CURRENT RESEARCH IN SOCIAL PSYCHOLOGY

A PROGRAM FOR CALCULATING P(S) IN COMPLEX, ASYMMETRIC STATUS STRUCTURES

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INTRODUCTION

Status characteristic theory (Berger, Cohen, and Zelditch 1972; Berger, Fisek, Norman, and Zelditch 1977) offers the most comprehensive understanding of status generalization processes available. The theory and its related program of research are widely recognized for its logical structure, scope-restricted arguments, graphic interpretation, and confirmation status. The theory describes how members of task groups use information about the status-value of characteristics they possess to form performance expectations for themselves and their co-actors. In turn, performance expectations influence a host of behaviors including the likelihood of accepting or rejecting influence.

Empirical research supports many predictions of status characteristic theory (Ridgeway and Walker 1995; Berger and Zelditch 1998). In the standardized status characteristic setting, laboratory subjects work collectively at a task which presents them with ambiguous choices. The first phase of such studies requires coacting partners to choose an optimal task solution and transmit their initial opinions electronically. Under pressure to coordinate answers with their partner (the collective element of the situation), actors may either stay with their initial opinion or defer to their partner during the second phase. Experimenters control experimentally the relative status of subjects and their co-actors, and the number of disagreements. Under conditions of disagreement, status characteristic theory implies that high-status actors are more influential than those with low-status. That is, the theory predicts that high-status actors stay with their initial opinions more often than their low-status partners. Researchers calculate probability of stay/self-response values, P(S), as the most common measure of acceptance or rejection of influence.

Status characteristic theorists introduced a graph-theoretic representation of the theory more than two decades ago (Berger et al. 1977). The graph-theoretic formulation offered, for the first time,

a method for predicting P(S) values from examination of graphic representations of initial status structures. Since then, Balkwell (1991) and Fisek and his colleagues (Fisek, Berger, and Norman (1991, 1995; and Fisek, Norman, Nelson-Kilger 1992) have introduced alternate methods for calculating P(S) values. Calculating P(S) is a laborious task. Recent formulations that permit variable path lengths (i.e., paths whose lengths are not whole numbers) only add to the difficulty (Fisek et al. 1995). Until recently, status characteristic researchers used cumbersome techniques to calculate P(S) (e.g., with hand calculators, elaborate spreadsheets, or makeshift computer programs).

Whitmeyer (1998) developed a computer program that calculates P(S) values. Apart from reducing the difficulty of making such calculations, Whitmeyer's program offers status characteristic researchers side-by-side comparisons of estimates for the three most common methods for calculating P(S). While it offers a significant advance, the program is limited to symmetric status structures. Below, I modify and extend Whitmeyer's program to calculate P(S) values for *asymmetric* structures.

STATUS CHARACTERISTICS AND ASYMMETRIC STRUCTURES

The graph-theoretic formulation of status characteristic theory (Berger et al. 1977) opened the door to the analysis of complex symmetric and asymmetric status structures. Figure 1 is an asymmetric structure described by Berger et al. (1977:120). Figure 1 describes a status situation in which P and O are differentiated on two specific characteristics, C_1 and C_2. P alone possesses a salient state of a third characteristic, C_3. To simplify presentation, Figure 1 includes negative signs only (i.e., for dimensionality relations that join opposite states of characteristics). All unsigned path segments carry positive valences.

The completed status structure shows that four positive paths and one negative path connect P to task outcome states. Positive paths include one of length 4, two of length 5, and one of length 6. The negative path is a five-path. Four negative paths, one of length 4, two of length 5, and one of length 6, and one positive path of length 6 connect O to task outcome states. The structure is complex and asymmetric.
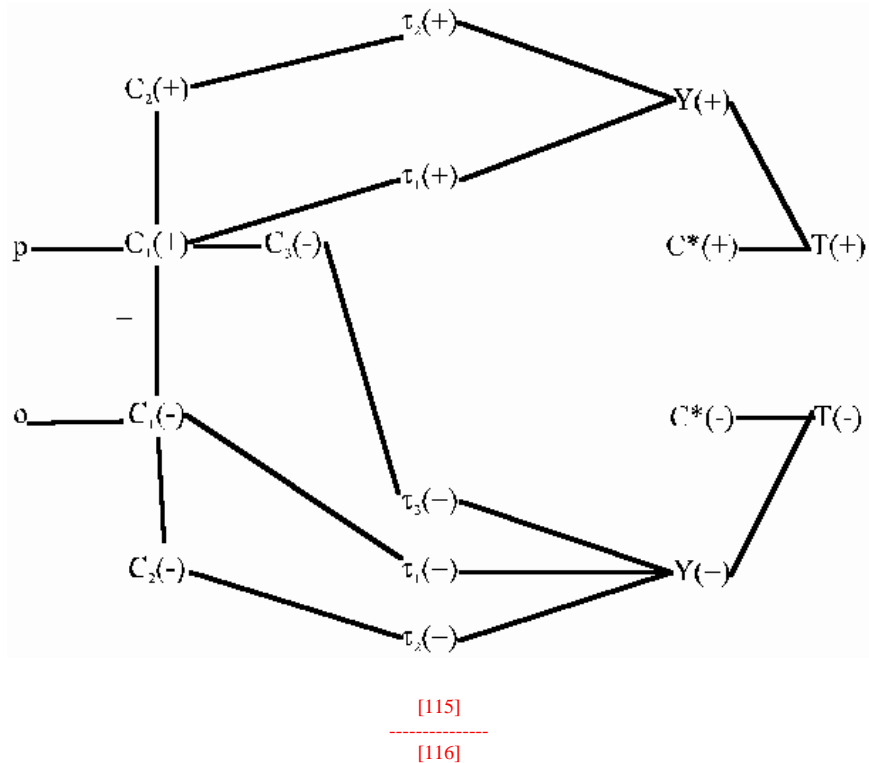
CALCULATING P(S) FOR ASYMMETRIC STRUCTURES

I offer a simple revision of Whitmeyer's program for calculating P(S) values. My revision asks analysts to enter path lengths for both P and O, calculates expectations for both, and then calculates P(S) values. As does the original program, the new program gives predictions for the original linear model (Berger et al. 1977), Balkwell's (1991) modification of the linear model, and the exponential model developed by Fisek et al. (1992). The program structure uses routines similar to Whitmeyer (1998) to permit line-by-line comparison. It requests values for the standard parameters m and q, calculates to seven decimal places, and is in every respect compatible with the earlier program. I provide program code in the appendix.

I reproduce elements of a typical program run for the status structure shown in Figure 1. The example sets m = .66 and q = .1.

Figure 1.

```
m? .66q? .1Path length for P? 4Path length for P? 5
Path length for P? 5
Path length for P? 6
Path length for P? -5
Path length for P? 0
Path length for O? -4
Path length for O? -5
```

```
Path length for O? -5
Path length for O? -6
Path length for O? 6
Path length for O? 0
Fisek exponential:
    e(p) is .1889892
    e(o) is -.2221326
    P(S)p is .7011122
    P(S)o is .6188878
BFNZ polynomial:
    e(p) is .229607e(o) is -.2710155
    P(S)p is .7100623
    P(O)o is .6099378
BFNZ polynomial, Balkwell coeffs.:
    e(p) is .1952574
    e(o) is -.2291653
    P(S)p is .7024423
    P(S)o is .6175578
more? n
```

Program output reflects the asymmetrical structure. Values for e(p) and e(o) differ in magnitude and sign. I end by echoing Whitmeyer's (1998) dream of a graphical program that would calculate P(S) versions directly from graphic representations of status structures. Until then, the current modification of Whitmeyer's program permits calculation of P(S) values for complex symmetric and asymmetric structures.

APPENDIX

QuickBASIC (.BAS) file for revision of Whitmeyer's Expectation Advantage Program

```
REM This program revises Whitmeyer's program for computing p(s).
REM It computes p(s) for paths of given lengths. It uses three
REM methods to compute f(i) for path-lengths. One is Fisek's exponential
REM function; one is the polynomial function from Berger, Fisek
REM Norman, and Zelditch (1977: ch. 5) with user-input values, and
REM one uses Balkwell's (1991 Advances) values for k and f(7).
REM Unlike Whitmeyer's program, this one computes separate expectations for
REM P and O. Consequently, the program can accommodate asymmetric status
REM structures.
PRINT
PRINT "Three different models for f(i) (Fisek, BFNZ, Balkwell)."
PRINT
f4 = .1768: k = 3
REM PRINT "For BFNZ, to calculate f(i), give f(4) (usually 0.1768)"; : INPUT
f4
REM PRINT " ... and k (usually 3)"; : INPUT k
xk = 3.191636: f7 = .005
PRINT : PRINT "Put path length of 0 when done.": PRINT
PRINT "m"; : INPUT m
PRINT "q"; : INPUT q
REM This first routine calculates P's expectations.
```

```
50     alefta = 1: blefta = 1
       aleftb = 1: bleftb = 1
       aleftc = 1: bleftc = 1
       p = 0: np = 0
```

```
DO
PRINT "Path length for P"; : INPUT i
       IF i < 0 THEN
         j = -i
         fa = 1 - EXP(-2.618 ^ (2 - j))
         xp1 = k ^ (4 - j)
         fb = 1 - (1 - f4) ^ xp1
         xp = xk ^ (7 - j)
         fc = 1 - (1 - f7) ^ xp
         np = 1
         alefta = alefta * (1 - fa)
         aleftb = aleftb * (1 - fb)
         aleftc = aleftc * (1 - fc)
       ELSEIF i > 0 THEN
         xp1 = k ^ (4 - i)
         fa = 1 - EXP(-2.618 ^ (2 - i))
         fb = 1 - (1 - f4) ^ xp1
         xp = xk ^ (7 - i)
         fc = 1 - (1 - f7) ^ xp
         p = 1
         blefta = blefta * (1 - fa)
         bleftb = bleftb * (1 - fb)
         bleftc = bleftc * (1 - fc)
       END IF
       LOOP UNTIL i = 0
REM The next routine calculates O's expectations.
       dleftd = 1: eleftd = 1
       dlefte = 1: elefte = 1
       dleftf = 1: eleftf = 1
       o = 0: no = 0
```

```
DO
PRINT "Path length for O"; : INPUT i
       IF i < 0 THEN
         j = -i
         fd = 1 - EXP(-2.618 ^ (2 - j))
         xp1 = k ^ (4 - j)
         fe = 1 - (1 - f4) ^ xp1
         xp = xk ^ (7 - j)
         ff = 1 - (1 - f7) ^ xp
         no = 1
         dleftd = dleftd * (1 - fd)
         dlefte = dlefte * (1 - fe)
         dleftf = dleftf * (1 - ff)
```

```
    ELSEIF i > 0 THEN
      xp1 = k ^ (4 - i)
      fd = 1 - EXP(-2.618 ^ (2 - i))
      fe = 1 - (1 - f4) ^ xp1
      xp = xk ^ (7 - i)
      ff = 1 - (1 - f7) ^ xp
      o = 1
      eleftd = eleftd * (1 - fd)
      elefte = elefte * (1 - fe)
      eleftf = eleftf * (1 - ff)
    END IF
    LOOP UNTIL i = 0
```

```
REM This last routine calculates P(S) and prints e(p), e(o) and P(S)s.
PRINT "Fisek exponential:"
        ep = (1 - blefta) * p - (1 - alefta) * np
        eo = (1 - eleftd) * o - (1 - dleftd) * no
        PRINT " e(p) is "; ep
        PRINT " e(o) is "; eo
        spp = m + q * (ep - eo)
        spo = m + q * (eo - ep)
        PRINT " P(S)p is "; spp
        PRINT " P(S)o is "; spo
        ep = (1 - bleftb) * p - (1 - aleftb) * np
        eo = (1 - elefte) * o - (1 - dlefte) * no
        PRINT : PRINT "BFNZ polynomial:"
        PRINT " e(p) is "; ep
        PRINT " e(o) is "; eo
        spp = m + q * (ep - eo)
        spo = m + q * (eo - ep)
        PRINT " P(S)p is "; spp
        PRINT " P(S)o is "; spo
        ep = (1 - bleftc) * p - (1 - aleftc) * np
        eo = (1 - eleftf) * o - (1 - dleftf) * no
        PRINT : PRINT "BFNZ polynomial, Balkwell coeffs.:"
        PRINT " e(p) is "; ep
        PRINT " e(o) is "; eo
        spp = m + q * (ep - eo)
        spo = m + q * (eo - ep)
        PRINT " P(S)p is "; spp
        PRINT " P(S)o is "; spo
        PRINT : PRINT "more"; : INPUT a$
        IF a$ = "y" GOTO 50
        IF a$ <> "y" THEN STOP
```

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