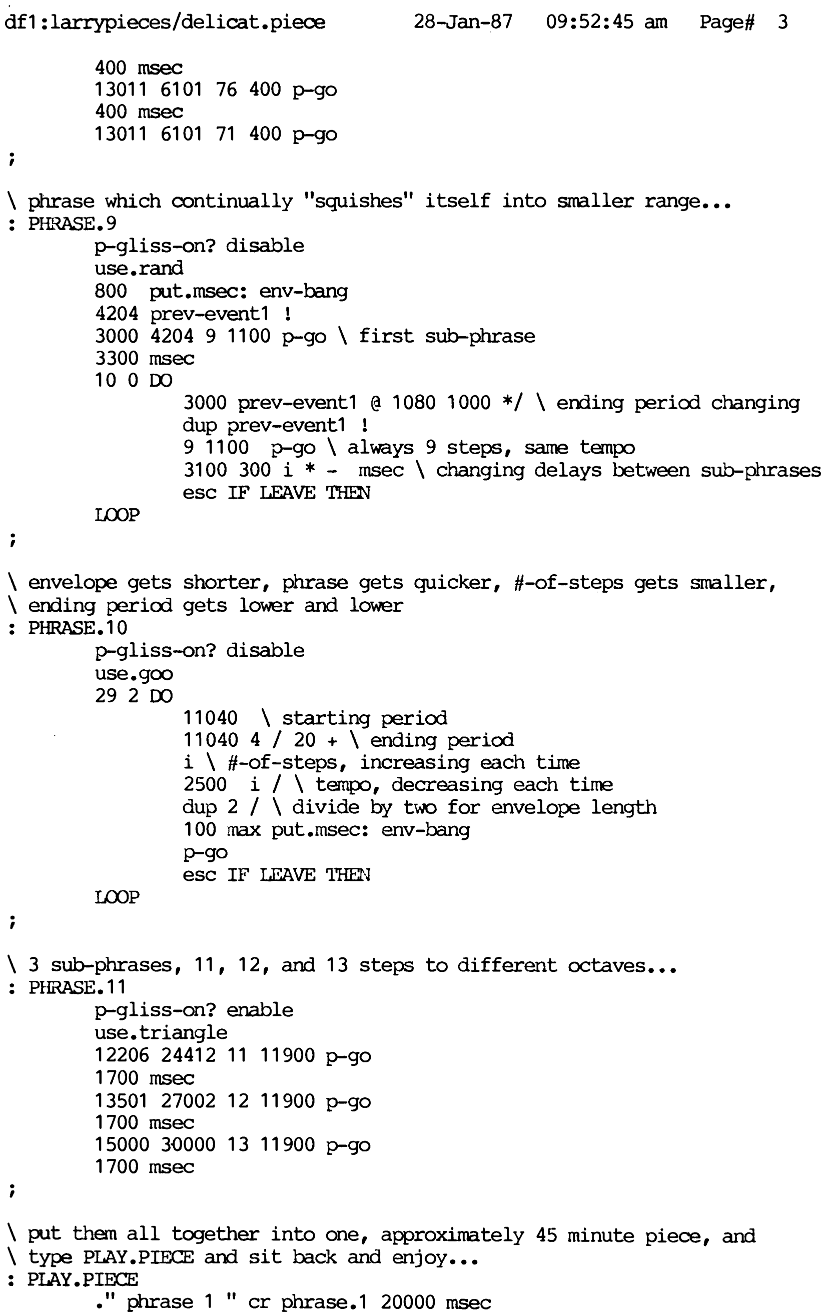
\ number of steps decreases slightly
: PHRASE.4
        use.triangle
        p-gliss-on? disable
        2900  put.msec: env-bang
        4 0 DO
                9405 6544  44 i - 3200  p-go
                esc IF LEAVE THEN
        LOOP
;

\ fast descending, getting slower and slower
: PHRASE.5
        p-gliss-on? disable
        use.goo
        60 put.msec: env-bang
        80  prev-event1 !
        400 799 29 80 p-go
        6 0 DO
                400 799 29 prev-event1 @ 12 11
                */
                dup prev-event1 ! p-go
                esc IF LEAVE THEN
        loop
;

\ successively smaller subdivisions
: PHRASE.6
        p-gliss-on? disable
        use.rand
        100 put.msec: env-bang
        11 0 DO
                940   703 31 i + 470 p-go
                esc IF LEAVE THEN
        LOOP
;

\ downward glissandi
: PHRASE.7
        use.triangle
        p-gliss-on? enable
        16 0 DO
                122 1156  19  i - 50 p-go
                esc  IF LEAVE THEN
        LOOP
;

\ three phrases, 80, 76, and 71 steps respectively
: PHRASE.8
        p-gliss-on? disable
        use.sawtooth
        120  put.msec: env-bang
        13011 6101 80 400 p-go
```



```
df1:larrypieces/delicat.piece       28-Jan-87   09:52:45 am   Page#  3

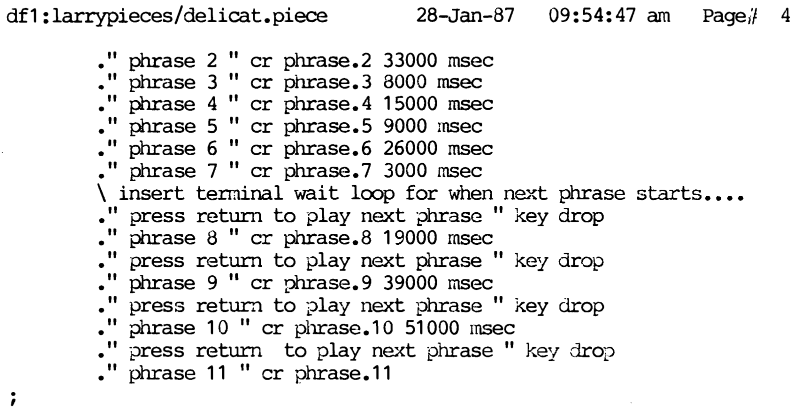
        400 msec
        13011 6101 76 400 p-go
        400 msec
        13011 6101 71 400 p-go
;

\ phrase which continually "squishes" itself into smaller range...
: PHRASE.9
        p-gliss-on? disable
        use.rand
        800  put.msec: env-bang
        4204 prev-event1 !
        3000 4204 9 1100 p-go \ first sub-phrase
        3300 msec
        10 0 DO
                3000 prev-event1 @ 1080 1000 */ \ ending period changing
                dup prev-event1 !
                9 1100  p-go \ always 9 steps, same tempo
                3100 300 i * -  msec \ changing delays between sub-phrases
                esc IF LEAVE THEN
        LOOP
;

\ envelope gets shorter, phrase gets quicker, #-of-steps gets smaller,
\ ending period gets lower and lower
: PHRASE.10
        p-gliss-on? disable
        use.goo
        29 2 DO
                11040  \ starting period
                11040 4 / 20 + \ ending period
                i \ #-of-steps, increasing each time
                2500  i / \ tempo, decreasing each time
                dup 2 / \ divide by two for envelope length
                100 max put.msec: env-bang
                p-go
                esc IF LEAVE THEN
        LOOP
;

\ 3 sub-phrases, 11, 12, and 13 steps to different octaves...
: PHRASE.11
        p-gliss-on? enable
        use.triangle
        12206 24412 11 11900 p-go
        1700 msec
        13501 27002 12 11900 p-go
        1700 msec
        15000 30000 13 11900 p-go
        1700 msec
;

\ put them all together into one, approximately 45 minute piece, and
\ type PLAY.PIECE and sit back and enjoy...
: PLAY.PIECE
        ." phrase 1 " cr phrase.1 20000 msec
```



```
df1:larrypieces/delicat.piece        28-Jan-87   09:54:47 am   Page# 4

        ." phrase 2 " cr phrase.2 33000 msec
        ." phrase 3 " cr phrase.3 8000 msec
        ." phrase 4 " cr phrase.4 15000 msec
        ." phrase 5 " cr phrase.5 9000 msec
        ." phrase 6 " cr phrase.6 26000 msec
        ." phrase 7 " cr phrase.7 3000 msec
        \ insert terminal wait loop for when next phrase starts....
        ." press return to play next phrase " key drop
        ." phrase 8 " cr phrase.8 19000 msec
        ." press return to play next phrase " key drop
        ." phrase 9 " cr phrase.9 39000 msec
        ." press return to play next phrase " key drop
        ." phrase 10 " cr phrase.10 51000 msec
        ." press return  to play next phrase " key drop
        ." phrase 11 " cr phrase.11
;
```