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Ratio versus Frequency Scores: Focus of Attention and the Balance Between Positive and Negative Thoughts[1]

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Numerous conceptual and statistical difficulties complicate the use of raw thought frequencies in cognitive assessment. To overcome such problems, investigators have used a variety of ratio scores; however, these are not easily comparable across studies and their use evokes a variety of associated difficulties. Therefore, the present investigation compared results using raw frequencies and a variety of ratio scores on a cognitive assessment task where both the valence and the focus of attention of thoughts were examined. Scores evaluated included a positive/negative ratio as well as Schwartz's States of Mind (SOM) ratio [positive/(positive + negative)] with and without correction of zero frequencies of either positive or negative thoughts. Results indicate that (a) partitioning thoughts as a function of attentional focus (self, other, situation-focused thoughts) yield different frequencies and ratios for each thought type, (b) positive and negative thoughts are independent, (c) although different ratios and correlations are appropriate, depending on the nature of the assessment task, results using the SOM ratio with a correction factor most closely resemble results obtained when using frequencies, (d) when a positive/negative ratio is used, a correction factor and a log transformation reduce the effects of missing data and of positive skewness, and (e) the mean of subjects' SOM ratios and the ratio of subjects' mean frequencies yield similar results.

KEY WORDS: cognitive assessment; positive and negative thoughts; ratios; SOM scores; states of mind model.

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Recent investigations in the assessment of thoughts have demonstrated that asymmetry exists between the frequencies of positive and negative thoughts, with positive thoughts outnumbering negative ones in most circumstances (Ingram & Kendall, 1987; Schwartz & Garamoni, 1986a, 1986b). Studies have shown that positive and negative thoughts are independent dimensions (e.g., Amsel & Fichten, 1988; Heimberg, Keller, & Peca-Baker, 1986; Myszka, Galassi, & Ware, 1986), with negative thoughts often showing a greater effect on functioning. The prevalence of this type of finding has prompted Kendall and his colleagues (e.g., Kendall & Hollon, 1981; Kendall, 1984) to discuss the "power of non-negative thinking." Although most of the research evidence does, indeed, suggest that negative thoughts are particularly important in influencing cognitions, affect, and behavior, a number of studies have shown that positive thoughts are particularly influential (e.g., Fichten, 1986, Heimberg, Acerra, & Holstein, 1985; Hollandsworth, Glazeski, Kirkland, Jones, & VanNorman, 1979). Recently, it has been proposed that positive and negative thoughts may serve different functions in mediating cognitions, affect, and behavior (Fichten, Tagalakis, & Amsel, in press; Ingram & Wisnicki, 1988; Kendall & Ingram, 1987).

Because of these conceptual considerations, a number of researchers have suggested (e.g., Acton & Cameron, 1985; Amsel & Fichten, 1988; Hope, Heimberg, Zollo, Nyman, & O'Brien, 1987; Marchione, Michelson, Greenwald, & Dancu, 1987; Myszka *et al.*, 1986), most notably Robert Schwartz and his colleagues (Schwartz, 1986; Schwartz & Garamoni, 1986a, 1986b, 1989; Schwartz & Michelson, 1987), that different ratios of positive and negative thoughts characterize functional and dysfuntional thinking about events. Not only may ratios constitute more meaningful units of analysis than frequency scores, but ratios may also simplify statistical operations. For example, ratios would simplify complex ANOVA designs, the use of both positive and negative thoghts in regression analyses and correlations, as well as the problem of large individual differences in total thought frequency in correlational analyses. Furthermore, ratios would allow for easier comparison of questionnaire and open-ended measures of thoughts (cf. Clark, 1988; Fichten, Amsel, & Robillard, 1988) and data in other cases where it is necessary to evaluate widely different thought frequencies.

Schwartz and his colleagues have convincingly demonstrated that their States of Mind (SOM) thought ratio [positive/(positive + negative)] discriminates adaptive and maladaptive thinking. However, the SOM ratio has generally been used only as a proportion of mean frequencies (i.e., ratio of means). Its suitability for designs that use individual subjects' scores (i.e., mean of ratios) has, to date, been demonstrated by only a few investigations (e.g., Kendall, Howard, & Hays, 1989; Schwartz & Michelson, 1987).

PROBLEMS IN USING RATIOS FOR INDIVIDUAL SUBJECTS

There are a number of difficulties in adapting the SOM to individual subjects, particularly the issue of how to assign a meaningful score when a subject has either no positive or no negative thoughts. Although the frequencies of both positive and negative thoughts have been shown to be related to relevant criterion variables (e.g., Fichten *et al.*, 1988; Galassi, Frierson, & Sharer, 1981a, 1981b; Missel & Sommer, 1983; Schwartz & Gottman, 1976), the ratio score assumes a value of either 0 or 1 if the frequency of positive or negative thoughts is 0, regardless of the frequency of opposite-valenced thoughts. For example, if a subject has 0 positive and 1 negative thought, the SOM ratio would equal 0. But the ratio would also equal 0 if a subject had no positive and 5 negative thoughts. Thus, the ratio would equal 0 if the subject indicates a single negative thought, such as "I feel uncomfortable." However, the ratio would also equal 0 if the subject had the following thoughts: "I feel uncomfortable. How can I get out of this? What a fool I am to get into such a situation. I'll probably botch the whole thing. I just don't know what to do." Because the frequency of negative thoughts is strongly related to maladaptive functioning, the ratio should reflect the number of negative thoughts.

Similarly, if a subject has no negative thoughts, regardless of the number of positive ones, the ratio equals 1. Since the number of positive thoughts is also a powerful predictor of adaptive thinking and positive affect, the ratio should reflect the number of positive thoughts. Yet it does not do so.

If one examines other types of ratios, for example, the simple positive/negative or negative/positive ratio (cf. Amsel & Fichten, 1988; Hope et al., 1987), yet another difficulty emerges. Because division by 0 is not possible, if the frequency in the denominator of the ratio is 0, the subject's score would usually be considered missing. This not only reduces sample size but does so in a nonrandom fashion by eliminating those subjects whose thoughts are exclusively of one valence. For example, if a positive/negative ratio score is used, subjects with only positive thoughts would be considered missing.

These problems are particularly common when there are low thought frequencies. This is likely in situations that involve categorizing thoughts beyond the positive/negative dichotomy, such as focus of attention groupings (e.g., self, other, situation-focused), a factor that has been receiving increasing interest in the literature (Amsel & Fichten, 1988; Fichten, 1986; Fichten & Amsel, 1988; Hope et al., 1987). An obvious solution to the problem is to apply a correction factor. Therefore, the goal of the present investigation was to explore different ratios of positive and negative thoughts, with and

without a variety of correction factors, and to compare the findings using both raw frequencies and the various ratio scores.

METHOD

Overview

College students participating in a larger investigation completed measures that assessed attitudes, thoughts, and feelings concerning interaction with disabled peers. Subjects were divided into two groups on the basis of level of ease with disabled persons, and their scores were compared. Dependent measures included attitudes, self-efficacy expectations, comfort ratings, and the following thought frequencies: curiosity and negative and positive self, other, and situation-focused thoughts.

Types of Ratios. To explore the utility of different proportions, Schwartz's SOM and positive/negative ratios were calculated for each subject; separate ratios were computed for self, other, and situation-focused thoughts. Because other-focused thoughts have been shown to be particularly important when interaction with a negatively valued group is evaluated (cf. Amsel & Fichten, 1988; Fichten, 1986; Fichten & Amsel, 1988; Fichten et al., 1988), we also computed the following thought ratios: self-focused positive/other-focused negative and other-focused positive/self-focused negative.

Correction Factors. We calculated both uncorrected ratios and corrected ratios where 0s were replaced with a small arbitrary constant. The addition of a small positive constant such as 0.5 or 1.0 is commonly used when x approaches zero in the application of many nonlinear transformations such as log (x) or square root of x (Ferguson, 1986); this correction is generally applied equally across the entire set of data. We applied corrections of 0.1, 0.5, or 1.0 if *one* of the two valenced thought frequencies equaled 0. The correction was not applied when *both* positive and negative thought frequencies equaled 0 because this would have resulted in spurious SOM values of 0.5 and meaningless $+/-$ values of 1.0.

The purpose of our correction was replacement of the small number of ratios rendered undefined or undifferentiated by the lack of thoughts of one valence. Since the smallest unit of observation was a single thought, it was decided that a correction factor less than or equal to 1 would be appropriate. Also, we decided to apply the correction only to scores of 0 so as to change a minimun number of values. Therefore, correction factors of 0.1, 0.5, and 1.0 were applied. The effects of using various proportions and correction factors on sample sizes, on means and standard deviations, and, most important, on the nature of the resulting findings are illustrated in the present investigation.

Subjects

Subjects for the present investigation were 52 male and 72 female volunteer college students enrolled in four sections of general psychology; none had a physical disability. Subjects' mean age was 18. All subjects were participating in a larger investigation (Fichten et al., 1989).

Measures

General Information Form. This measure includes questions about sex, age, and previous contact with individuals with disabilities. Ease with students who use a wheelchair is assessed using 6-point scales (1 = very uncomfortable, 6 = very comfortable). Ease scores have been shown to have moderately high test-retest reliability (r = .73; Fichten et al., in press, and r values ranging from .58 to .92 in our current work in progress), and data show that Ease scores discriminate between interaction with disabled and with nondisabled peers and are logically related to relevant criterion variables (Amsel & Fichten, 1988; Fichten & Amsel, 1988).

Attitudes Toward Disabled Persons Scale (ATDP) - Form 0. This widely used standardized measure consists of 20 Likert-type items and assesses the degree to which people see the adjustment and needs of people with a physical disability as different from those of able-bodied individuals. Data provided by Yuker, Block, and Younng (1970) indicate good psychometric properties for the test. The single summary score is usually interpreted as a measure of acceptance-rejection of people with a physical disability (the higher, the more accepting).

Cognitive Role-Taking Tasks. This measure, fully described by Fichten (1986) and Fichten and Martos (1986), is used to collect thoughts and feelings. In the present investigation brief descriptions of four hypothetical interaction situations between able-bodied and wheelchair-user college students were provided. Subjects were asked to imagine that they were involved in each interaction and to list, in written form, the thoughts and feelings they experienced while imagining themselves in the situation. After listing their thoughts concerning an interaction, subjects indicated, on 10-point scales, how comfortable they would feel in the situation (Comfort Interacting Scale).

College Interaction Self-Efficacy Questionnaire (CISEQ-W). This 40-item measure evaluates strength of self-efficacy expectations concerning interaction between same-sex able-bodied and wheelchair-user college students. Respondents indicate how comfortable they would be performing a variety of interaction behaviors (e.g., asking for a favor, initiating a conversation) on 6-point scales. For each behavior subjects feel they can do (i.e., score equal to or greater than 4 on the comfort question), they indicate how

confident they are of this (10 = very uncertain, 100 = certain). Confidence scores are summed and divided by 40 to yield the self-efficacy strength score. Data provided by Fichten, Bourdon, Amsel, and Fox (1987) indicate internal consistency coefficients that range from .94 to .99 and show that scores on the measure are significantly related to knowledge of apropriate behavior and to attitudes toward disabled persons.

Procedure

For the purposes of the larger investigation, after completing the General Information Form, subjects were presented two 5-minute audiotaped cognitive modeling interventions; each of these described a hypothetical interaction situation with a wheelchair-user peer and listed 26 thoughts. Subjects were instructed to imagine that they were involved in the interaction and to imagine that it was they who were having the thoughts modeled on the tape. All subjects were exposed to two audiotaped interventions where they heard modeled either exclusively positive thoughts, exclusively negative thoughts, positive thoughts that changed to negative ones ("giving up" sequence), or negative thoughts that changed to positive ones ("coping" sequence). After these activities, all subjects completed the following measures with reference to a wheelchair-user stimulus person: CISEQ-W, ATDP, and the Cognitive Role-Taking Tasks. Although the comfort ratings were always completed after the thought-listing portion of the Cognitive Role-Taking Tasks, there is no reason to assume that thought listing is reactive or that the order in which measures were completed influenced Comfort Interacting Scale scores (cf. Fichten et al., 1988).

Thoughts on the Cognitive Role-Taking Tasks were coded in accordance with a slightly modified version of the Fichten and Martos (1986) coding manual into Curiosity, Neutral, and 6 valenced categories: Positive or Negative and either Self-Focused, Other-Focused, or Situation-Focused. Thoughts were rated by a coder trained to a 71% thought-by-thought interrater agreement criterion (O'Leary & Kent, 1973). Interrater agreements between the coder and a second trained coder on four spot-checks of reliability (21 thought-listing protocols) ranged from 77 to 82%, with a mean of 79% [Kappa coeficient (Cohen, 1960) = .73].

RESULTS

Because there were no significant sex differences on any of the variables and because there were no significant differences among the four experimental conditions on any of the dependent measures, data from males and females and from the four experimental conditions were combined.

Comparisons Between High and Low Ease Groups

For the purposes of the larger investigation, subjects who where either comfortable or uncomfortable with wheelchair users were grouped into High Ease and Low Ease groups (based on the mean Ease with Wheelchair Users score), and their scores on all dependent measures were compared in a series of *t* tests.

Results detailed by Fichten et al. (in press) show that those who felt at ease with wheelchair users, compared with those who did not, differed significantly in the expected direction on self-efficacy beliefs concerning being able to interact comfortably (CISEQ-W), attitudes toward people with disabilities (ATDP), and on the comfort ratings on the thought-listing measure (Cognitive Role-Taking Tasks-Comfort Interacting Scale).

Of concern to the present investigation are the thought frequency and ratio scores of subjects in the Low and High Ease groups. Results of two-way ANOVA comparisons on thought frequencies [2 Ease (High/Low) × 2 Valence (Positive/Negative)] on Total, and on Self, Other, and Situation-Focused thoughts are presented in Table I.

Thought Frequencies: Findings. Results on thought frequencies indicate that significantly more Positive than Negative Self-Focused thoughts were listed. On Other-Focused thoughts the opposite was found. Because the frequencies of Self-Focused thoughts were much greater than those of Other-Focused thoughts, the results on Total thoughts also show significantly more Positive than Negative thoughts. There were no significant findings on Situation-Focused thoughts, possibly because few such thoughts were listed. Planned comparisons on the frequencies of Positive and of Negative thoughts in the two Ease conditions show significant differences on Negative thoughts in the Total, Self-Focused, and Other-Focused categories; there were no significant differences on Positive thoughts.

Of particular interest to the present investigation are the interactions of Ease and Valence. Detailed in Table I, these show significant differences in the expected direction on Total, Self-Focused, and Other-Focused thoughts (i.e., relatively more positive and fewer Negative thoughts in the High Ease than in Low Ease groups).

Ratios: Sample Sizes, Means, and Standards Deviations. Results from previous investigations (e.g., Fichten, 1986; Fichten et al., 1988) indicate that when thoughts concerning interaction are listed, Self-Focused thoughts are the most common, followed by Other-Focused thoughts. Thoughts about the Situation are rare. This trend is also evident in the present investigation.

These discrepancies in frequency have a major impact on ratio sample sizes, and, as the data on ratios in Table II show, they affected the uncorrected +/− ratios more extremely than the SOM ratios. Of course, because the incidence of 0 scores is lower for Totals, sample sizes for ratios on total scores were not as dramatically affected as were those for ratios of thoughts

Table I. Comparisons of Subjects Who Are High and Low in Ease with Wheelchair Users

	Low ease (N = 61)		High ease (N = 63)		Results $F(1, 122)$		
Variable: Means of frequencies	M	SD	M	SD	Ease	Valence	Interaction
Total thoughts (Cognitive Role-Taking Tasks)							
Total positive thoughts	3.69	2.64	4.16	3.02	2.02	10.54[b]	7.46[b]
Total negative thoughts	3.51	3.09	2.06	2.06			
Self-focused thoughts							
Positive	3.12	2.40	3.40	2.49	1.26	20.63[c]	3.98[a]
Negative	2.36	2.40	1.46	1.63			
Other-focused thoughts							
Positive	0.51	0.70	0.68	1.11	1.70	4.12[a]	8.47[b]
Negative	1.13	1.49	0.57	0.88			
Situation-focused thoughts							
Positive	0.07	0.31	0.08	0.27	0.25	0.11	0.00
Negative	0.02	0.13	0.03	0.18			

[a] $p < .05$.
[b] $p < .01$.
[c] $p < .001$.

in the different focus of attention categories. The small frequency of Situation-Focused thoughts (n = 4 and n = 7) prohibited further examination of these ratio scores.

The 0.1, 0.5, and 1.0 corrections did not affect sample sizes of SOM ratios because the denominator is always a positive integer (total frequency of valenced thoughts). Also, the corrections had only a minimal effect on means and standard deviations because the numerator could, at most, change from 0 to 1.0, and the denominator, which can be quite large, could increase by a maximum of 1.0. While not substantial, the effect of the corrections on SOM standard deviations was to make them smaller, thereby reducing the variability of scores and increasing the likelihood of finding significance.

While the corrections did have a favorable impact on the sample sizes of the +/− ratios (as well as on the ns of the Self+/Other− and of the Other+/Self− ratios), the same effect could have been achieved with any reasonable estimation of the missing values. However, the effect of the 0.1 correction on means and standard deviations was considerable; the distribution of scores became highly positively skewed, with means up to 10 times larger and standard deviations up to 15 times greater than on uncorrected ratios. This skewness occurred because it is more common for the negative than for the positive score to be missing. When the negative score is replaced by a small constant, the theoretical range of possible results has no ceiling, whereas it does have a lower bound close to 0.

When the frequencies of positive and negative thouhghts are very uneven, further improvement of both uncorrected and corrected +/− ratios would be expected with the application of a power transformation such as log (x) to achieve a more normal distribution and lower variance (Smith, 1976). Results in Table II demonstrate the effects of a log transformation on the corrected +/− ratios. It should be noted that while the transformation affected the 0.1 corrected scores most dramatically, improvement can also be seen in the ratios with correction factors of 0.5 and 1.0.

The distribution of the SOM ratio might also be seen as problematic; the distribution is truncated, with a floor of 0 and a ceiling of 1.0. The correction factors were applied in order to achieve different SOM scores depending on the frequency of the non-0 valenced thoughts (i.e., SOM scores of 0 and 1 would be eliminated). Because of the existence of a minimum and a maximum value, even the corrected scores are limited in reflecting extremely adaptive or maladaptive thinking. A data transformation such as 2 arcsine root (x) is often used to deal with this problem in the distribution of fractions (Kruskal, 1968). This transformation stretches the tails of the distribution, enhancing differences in the upper and lower quartiles. Table II shows that for this data set the results of an arcsine transformation were negligible.

Ratios: Findings. Given the significant Ease × Valence interactions on thought frequencies, one would expect parallel significant findings on the

Table II. Comparisons of High and Low Ease Groups' Ratio Scores[a]

Variable: Mean of ratios	Low ease			High ease			Results
	N	*M*	*SD*	*N*	*M*	*SD*	*t*
Overall ratios							
SOM [Tot + /(Tot + & Tot −)]							
Uncorrected	61	0.55	(0.31)	60	0.65	(0.27)	2.03[c]
0.1 Corrected	61	0.54	(0.30)	60	0.65	(0.26)	2.11[c]
0.5 Corrected	61	0.53	(0.27)	60	0.64	(0.23)	2.38[c]
1 Corrected	61	0.52	(0.25)	60	0.63	(0.21)	2.63[c]
Transformed (0.1) corrected	61	1.68	(0.76)	60	1.93	(0.65)	1.95[b]
Transformed (0.5) corrected	61	1.64	(0.62)	60	1.89	(0.52)	2.35[c]
Transformed (1) corrected	61	1.62	(0.55)	60	1.86	(0.45)	2.65[d]
Total + /Total −							
Uncorrected	50	1.38	(1.47)	49	2.23	(1.87)	2.53[c]
0.1 Corrected	61	9.98	(21.88)	60	11.33	(21.56)	.34
0.5 Corrected	61	2.91	(4.22)	60	3.73	(4.05)	1.09
1 Corrected	61	2.04	(2.21)	60	2.79	(2.24)	1.86[b]
Transformed (0.1) corrected	61	0.98	(1.47)	60	1.34	(1.39)	1.36
Transformed (0.5) corrected	61	0.72	(0.96)	60	1.06	(0.88)	2.05[c]
Transformed (1) corrected	61	0.62	(0.78)	60	0.96	(0.72)	2.46[c]
Self + /Other −							
Uncorrected	30	1.60	(1.38)	24	3.06	(2.29)	2.75[d]
0.1 Corrected	41	12.39	(21.35)	41	15.97	(20.92)	.76
0.5 Corrected	41	3.43	(3.96)	41	4.65	(3.75)	1.44
1. Corrected	41	2.32	(1.98)	41	3.24	(2.19)	2.01[c]
Transformed (0.1) corrected	41	1.36	(1.54)	41	1.95	(1.38)	1.85[b]
Transformed (0.5) corrected	41	0.95	(0.93)	41	1.36	(0.80)	2.15[c]
Transformed (1) corrected	41	0.80	(0.73)	41	1.13	(0.65)	2.21[c]
Other + /Self −							
Uncorrected	44	0.25	(0.35)	39	0.40	(0.61)	1.46
0.1 Corrected	60	1.56	(4.63)	59	2.24	(5.92)	.71
0.5 Corrected	60	0.52	(0.93)	59	0.79	(1.20)	1.36
1 Corrected	60	0.43	(0.52)	59	0.65	(0.70)	1.92[b]
Transformed (0.1) corrected	60	−0.09	(0.97)	59	0.11	(1.08)	1.09
Transformed (0.5) corrected	60	−0.19	(0.58)	59	−0.01	(0.67)	1.55
Transformed (1) corrected	60	−0.19	(0.47)	59	−0.03	(0.57)	1.73[b]
Focus of attention ratios							
Self-focused ratios							
SOM: Self							
Uncorrected	60	0.60	(0.33)	59	0.69	(0.30)	1.46
0.1 Corrected	60	0.60	(0.32)	59	0.68	(0.28)	1.53
0.5 Corrected	60	0.58	(0.27)	59	0.66	(0.24)	1.71[b]
1 Corrected	60	0.56	(0.24)	59	0.63	(0.20)	1.83[b]
Transformed (0.1) corrected	60	1.81	(0.79)	59	2.03	(0.71)	1.57
Transformed (0.5) corrected	60	1.73	(0.61)	59	1.92	(0.53)	1.79[b]
Transformed (1) corrected	60	1.68	(0.53)	59	1.85	(0.43)	1.90[b]
Self + /Self −							
Uncorrected	44	1.44	(1.37)	39	1.94	(2.09)	1.31
0.1 Corrected	60	11.56	(21.02)	59	15.52	(22.24)	1.00
0.5 Corrected	60	3.17	(3.96)	59	4.14	(4.17)	1.30
1 Corrected	60	2.13	(2.01)	59	2.73	(2.28)	1.50
Transformed (0.1) corrected	60	1.24	(1.54)	59	1.65	(1.56)	1.42
Trasnformed (0.5) corrected	60	0.85	(0.94)	59	1.14	(0.93)	1.66[b]
Transformed (1) corrected	60	0.70	(0.74)	59	0.93	(0.70)	1.74[b]
Other-focused ratios							
SOM: Other							
Uncorrected	41	0.41	(0.41)	41	0.53	(0.46)	1.27
0.1 Corrected	41	0.41	(0.36)	41	0.53	(0.39)	1.48
0.5 Corrected	41	0.40	(0.21)	41	0.52	(0.22)	2.48[c]
1 Corrected	41	0.40	(0.14)	41	0.51	(0.12)	3.83[c]

Table II. Continued

Variable: Mean of ratios	Low ease			High ease			Results
	N	M	SD	N	M	SD	t
Transformed (0.1) corrected	41	1.34	(0.86)	41	1.63	(1.95)	1.48
Transformed (0.5) corrected	41	1.35	(0.46)	41	1.61	(0.47)	2.55[c]
Transformed (1) corrected	41	1.37	(0.30)	31	1.60	(0.25)	3.84[e]
Other+/Other−							
Uncorrected	30	0.41	(0.65)	24	0.56	(0.90)	.73
0.1 Corrected	41	3.00	(4.32)	41	6.21	(8.13)	2.23[c]
0.5 Corrected	41	0.94	(0.81)	41	1.65	(1.46)	2.71[d]
1 Corrected	41	0.78	(0.49)	41	1.22	(0.68)	3.31[e]
Transformed (0.1) corrected	41	0.48	(1.22)	41	1.01	(1.46)	1.76[b]
Transformed (0.5) corrected	41	0.22	(0.55)	41	0.56	(0.65)	2.61[c]
Transformed (1) corrected	41	0.19	(0.35)	41	0.48	(0.35)	3.74[e]

[a]Values are means. Numbers in parentheses are standard deviations. SOM ratios were transformed using 2(arcsine $\sqrt{x}$). Other ratios were log-transformed.
[b]$p < .10$.
[c]$p < .05$.
[d]$p < .01$.
[e]$p < .001$.

following comparisons of High and Low Ease subjects' ratio scores: Total, Self-Focused, and Other-Focused. Results on uncorrected ratios, detailed in Table II, show that while the comparisons on both the Total+/Total− and on the Total SOM ratios were significant, as was the Self+/Other− ratio, none of the comparisons on Self- or on Other-Focused ratios even approached significance.

On ratios with a 0.5 or 1.0 correction the results on SOM ratios, although not substantially different, do seem to better follow the pattern of significant findings on raw frequencies. At least marginal significance was achieved on those comparisons where significant differences were expected. The arcsine transformation, again, did not substantially alter the nature of the findings.

On +/− ratios, the results are similar. The 0.5 and 1.0 corrected ratios best reflect the differences seen with the frequencies, althought in this case a log transformation was needed to achieve even marginal significance on the Self+/Self− ratio. The huge standard deviations of +/− ratios with the 0.1 correction, which even a log transformation failed to correct, could, in part, explain the paucity of significant findings.

Mean of Ratios versus Ratios of Means

Schwartz and his colleagues have provided norms for the SOM ratio as a ratio of means (ratio based on mean frequencies of positive and negative thoughts). Therefore, we compared the ratios of means and the uncorrected and corrected means of ratios (sum of individual subjects' ratios scores divided by the number of subjects). Data presented in Table III indicate that, generally, the ratio of means and the mean of ratios solutions provide comparable results and also that increases in the correction factor yield decreases in the SOM ratios and values that approach the theoretical SOM model set points.

Data in Table III also show that partitioning thoughts as a function of focus of attention yields dramatically different SOM ratios, with Self-Focused thoughts being higher than Other-Focused thoughts. While it would be tempting to suggest that this is true only in the case of interactions with wheelchair users, reanalysis of data on nondisabled subjects' thoughts concerning interaction with able-bodied peers shows the identical pattern of results (R. M. Schwartz, personal communication, July 1987).

Relationships Between Variables

Scores on all measures were also correlated to examine the extent to which attitude and affect variables are related to thought-listing frequencies

Table III. Comparison of SOM Ratios: Mean of Ratios versus Ratio of Means

Variable	Thoughts: Total *N*	Score	SOM[a]	Self-focused *N*	Score	SOM[a]	Other-focused *N*	Score	SOM[a]
Low ease									
Ratio of means	61	.51	IDC	61	.57	PD	61	.31	NM
Mean of ratios (uncorrected)	61	.55	IDC	60	.60	PD	41	.41	ND
Mean of ratios (0.1 corrected)	61	.54	IDC	60	.60	PD	41	.41	ND
Mean of ratios (0.5 corrected)	61	.53	IDC	60	.58	PD	41	.40	ND
Mean of ratios (1.0 corrected)	61	.52	IDC	60	.56	PD	41	.40	ND
High ease									
Ratio of means	63	.67	PD	63	.70	PM	63	.54	IDC
Mean of ratios (uncorrected)	60	.65	PD	59	.69	PM	41	.53	IDC
Mean of ratios (0.1 corrected)	60	.65	PD	59	.68	PD	41	.53	IDC
Mean of ratios (0.5 corrected)	60	.64	PD	59	.66	PD	41	.52	IDC
Mean of ratios (1.0 corrected)	60	.63	PD	59	.63	PD	41	.51	IDC

[a]SOMs refer to Schwartz and Garomoni's (1986a) States of Mind thought ratios [Positive/(Positive + Negative)]. Ranges of the five states of mind are as follows: PM (Positive Monologue) = SOM ratio equal or greater than .69; PD (Positive Dialogue) SOM ratios .56 to .68; IDC (Internal Dialogue or Conflict) = SOM ratios .45 to .55; ND (Negative Dialogue) = SOM ratios .32 to .44; NM (Negative Monologue) = SOM ratios less than or equal to .31.

and to ratio scores and to evaluate the relationships among thought frequency and ratio scores. Because of the number of coefficients, we have not included the correlational data here; these are available from the authors.

Results show that Ease, comfort during interaction (Cognitive Role-Taking Tasks–Comfort Interacting Scale), self-efficacy expectations concerning future interaction (CISEQ-W), and attitudes toward disabled persons (ATDP) are all highly and significantly correlated. Of particular interest to the present investigation, the data also show that the frequencies of Negative thoughts, both Self-Focused and Other-Focused, are significantly related to scores on all of these measures, with the exception of the ATDP. In contrast, the frequency of Positive thoughts was found to be related only to comfort during interaction (positive correlation) and to the frequency of Curious thoughts (negative correlation), suggesting that Positive and Negative thoughts are functionally independent. That this may be the case is also indicated by the results showing that the frequencies of Positive and Negative thoughts, regardless of focus of attention, were not significantly correlated. Significant correlations among the various ratios and scores on all other measures, excepting the ATDP, suggest that ratio scores may better reflect the joint contribution of positive and negative thoughts to cognitions, affect, and behavior.

The stability across the range of correction factors and transformations of the SOM ratio are evident in the uniformly good correlations between SOM ratios and scores on the other variables. In the case of the +/− ratios, the results are consistent with findings on the *t* tests and show that correlations using the logged 1.0 corrected +/− ratios better match results on raw frequencies, relative to other correction factors placed on the +/− ratios.

DISCUSSION

Independence of Positive and Negative Thoughts

The present study reaffirms that positive and negative thoughts are functionally and statistically independent. Results showing that focus of attention influences the balance of positive and negative thoughts strengthen this conclusion. For example, although there were generally more positive than negative self-focused thoughts listed, the opposite was true for other-focused thoughts. Correlational results also suggest that positive and negative thoughts are independent in that they are related to different factors. Also, the frequencies of positive and negative thoughts were not significantly related either for totals or for any of the focus of attention categories.

The differential findings on positive and negative thoughts and on self- and other-focused thoughts suggest that thoughts of different valence may

differ in origin and function and that both valence and focus of attention are discrete dimensions that must be evaluated during cognitive assessment of thoughts concerning interaction with specific target groups of individuals.

Considerations in Using Ratio Scores

Because positive and negative thoughts appear to be independent dimensions, it is important that investigators have tools available to simplify analysis and interpretation of valenced information. Comparing thoughts using two valence and two focus of attention categories poses certain difficulties for data evaluation. First, there is an increased likelihood of subjects having no thoughts in a particular category. Second, self- and other-focused thoughts occur with different frequencies, with self-focused thoughts being more common. Furthermore, it is difficult to compare results from studies where the data were collected in ways that may have produced different frequencies of total thoughts, such as findings from studies using thought-listing and questionnaire measures.

Calculating ratios of frequency scores provides a statistical simplification because it allows for less complex designs and provides a direct way of contrasting valence and focus of attention data. It should be noted, however, that the unmindful calculation of ratio scores may mask the existence of very small frequencies. Raw frequencies must be examined and care should be taken to avoid situations where the validity of the data may be questionable.

Such a case arises in the present investigation of situation-focused thoughts, which were found to be substantially less common than either self- or other-focused thoughts. The cause of these low frequencies is moot, and the possibility that they are a function of the particular structure imposed on cognitions must be considered. It has been suggested (Schwartz, personal communication, 1988) that in social situations, interaction between self and other may *be* the situation, as opposed to contexts in which the task is more separable from the person (e.g., obsessive thoughts about cleanliness). Although our studies of social interaction only permit us to speculate on the reasons, situation-focused thoughts occurred so infrequently that we did not feel it appropriate to compute ratios in this case. In circumstances that are not so obvious, comparison of findings using ratios and raw frequencies and examination of the stability and interpretability of the ratio scores may resolve the question. Furthermore, the method used to collect cognitions, in this case thought listing, may have some effects on the frequencies and, hence, on the ratios (Fichten et al., 1988).

Choice of Type of Ratio. To create meaningful ratios one must address a number of additional difficulties as well. For example, the problem of missing scores in one of the valenced frequencies has an impact on sample size, means, and standard deviations as well as on the resulting findings. It was because of these problems that we investigated the effects of three correction factors (0.1, 0.5, and 1.0) for missing scores on Schwartz's SOM ratios and on raw and logged +/− ratios.

One of the considerations in choosing a ratio must be that a score fashioned in the manner of the SOM ratio is always a fraction, while a ratio such as +/− is usually greater than 1.0. The latter often yields a positively skewed distribution of scores. The problem of skewness is exaggerated by the use of a fraction as the correction factor used to replace zeros in the denominator. The present results show, however, that as the correction value approaches 1.0, the means and standard deviations stabilize toward the uncorrected values.

The data show that SOM ratios had a number of advantages over the +/− ratios. Findings on the SOM ratios were most consistently related to results on valenced frequencies. Although this should not be seen as an assertion of the superior validity of raw frequencies, we would hesitate to recommend a transformation that yields results totally discrepant from those found using raw scores. For example, findings in the present investigation showed that the raw frequencies of positive and negative thoughts are related to different variables; the SOM ratios appeared to be related to most of these. This was true for ratios on total, self-, an other-focused thoughts. In addition, there were fewer instances of missing data than for the +/− ratios. SOM ratios also have meaning independent of context since Schwartz and his colleagues have provided normative ranges that characterize adaptive and maladaptive thinking in a variety of situations (Schwartz & Garamoni, 1986a). These norms could not be used if investigators report transformed SOM scores. Also, transformations do not appear to improve the findings. Therefore, we do not recommend the use of transformations with SOM scores.

SOM Ratios. In the present study, the "best" results on SOM ratios were achieved with a 1.0 correction for missing scores. This resulted in the best fit with frequency data on both positive and negative thoughts and resulted in the lowest standard deviations and the highest correlations in the expected direction. For example, raw frequencies showed that the level of ease with a specific target group of individuals, wheelchair users, had an impact on both self- and other-focused thoughts. The effect of high ease was to offset the balance of positive and negative thoughts by decreasing the number of negative self-focused thoughts relative to positive ones, whereas the effect of low ease was to increase the relative frequency of negative other-focused thoughts. Using SOM set points on self-focused thoughts, the mean of ratios SOM scores of high ease subjects connoted a "positive dialogue" while those of low ease subjects fell at the border of the "internal dialogue of conflict" and the "positive dialogue" ranges. On other-focused thoughts,

low ease subjects' internal dialogue reflected a "negative dialogue" while high ease subjects' scores showed an "internal dialogue of conflict."

The SOM mean of ratios with a 1.0 correction provides a good fit with the ratio of means solution for which norms already exist. The data also show that, generally, this correction to the SOM ratio results in values that stabilize around the theoretical set points. Thus, the correction to the SOM ratio results in less ambiguity of interpretation and allows investigators to go beyond noting changes in positive and negative thoughts during an intervention by evaluating how closely clients' thoughts approximate the set points for functional and dysfunctional thinking noted by Schwartz and his colleagues.

Frequencies and Other Ratios. As for the +/− ratios and the Self+/Other− and Other+/Self− ratios, the results indicate that use of the uncorrected ratios results in major drops in sample size. All correction factors improved this and allowed for the use of the full sample, a procedure equivalent to using raw frequencies where 0s *are* used. Also, all corrections make distinctions among frequencies that show particularly maladaptive behavior. The 0.1 correction, however, resulted in extreme skewness of the distribution and huge standard deviations. The 0.5 and 1.0 corrections gave more satisfactory results, with the best results being provided by the log-transformed 1.0 corrected +/− ratios.

Although we prefer the SOM ratio to raw frequencies or +/− ratios for the reasons discussed earlier, there may be questions or hypotheses in relation to specific variables that require an investigator to choose otherwise. For example, using raw frequencies may be best approach to the study of the origin and function of positive thoughts and the Self+/Other− ratio may be a good index of thoughts concerning people with disabilities. In other contexts, other types of +/− ratios may be appropriate. In such cases, we recommend that the ratio be 1.0 corrected and log-transformed since this best captures missing subjects and corrects for the deleterious effects of positive skewness.

SUMMARY AND CONCLUSIONS

The results show that positive and negative thoughts are both statistically and functionally independent and that focus of attention has an impact on the nature of thoughts listed. To better reflect the contributions of thoughts of different valence and to simplify statistical operations, we recommend that investigators consider the use of ratios in their data analysis.

To this end we explored the properties of various ratios as well as of different correction factors that may be used to replace 0 scores that cause

difficulties in using ratios for individual subjects in situations where low thought frequencies are observed. Our evaluation suggests that the most suitable ratio for the majority of investigations is the SOM ratio proposed by Schwartz and his colleagues. Theoretically derived values for the SOM already exist; these appear to have validity when proportions are calculated using the group mean frequencies. To adapt the SOM to single subjects, we recommend a correction of 1.0 when a subject has either no positive or no negative thoughts. Results using this correction not only appear to resemble findings using raw frequencies but also provide values that approximate ratios of mean group frequencies as well as the theoretically derived values.

Using ratios has a number of advantages, including rendering findings of different studies comparable as well as establishing norms for adaptive and maladaptive thinking about events. Because of the properties of the SOM ratio and because of the availability of theoretically derived set points, we feel that the SOM has the potential of becoming the "standard ratio" that may be reported by investigators on a routine basis. Until more evidence concerning its validity becomes available, we recommend that investigators report both raw frequency and SOM ratio results.

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