ATTITUDE FORMATION AS A FUNCTION OF INFORMATION THROUGH TIME*

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We are concerned with the history of a specific attitude (such as hostility) as it determines an individual's social interaction. The social response of one individual to another, or to a group, may depend on the readings which the individual has from various indicators reflecting the attitudes of others. Social response may also be a function of how these readings are retained.

This paper will attempt mathematical models (suggested by Milton Friedman's economic model for expected income)*** to describe the genesis of an emotional attitude, through time, as the subject is exposed to varying amounts of information. The models will be deterministic and stochastic. ****

May one predict, for example, what part (or proportion) of felt hostility will be expressed by an individual in units of time? In a day, week, or month, the environment moves attitudes in each of us. Hostility adds in units of time. Also, engendered hostility is reduced (forgotten, decays) in symbolic and overt individual responses in these same units of time.

This submission is in two parts; Model One suggests that current measurement of an attitude is most influenced by the bits of information historically closest to the measure.

Model Two suggests formulas for following and predicting attitude development.

Model One

Let us assume what appears logical: an attitude is most influenced by its most recent experiences.

Let H be hostility experiences in any time interval. H in one interval is equal to H in any other time interval.

We call the present time point of measurement T. The unit of time, of which T is the end point, is called t. t-1 precedes t.

Let i be a t period influenced by H. $i = 1, 2, 3 \ldots n$, such that, $i \leq n$.

Let the proportion of H retained or forgotten in the i th interval, after the t interval in which it occurred, be Pi.

There are numerous possible t period combinations and their associated Pi proportions (or ratios). The mean, M, of these possible combinations is:

$$M = \sum_{i=1}^{n} P_i \, i \qquad \text{(a)}$$

Let the values of H, measured at T, be V_T, so that:

$$V_T = H_t(1) + H_{t-1}(1 - P_1) + H_{t-2}(1 - P_1 - P_2) + \ldots + H_{t-n+1}(Pn) \qquad \text{(b)}$$

V_T is the historical influence of Pi proportions up to the present moment, T. We note in formula (b) (if H_t (1) represents 100% of hostility feeling at time T) that each succeeding Pi unit subtracts larger and larger amounts from $H_t(1)$, therefore, remoter time units carry less and less weight.

Note that (a) and (b) are deterministic formulas. The H influence is not random and H is constant over time with zero variance between periods. Pi represents constant proportions through time so that, if P_1 is 50%, then 50% of H decays in the period immediately before the interval in which H_t was made.

Psychology, with its usual nominal and ordinal measuring scales, would appear unfit territory for deterministic approaches. Later we shall deal with a stochastic theory.

Since, by assumption, $H_t = H_{t-1} = H_{t-n}$, from (b) we find:

$$V_T = H\left[1 + (1 - P_1) + (1 - P_1 - P_2) + \ldots + Pn\right] \qquad \text{(c)}$$

and

$$V_T = H\left[(P_1 + P_2 + P_3 + \ldots + Pn) + (P_2 + P_3 + \ldots + Pn) + (P_{n-1} + Pn) + Pn\right] \qquad \text{(d)}$$

Pn is in n expressions and Pn-1 is in n-1 expressions, therefore:

$$V_T = H\left[1\,P_1 + 2P_2 + 3P_3 + \ldots + n\,Pn\right] \qquad \text{(e)}$$

and from (a):

$$V_T = H\left(\sum_{i=1}^{n} P_i \, i\right) = HM \qquad \text{(f)}$$

The memory schedule for hostility, H, refers to the proportions of H in the various categories. The proportions of H in one t period over V_T is:

$$H_t(1) / HM \qquad \text{(g)}$$

$$H_{t-1}(1 - P_1) / HM \qquad \text{(h)}$$

$$H_{t-2}(1 - P_1 - P_2) / HM \qquad \text{(i)}$$

. . . . . .

$$H_{t-n} + 1\,(Pn) / HM \qquad (j)$$

Since H is constant, we may cancell and add:

$$(P_1 + P_2 + P_3 + \ldots + Pn) / M \qquad (k)$$

$$(P_2 + P_3 + \ldots + Pn) / M \qquad (1)$$

$$(P_3 + \ldots + Pn) / M \qquad (m)$$

$$(Pn) / M \qquad (n)$$

In the addition of each numerator of formulas (k) through (n) we have the proportion of remembered hostility from various time periods, which is what remains after forgetting. Apparently, we may achieve as many different estimates of hostility summations as there are Pi retention terms. Recall that each i category in the retention schedule (between the parenthesis signs, above) represents Pi's which are first responding to the influences of an earlier H time interval. Pi is that proportion of total hostility which is still felt, or forgotten, in one unit of time.

For example:

1. Assume each new, different, hostility experience to be totally felt (equals 100%).
2. Assume each t time period to possess its own new, 100% hostility (H).
3. Assume H is forgotten at the following rate:

   $t - 1 = 50\% = P_1$

   $t - 2 = 30\% = P_2$

   $t - 3 = 20\% = P_3$ then,

t	H	t-1	t-2	t-3	Sum of t-1 t-2 t-3	V_T
1	100					100
2	100	50			50	150
3	100	50	30		80	170
4	100	50	30	20	100	170
5	100	50	30	20	100	170
6	100	50	30	20	100	170

Starting at level t_3, we note the vertical V_T column is the same number, 170, as those below it. We suggest that the normal human animal eventually reaches some level of healthy hostility control. A level where incoming conscious hostile experiences balances those forgotten.

$P_1 + P_2 + P_3$ (in t_3 above) estimates the distribution of hostility for single time periods:

$$(0.5)(1) + (0.3)(2) + (0.2)(3) = 1.7$$

The illustration assumes new hostility to every i period. Skipped, or infrequent H, suggests that residue hostility may completely decay.

Evidently the younger memory categories (t-1 is the most recent; t - n + 1, the oldest are weighthier through time relative to older memories. This should indicate that our immediate hostile experiences are more potent to retention than older ones.

In all the above work we have assumed determinism, stability, and constancy of i, H, t, and Pi. Psychology, however, is a science of random variables. What is control and prediction in it is correlation and values varying within and v 'thout significance levels. Once we accumulate sufficient information on past V_T values and assume normality, we may then set variance limits about the mean.

We assume, briefly, one stochastic approach as follows: Let H be a random variable in one t period of varying size. Suppose we have only two possibilities for i, one and two, i.e., hostility decays after one period or after two.

Assume, also, that the proportion decaying after one can be either 0.4 or 0.6 with a probability of one-half for each. Hostility which does not decay after one must, in this pretense, decay after two. Also, for 2, there is a 0.5 probability that 60% will be forgotten after two periods and 0.5 that 40% will decay after two periods.

Given the above, the mean hostility period equals:

$$0.5\,[1\,(0.4) + 2\,(0.6)] + 0.5\,[1\,(0.6) + 2\,(0.4)] = \qquad (o)$$

$$1\,[0.5\,(0.4) + 0.5\,(0.6)\quad + 2\,[0.5\,(0.6) + 0.5\,(0.4)] = \qquad (p)$$

$$1\,(0.5) + 2\,(0.5) = 1.5 \qquad (q)$$

(o) computes the mean, using the previous assumptions, as follows: There are two probability distributions, each having one-half weight (probability) in the total. In the first distribution, 40% of felt hostility is forgotten after one period, 60% after two periods. For the second distribution, 60% decays after one period, 40% after two. The two combined distributions terminate in (q); (q) demonstrates 50% retention after one period and 50% retention after two.

Sigmund Freud's approach (early childhood experiences are vital to personality development), and the current Harvard University studies on the first three years of life (Drs. Burton White and Jerome Bruner), appears against our hypothesis that the most recent attitude experiences are the most influential. Future investigations might pursue this: techniques or mechanisms for handling attitudes are formed as a function of our earliest experiences. When and how these mechanisms are called in to use is a function of our most recent experiences.

Model Two

Let us assume a person has a psychiatrically approved(normal, healthy, adjusted) optimal way of handling hostile feelings. He may then behave non-optimally in two extreme forms: rigid and repressed on one hand, violently anti-social on the other. It is an obvious convenience for psychologists to be able to trace and predict future deviant behavior. Numerous instruments describe personality at the time of measurement. Model Two proposes an ongoing series of correlated personality tests, administered at stated intervals, sufficient to indicate a trend. It may also proclaim, to therapist and counselor, which single time unit is noteworthy in abnormal behavior.

The following is untested theory:

1. The ratio of overtly expressed hostility provides a personality measure of hostility equilibrium, or control, in a unit of time t.

$$m = H_1 / H_2 \qquad (r)$$

where, m = proper handling of hostility in one unit
H_1 = overt expression
H_2 = memory hostility

2. The ratio of expressed hostility (H_1), to present hostile external stimuli (H_{22}), is also a measure of personality control in one unit of time t.

$$m = H_1 / H_{22}$$

3. Therefore, $m = H_1 / H_2 + H_{22}$ (s)
4. The aging schedule, M, or what happens to hostility through time, may be an effective way of currently handling and predicting personality deviations.
5. The mean average of $H_2 + H_{22}$, in many time periods, is a predicting measure of H_1 in one period for normal individuals.
6. Let R_2 equal $H_2 + H_{22}$ in any time interval. Let R_2 in one interval be equal to R_2 in any other interval.
7. One time period may be a day, week, month, etc.
8. Let m (number 3, above) in the i th. interval be Pi. Pn indicates m through n periods. There are, theoretically, unlimited combinations of Pi patterns starting and interacting in different t periods.
9. The mean, M, of all Pi periods is:

$$M = \sum_{i=1}^{n} P_i\, i \qquad (t)$$

10. Finally, let the total value of H_1 at time T be V_T.

The above purports to be a deterministic model where the exogenous variables are not random. R_2 is constant and equal in different t's with variance zero. Pi is a constant proportion in different intervals, not a probability. In equilibrium, R_2 for t equals R_2 for t + 1, t + 2, etc.; also, Pi at t equals Pi at t + 1, etc.

$$V_T = R_{2t}(P_1) + R_{2t+1}(P_2) + R_{2t+2}(P_3) + \ldots + R_{2t-n+1}(Pn) \qquad (u)$$

The first term to the right of the equal sign signifies R_2 for period t, part or all of which may transform into H_1. The second term includes residue from P_1 in P_2, plus new R_2 for period t + 1. The third term includes residue from $P_1 + P_2$ plus new R_2 for period $t + 2$, and so on.

Since, by assumption, $R_{2t} = R_2 t + 1$, expression (u) is rewritten as:

$$V_T = R_2 \left[(P_1 + P_2 + P_3 + \ldots . + Pn - 1 + Pn)\right] \quad (v)$$

Because Pn is equal in n expressions, V_T is rewritten:

$$V_T = R_2 (1P_1 + 2P_2 + 3P_3 + \ldots . + nPn) \quad (w)$$

Substituting formula (u) in (x):

$$V_T = R_2 \left(\sum_{i=1}^{n} P_i \, i \right) = R_2 M \quad (x)$$

and

$$M = V_T / R_2 \quad (y)$$

and

$$R_2 = V_T / M \quad (z)$$

Equation (x) proposes that hostile expression, H_1, is a function of past retention.

Equation (y) suggests that, in equilibrium, an effective control of hostility depends upon the reduction of R_2 tension through time.

Formula (z) indicates that average, over-all hostility, may demonstrate the effectiveness of adjustment in a single time unit.

We suggest the Minnesota Multiphasic Personality Inventory (adapted) as an instrument for Model Two measurement in single time periods: One of the secondary scales, hostility (Ho).

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*** Milton Friedman, A Theory of the Consumption Function, Princeton University Press, Princeton, 1957, Chapter 3.

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