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Distinctiveness-based illusory correlations and stereotyping: A meta-analytic integration*

Brian Mullen† and Craig Johnson

Department of Psychology, Syracuse University, Syracuse, NY 13210, USA

This article reports the results of a meta-analytic integration of previous research on illusory correlation in stereotyping effects. The following patterns were observed. The basic distinctiveness-based illusory correlation effect is highly significant, and of moderate strength. Consistent with theoretical expectations, distinctiveness-based illusory correlation effects are stronger when the distinctive behaviour is negative. Effects are also stronger as a function of the number of exemplars presented in the stimulus array. This is consistent with the effects of memory load on covariation judgement demonstrated elsewhere. Finally, subjects' judgements of covariation in the distinctiveness-based illusory correlation paradigm are significantly predicted by the paired distinctive covariation judgement strategy. This indicates that subjects' judgements of covariation in the illusory correlation in stereotyping paradigm seem to reflect a responsiveness to the information being presented to them, and especially a reliance upon distinctive information. Discussion considers possible mechanisms for these effects, and suggests that future research examine the processes underlying the effects of the valence of the distinctive behaviours, the effects of the number of exemplars, and the strategies followed in making these types of covariation judgements.

> When the results [of the sixth national census of 1840] were published in 1841 ... the total number of those reported to be feeble-minded in the United States was over 17,000, of which nearly 3,000 were black. If these staggering census statistics were to be believed, free blacks had an incidence of mental illness six times higher than the white population. . . . Even though Edward Jarvis cogently rebutted the faulty statistics of the census of 1840 as early as 1842 by showing that there were gross errors in its compilation (for example, there were 133 black, insane paupers listed in the town of Worcester, Massachusetts, which had a total black population of 151), the association of blackness and madness remained in currency throughout the rest of the century. (Gilman, 1985, pp. 137–138)

Distinctiveness-based illusory correlations are erroneous judgements of the relation between two variables based on the co-occurrence of distinctive stimulus events. In the original demonstration of this phenomenon, Chapman (1967) presented a list of word pairs to subjects, each word being paired with the others with equal frequency. Chapman observed that subjects consistently overestimated the frequency with which the two longest words in the list had been paired together. In the context of a list of relatively short words, each long word was distinctive, and the co-occurrence of two long words was,

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† Requests for reprints.

apparently, particularly distinctive. It was this extreme distinctiveness, and the resultant increased availability (Tversky & Kahneman, 1974), of the pairing of the two distinctive stimulus events that led subjects to overestimate the frequency of this particular word pair.

Hamilton & Gifford (1976) extended this simple information-processing phenomenon to the development of a paradigmatically new approach to the perception of social groups. It was reasoned that overestimation of the co-occurrence of distinctive events could lead to an illusory correlation between relatively rare behaviours and the relatively smaller social group. Since the relatively rare behaviours are usually undesirable, and the relatively smaller social group is (by definition) the minority group, this pairing of distinctive events will lead people to overestimate the frequency of undesirable behaviours performed by minority group members. This extension of the illusory correlation provided a cognitive, non-motivational foundation for the development of negative stereotypic beliefs about minority groups (for presentation of this perspective on illusory correlation and stereotyping, see Hamilton, 1976, 1979, 1981; Hamilton & Sherman, in press).

Since Hamilton & Gifford's (1976) integration of illusory correlation and stereotyping, a number of studies have examined the basic hypothesis that perceptions of social groups take the form of illusory correlations between distinctive stimulus events. The notion that people overestimate the association between the smaller social group and the rarer behaviour has stimulated a considerable amount of interest and attention over the years. This article presents a meta-analytic integration (Glass, 1976; Mullen, 1989; Mullen & Rosenthal, 1985; Rosenthal, 1980, 1984) of the research on distinctiveness-based illusory correlation in stereotyping (hereafter referred to simply as 'illusory correlation'). This meta-analytic integration was developed to address a number of specific issues about illusory correlation effects.

Significance, magnitude and consistency of effects

The most common and straightforward application of meta-analytic techniques is to gauge the combined significance, magnitude and consistency of the effects in a particular research literature. This is certainly an important issue regarding the literature on illusory correlation. For example, Feldman, Camburn & Gatti (1986) reported the results of four studies which consistently failed to provide compelling support for the basic illusory correlation effect. These authors observed that, while illusory correlation effects may be theoretically interesting, they may also be practically irrelevant. However, if the combined effects of tests of the illusory correlation effect are significant, strong and consistent, then this perspective on the development of stereotypes may be considered practically important as well as 'merely' theoretically interesting.

Prediction and explanation of illusory correlation

Developing a gauge of the combined significance and magnitude of effects is a critical element of the meta-analytic integration of any research domain. However, hypothesis testing and model construction at the meta-analytic level can also be useful and informative (cf. Miller, 1988; Mullen & Hu, 1988, in press). Several concepts and principles, derived from the broader cognitive literature on covariation judgement (Arkes & Harkness, 1983; Beyth-Marom, 1982; Shaklee, 1983), can be brought to bear on the research examining illusory correlation.

Valence of the distinctive behaviour

Two different theoretical accounts suggest that illusory correlation effects should be stronger when the distinctive behaviour is negative. First, it will be recalled that Chapman & Chapman (1967, 1969) delineated other contributions to the basic illusory correlation effect, including the expected strength of the association between the two stimulus events (cf. also Hamilton & Rose, 1980). For example, although the pair *bacon–eggs* was presented with the same frequency as the pair *tiger–eggs*, subjects consistently overestimated the frequency of the first pair relative to the second pair. In a similar way, subjects may have already acquired an association between members of minority groups and negative behaviours. In an iterative, recursive manner, this acquired association between minority groups and negative behaviours may itself have been generated through the operation of previous illusory correlation effects. Thus, just as *bacon* and *eggs* are particularly likely to go together in the minds of the subjects, giving rise to more illusory correlation, 'smaller group' and 'negative behaviour' may also be particularly likely to go together in the minds of the subjects, similarly giving rise to more illusory correlation. Demonstration of the effects of expectations on illusory correlation effects is found also in recent research by Spears, van der Pligt & Eiser (1986) and Spears, Eiser & van der Pligt (1987).

Second, research in other areas (e.g. Kanouse & Hanson, 1972; Ritchie, McClelland & Shimkunas, 1967) suggests that negative/undesirable information is more salient and attracts more attention (perhaps because it is typically less frequent than neutral or positive information). Extended to the illusory correlation paradigm, the negativity of the rare negative behaviour may lend more distinctiveness and more salience to the paired distinctive minority group–rare behaviour cell than would be the case when the rare behaviour is not negative. Demonstration of the effects of salience on illusory correlation effects is found in recent research by Spears, van der Pligt & Eiser (1985).

Note, however, that the only studies that have considered the effects of negative distinctive behaviours vs. those of non-negative distinctive behaviours (Hamilton & Gifford, 1976; Schaller & Maass, 1987) suggested little or no effect of the valence of the distinctive behaviour. Clearly, in light of the 'expectation-based' and 'salience' accounts which suggest the importance of distinctive behaviour valence, this facet of illusory correlations in stereotyping needs to be examined carefully.

Memory load–number of exemplars

Several studies have demonstrated that errors in judgement of covariation increase under conditions of increased memory load (e.g. Arkes & Harkness, 1983; Beyth-Marom, 1982; Shaklee & Mims, 1982; Ward & Jenkins, 1965). One way in which memory load would be increased in the illusory correlation paradigm is through the size of the list of group–behaviour pairs: the greater the number of exemplars in the list, the greater the memory load requirements of the task. Therefore, the illusory correlation effect should increase as a function of the number of exemplars in the stimulus list.

Only one study has examined the effect of the number of exemplars in the stimulus array on illusory correlation in stereotyping (Fiedler, Hemmeter & Hofman, 1984). This study reported no significant effect of number of exemplars. However, subjects exposed to a 'greater number of' exemplars in this study were really exposed to three repetitions of the same exemplars (rather than being exposed to three times the number of unique exemplars). Clearly, in light of the demonstrated effects of memory load requirements for covariation judgements in general, this element of illusory correlation should be scrutinized.

Strategies in the judgement of covariation

Cognitive researchers have been concerned with mapping the strategies subjects use to arrive at erroneous judgements for as long as such erroneous judgements have been observed (e.g. Smedslund, 1963). Some researchers have examined subjects' self-reports of the strategies followed in illusory correlation studies (e.g. Adi, Karplus, Lawson & Pulos, 1978; Smedslund, 1963). The difficulties with relying upon self-reports of internal processes are well known (cf. Nisbett & Wilson, 1977). Other researchers have adopted a more normative theoretical approach, which involves examining the predictive accuracy of various judgemental 'strategies'. The predictive accuracy of these strategies is examined by comparing the judgements generated by subjects with the judgements predicted by various algebraic models (cf. Arkes & Harkness, 1983; Shaklee & Tucker, 1980). It is not necessary to assume that subjects consciously, intentionally follow a given strategy by performing intricate calculations. Rather, the strategies may represent implicit, non-conscious information-processing heuristics which may guide the individual's encoding, storage and retrieval of information (cf. Lewicki, 1986; Nisbett & Ross, 1980).

(*a*)

		Group A	Group B
Desirable behaviour	*N*	18	9
	%	46.15	23.08
	cell	a	b
Undesirable behaviour	*N*	8	4
	%	20.51	10.26
	cell	c	d

(*b*)

		Group A	Group B
Desirable behaviour	*N*	18	6
	%	45.00	15.00
	cell	a	b
Undesirable behaviour	*N*	12	14
	%	30.00	10.00
	cell	c	d

Strategy	Prediction (a)	Prediction (b)
CELL A	46.15[a]	45.00
CELL D	10.26	10.00[a]
CELL A − CELL B	23.07	30.00[a]
Sum of diagonals	12.82[a]	10.00

[a] Indicates study predicted to show strongest illusory correlation effect according to that strategy.

Figure 1. Two examples of stimulus arrays for illusory correlation studies.

The specific judgemental strategies employed by subjects in the illusory correlation paradigm have not been addressed by social psychologists. However, various strategies examined in the broader covariation judgement literature can be examined, at the meta-analytic level, to derive a gauge of the underlying process of illusory correlation in stereotyping. Consider the four judgement strategies which have been most commonly examined in the covariation judgement literature. By way of illustration, Fig. 1 presents two different 2 × 2 contingency tables, depicting the frequency of the specific group-behaviour descriptions which could be used in the basic illusory correlation paradigm.

CELL A (Nisbett & Ross, 1980; Rothbart, 1981; Smedslund, 1963), which might be considered the 'paired non-distinctive strategy', dictates that judgement of covariation increases as a function of the relative size of cell a. CELL D, which might be considered the 'paired distinctive strategy', dictates that judgement of covariation decreases as a function of the relative size of cell d. In some ways, this strategy is particularly important to the extension of illusory correlation to stereotyping, because it captures the underlying assumptions regarding the paired distinctive mechanism so often alluded to (e.g. Hamilton & Gifford, 1976; Hamilton & Sherman, in press). CELL A − CELL B (Ward & Jenkins, 1965) dictates that judgement of covariation increases as the relative size of cell a diverges from the relative size of cell b. (CELL A + CELL D) − (CELL B + CELL C) Ward & Jenkins, 1965), which might be called the 'sum of the diagonals' strategy, dictates that the judgement of covariation increases as the number of 'confirming cases' (cell a and cell d) increases relative to the number of 'disconfirming cases' (cell b and cell c).

For example, with everything else held constant, both CELL A and the sum of the diagonals strategies would predict a stronger illusory correlation effect for the stimulus array presented in Fig. 1*a* than for that presented in Fig. 1*b*. Alternatively, both CELL D and CELL A − CELL B would predict a stronger illusory correlation effect for the stimulus array presented in Fig. 1*b* than for that presented in Fig. 1*a*. However, there is no social psychological research that considers the predictive accuracy of these various strategies in the context of stereotyping.*

This article reports the results of a meta-analytic integration of research examining the illusory correlation paradigm. This analysis has four general goals: (1) to provide a precise summary of the combined significance, magnitude and consistency of the illusory correlation effect; (2) to gauge the effects of the valence of the distinctive behaviour on the basic illusory correlation effect; (3) to gauge the influence of the number of exemplars in the stimulus array on the basic illusory correlation effect; and (4) to model the strategies followed by subjects in judging covariation in the illusory correlation paradigm.

* There are a multitude of other possible strategies which could be pursued. However, these four strategies have received most attention in the broader cognitive literature on covariation judgement, and we restrict ourselves to these strategies in the present analyses. Note that one final strategy has been considered in previous research: [CELL A/(CELL A + CELL C)] − [CELL B/(CELL B + CELL D)]. This strategy, which is technically the algorithm for comparing 'conditional probabilities', dictates that the judgement of covariation increases as the conditional probability for one group is larger than the conditional probability for the other group. However, were subjects to follow a conditional probability strategy in the basic distinctiveness-based illusory correlation paradigm (where the actual conditional probabilities of the two groups are always equal: see below), their judgements of covariation would all be zero. In a sense, the conditional probability strategy is represented in each study by the null hypothesis against which subjects' judgements of covariation are compared.

Method

Meta-analysis generally refers to the statistical integration of results of independent studies. Procedurally, the statistical tests (e.g. *t* tests, *F* ratios, etc.) of a well-defined hypothesis are transduced to common metrics for significance levels (*z*, one-tailed *P*) and for effect sizes (Fisher's *z*, *r*, r^2, *d*). Once placed on common metrics, the significance levels and effect sizes of separate hypothesis tests can be combined, compared and examined for the fit of predictive models (Glass, 1976; Mullen, 1989; Mullen & Rosenthal, 1985; Rosenthal, 1980, 1984). In accord with the procedures specified in Cooper (1982), Mullen (1989) and Mullen & Rosenthal (1985), an exhaustive manual and computer search located studies using the 'ancestry' approach, the 'descendency' approach and the 'invisible college' approach, in addition to scanning the past 13 years of major social psychological journals and regional and national psychology association proceedings. Studies were selected for inclusion in these analyses if they met all of the following criteria.

1. Each included study had to implement the basic distinctiveness-based illusory correlation paradigm (wherein exemplars representing one of two social groups and one of two types of behaviours or traits are presented one at a time).
2. Each included study had to report the frequency of occurrence of each of the four types of stimulus events presented to subjects (representing the four cells in the contingency table).
3. The form of the contingency table characterizing the stimulus events had to be such that (*a*) the likelihood of one group engaging in a given behaviour type was equal to the likelihood of the other group engaging in that behaviour type, and (*b*) one of the four cells in the 2 × 2 contingency table comprised less than 25 per cent of the total number of exemplars, representing the paired distinctive cell.
4. The subjects were not given impression-formation instructions (which are explicitly supposed to reduce illusory correlation effects).*
5. The subjects were not members of the groups about which they received the information.
6. Each included study had to report (or intelligibly imply) a statistical test of the illusory correlation effect.

These tests of the illusory correlation effect could generally be classified into one of two distinct operationalizations: estimation and assignment. *Estimation* tasks required subjects to estimate what percentage, or how many, of the behaviours describing group A were of behaviour type 1, and how many of the behaviours describing group B were of behaviour type 1 (and, occasionally, again for the two groups for behaviour type 2). In these recall measurements, the two groups are interpreted by the subjects in terms of the two types of behaviours. *Assignment* tasks required subjects to assign or attribute each one of a number of behaviours to someone from group A or to someone from group B. In these recognition measurements, the two behaviour types are interpreted by the subjects in terms of the two groups. For both estimation and assignment measures, researchers generally use the individual subjects' responses to reconstruct a 2 × 2 contingency table for each subject. The phi values derived from these individual subjects' 2 × 2 contingency tables represent judgements of covariation; these values are then typically transformed into Fisher *z* scores which are then tested for the significance of the difference between zero and the mean phi to Fisher's *z* transform. These two distinct operationalizations of the basic illusory correlation effect were subjected to separate meta-analyses.†

Using these selection criteria produced a total of 14 articles with 23 separate studies; a total of 23 tests of the illusory correlation effect using assignment measures, and a total of 28 tests of the illusory correlation effect using estimation measures. The hypothesis tests included in this meta-analysis, along with the relevant statistical information, are presented in Table 1. Tests were coded as being in the expected direction if the illusory correlation effect observed was greater than zero. In those cases where direct statistical tests of the illusory correlation effect were not reported, authors of the original research were contacted and supplementary analyses were obtained. When this approach was not successful, reports of the absence of significant main effects which were not accompanied by test statistics were reconstructed as $p = .50$; reports of significant main effects were reconstructed as $p = .05$. These reconstructions are generally considered to be the most conservative best estimates which one can derive from incompletely reported hypothesis tests (Cooper, 1982; Mullen, 1989; Mullen & Rosenthal, 1985; Rosenthal, 1980, 1984).

* We thank Mark Schaller for suggesting this selection criterion.

† A few studies (e.g. Hamilton, Dugan & Troiler, 1985, Expt 2) used additional measurements of subjects' memories for the presented stimulus array. However, the majority of the empirical tests of the illusory correlation in stereotyping effect employed estimation and/or assignment, and so our efforts focus on these operationalizations.

Table 1. Studies included in the meta-analysis

Study	Task[a]	Statistic (d.f., DOE)[b]	n	Valence[c]	Cell sizes[d] a	b	c	d	z sig.	r effect
Acorn *et al.* (in press) Expt 1	A	t = 3.23 (23, +)	24	1	16	8	8	4	2.901	.559
	E	t = 2.31 (23, +)	24	1	16	8	8	4	2.167	.434
	A	t = 0.09 (24, +)	25	1	16	8	8	4	0.089	.018
	E	t = 1.47 (24, +)	25	1	16	8	8	4	1.423	.287
	A	t = 4.86 (23, +)	24	1	16	8	8	4	3.987	.712
	E	t = 2.81 (23, +)	24	1	16	8	8	4	2.577	.506
Acorn *et al.* (in press) Expt 2	A	t = 1.32 (28, +)	29	1	16	8	8	4	1.288	.242
	E	t = 1.03 (28, +)	29	1	16	8	8	4	1.011	.191
	A	t = 0.20 (27, +)	28	1	16	8	8	4	0.200	.038
	E	t = 1.52 (27, +)	28	1	16	8	8	4	1.475	.281
	A	t = 3.13 (29, +)	30	1	16	8	8	4	2.880	.503
	E	t = 2.31 (28, +)	29	1	16	8	8	4	2.190	.400
Acorn *et al.* (in press) Expt 3	A	t = 3.43 (31, +)	32	1	16	8	8	4	3.133	.525
	E	t = 1.89 (31, +)	32	1	16	8	8	4	1.824	.321
Crawley & Regan (1984)	A	χ^2 = 1.346 (1, +)	20	1	18	9	8	4	1.160	.259
	E	t = 5.66 (18, +)	20	1	18	9	8	4	4.230	.800
Feldman *et al.* (1986) Expt 1	A	t = 0.41 (100, +)	112	0	18	9	8	4	0.409	.041
Feldman *et al.* (1986) Expt 2	A	p = .50 (+)	56	0	18	9	8	4	0.000	.000
	E	p = .50 (+)	56	0	18	9	8	4	0.000	.000

Table 1. Studies included in the meta-analysis (*cont.*)

Study	Task[a]	Statistic (d.f., DOE)[b]	*n*	Valence[c]	Cell sizes[d] a	b	c	d	*z* sig.	*r* effect
Feldman *et al.* (1986) Expt 3	A	p = .50 (+)	87	0	18	9	8	4	0.000	.000
	E	r = .179 (83, +)	87	0	18	9	8	4	1.639	.179
Feldman *et al.* (1986) Expt 4	A	p = .50 (+)	67	0	18	9	8	4	0.000	.000
	E	r = −.272 (65, −)	67	0	18	9	8	4	−2.227	−.272
Fielder *et al.* (1984)	E	t = 1.13 (11, +)	12	0	16	8	8	4	1.074	.323
Hamilton *et al.* (1985) Expt 1	E	t = 2.46 (39, +)	40	1	18	9	8	4	2.357	.367
Hamilton *et al.* (1985) Expt 2	E	t = 2.98 (23, +)	24	1	18	9	8	4	2.710	.528
Hamilton & Gifford (1976) Expt 1	A	t = 2.57 (32, +)	33	1	18	9	8	4	2.431	.414
	E	t = 1.92 (32, +)	33	1	18	9	8	4	1.853	.321
Hamilton & Gifford (1976) Expt 2	A	t = 3.04 (51, +)	52	0	16	8	8	4	2.900	.392
	E	t = 1.75 (51, +)	52	0	16	8	8	4	1.716	.238
Jones *et al.* (1977)	E	F = 18.46 (1,42 +)	44	1	20	10	8	4	3.888	.553
Pryor (1986)	E	t = 3.83 (27, +)	28	1	18	8	9	4	3.391	.593
Ruvolo & Hamilton (1988) Expt 1	A	t = 4.13 (117, +)	118	1	16	8	8	4	3.982	.357
	E	t = 6.88 (117, +)	118	1	16	8	8	4	6.291	.537
Ruvolo & Hamilton (1988) Expt 2	A	t = 4.259 (141, +)	142	1	16	8	8	4	4.123	.338
	E	t = 4.675 (141, +)	142	1	16	8	8	4	4.500	.366
	A	t = 1.085 (130, +)	131	0	16	8	8	4	1.080	.095
	E	t = 0.957 (130, +)	131	0	16	8	8	4	0.953	.084

Table 1. Studies included in the meta-analysis (*cont.*)

Study	Task[a]	Statistic (d.f., DOE)[b]	*n*	Valence[c]	Cell sizes[d] a	b	c	d	*z* sig.	*r* effect
Schaller & (Maass (1987)	A	$t = 2.13$ (22, +)	23	1	24	12	8	4	2.008	.413
	E	$t = 2.94$ (22, +)	23	1	24	12	8	4	2.669	.531
	A	$t = 2.72$ (20, +)	21	0	24	12	8	4	2.477	.520
	E	$t = 2.16$ (19, +)	20	0	24	12	8	4	2.016	.444
Sherman *et al.* (1988)	A	$t = 4.39$ (44, +)	45	1	24	12	8	4	3.975	.552
	E	$t = 5.81$ (44, +)	45	1	24	12	8	4	4.977	.659
Spears *et al.* (1985)	A	$t = 2.45$ (120, +)	121	0	16	8	8	4	2.415	.218
	E	$t = 3.00$ (119, +)	118	0	16	8	8	4	2.938	.267
Titus (1982) Expt 1	A	$t = 2.05$ (49, +)	50	1	18	9	8	4	1.998	.281
	E	$r = .482$ (49, +)	50	1	18	9	8	4	3.581	.482
Titus (1982) Expt 2	E	$r = .470$ (49, +)	50	1	18	9	8	4	3.479	.470
Titus (1982) Expt 3	A	$t = 3.74$ (49, +)	50	1	18	9	8	4	3.490	.471
	E	$r = .560$ (49, +)	50	1	18	9	8	4	4.272	.560

[a] A = assignment task; E = estimation task.
[b] (d.f., direction of effect).
[c] 1 = negative distinctive behaviour; 0 = non-negative distinctive behaviour.
[d] These are the actual numbers of exemplars for each of the four cells in the 2 × 2 contingency defined in Fig. 1. The total number of exemplars for each study is defined as the sum of these four cell sizes. The various covariation judgement strategies were derived from proportionate cell sizes (i.e. these cell sizes divided by the total number of exemplars for each study).

In addition to the basic data (statistical test of illusory correlation, corresponding degrees of freedom and sample size), each statistical test was coded for the three study characteristics described earlier: the valence of the distinctive behaviour [coded as (1) for negative and (0) for non-negative*]; the number of exemplars in the stimulus array presented to subjects; and the actual frequencies of cells a, b, c and d in the stimulus array

* These 'non-negative' types of distinctive behaviours were comprised of positive behaviours (three hypothesis tests each for estimation and assignment), 'extreme' (as compared with 'average') evaluations (three hypothesis tests for estimation, four hypothesis tests for assignment), and 'attitudinal position' (three hypothesis tests for assignment, five hypothesis tests for estimation). There were no apparent differences between results for these various non-negative distinctive behaviours.

presented to subjects. From the actual frequencies of cells a, b, c and d, the corresponding predictions formulated by each of the strategies delineated above could be compared with the actual magnitude of the illusory correlation observed in each study. Specifically, this magnitude was predicted by the proportionate size of the cell (or combinations of cells) from the contingency table which each strategy holds to be critical in formulating judgements of covariation.

In the analyses reported below, tests for assignment and tests for estimation were separately subjected to the following meta-analytic procedures: combinations of significance levels and effect sizes, diffuse comparisons of significance levels and effect sizes, and focused comparisons of effect sizes. Formulae and computational procedures for these techniques are presented elsewhere (cf. Mullen, 1989; Mullen & Rosenthal, 1985; Rosenthal, 1984).

Results

General effects

Table 2 presents the results of the combinations and diffuse comparisons of significance levels and effect sizes for the 28 hypothesis tests measuring estimation, and for the 23 hypothesis tests measuring assignment. These analyses reveal that the combined effects of these hypothesis tests of the illusory correlation effect are highly significant, of moderate (estimation) or small-to-moderate (assignment) magnitude (cf. Cohen, 1977) and produce significantly heterogeneous results.*

Table 2. Results of combinations and diffuse comparisons of significance levels and effect sizes

		Estimation (k = 28)	Assignment (k = 23)
Combinations			
Significance levels	z	12.486	8.212
	p	7.55E-28	9.85E-16
	$nfs(p = .05)$	1964.5	790.7
Effect sizes	Fisher's z	0.358	0.265
	r	0.344	.259
	r^2	0.118	.067
	d	0.732	0.536
Diffuse comparisons			
Significance levels	χ^2	53.208	46.222
	d.f.	27	22
	p	.00120	.00185
Effect sizes	χ^2	86.539	57.273
	d.f.	27	22
	p	2.56E-9	.000056

Note. k = number of hypothesis tests; $nfs(p = .05)$ = failsafe number for the $p = .05$ level of significance.

* It should be noted in passing that the general effects did not vary as a function of year of publication. For estimation, $r = -.078$, $z = 0.628$, $p = .26486$; for assignment, $r = -.0003$, $z = 0.002$, $p = .4991$. Thus, there does not seem to be any noticeable increase or decrease in the significance and magnitude of these effects over the past 13 years which could be linked to broad historical, cultural shifts in reactions to minorities, etc.

Effects of valence of the distinctive behaviour

Table 3 presents separate combinations of significance levels and effect sizes for hypothesis tests where the distinctive behaviour was negative, and for hypothesis tests where the distinctive behaviour was not negative. Consistent with the reasoning developed earlier, these analyses reveal that the basic illusory correlation effect is stronger when the distinctive behaviour is negative in valence. This was the case for both measures of illusory correlation.

Number of exemplars

The upper half of Table 4 presents the correlations between Fisher's z for effect size and the number of exemplars in the stimulus array for each hypothesis test, along with the corresponding focused comparisons of effect size. Consistent with the reasoning developed earlier, the basic illusory correlation effect is stronger under conditions of increased memory load–larger numbers of exemplars in the stimulus array. This pattern was significant for hypothesis tests employing estimation measurements.

Table 3. Results of combinations and focused comparisons involving valence of distinctive behaviours

		Estimation	Assignment
Combinations			
Negative distinctive behaviours	k	17	13
Significance levels	z	11.739	8.543
	P	7.84E–26	1.07E–16
	$nfs(P = 0.05)$	889.7	369.1
Effect sizes	Fisher's $\bar{z}$	0.497	0.405
	$\bar{r}$	.460	.385
	$\bar{r}^2$	.211	.148
	$\bar{d}$	1.036	0.833
Non-negative distinctive behaviours	k	11	10
Significance levels	z	6.166	3.678
	p	4.70E–10	0.00012
	$nfs(p = .05)$	200.0	70.6
Effect sizes	Fisher's $\bar{z}$	0.216	0.157
	$\bar{r}$	.213	.156
	$\bar{r}^2$	.045	.002
	$\bar{d}$	0.436	0.316
Focused comparisons			
	z	3.436	2.984
	p	.00030	.00142

Note. k = number of hypothesis tests; $nfs(p = .05)$ = failsafe number for the $p = .05$ level of significance.

Table 4. Results of correlations and focused comparisons involving number of exemplars in stimulus array

	Estimation	Assignment
Focused comparisons		
k	28	23
r	0.339	0.202
z	2.294	1.201
P	0.01090	0.11488
Focused comparisons[a]		
k	15	11
r	0.253	0.671
z	1.550	2.674
P	0.06058	0.00374

[a] For the subset of hypothesis tests where the number of exemplars is greater than 36.

A median split on the number of exemplars revealed an interesting asymmetry in the stimulus arrays which are used in this research domain. All of the hypothesis tests which fell below the median number of exemplars used exactly the same stimulus array: 16 CELL A (majority group, common behaviour), 8 CELL B (minority group, common behaviour) 8 CELL C (majority group, distinctive behaviour), 4 CELL D (minority group, distinctive behaviour). Specifically, 13 (or 46 per cent) of the 28 estimation hypothesis tests and 12 (or 52 per cent) of the 23 assignment hypothesis tests used this configuration. Obviously, among that half of the hypothesis tests which used the smaller number of exemplars, there was absolutely no variation in the number of exemplars.

One possibility is immediately suggested by this uneven distribution of stimulus arrays. The effects of the number of exemplars delineated above may simply represent some quirk of a heavy reliance upon one set of stimulus materials on the part of half of the hypothesis tests. However, this does not appear to be the case. As presented in the lower half of Table 4, the prediction of the magnitude of the illusory correlation effect by the number of exemplars is weaker for estimation hypothesis tests, and stronger for assignment hypothesis tests, relative to the results for the total meta-analytic database. However, the number of exemplars still predicts the magnitude of the illusory correlation effect among those hypothesis tests that varied the number of exemplars in the stimulus array.

Judgement strategies

Table 5 presents the correlations between Fisher's z for effect size and the predictions derived from each of the four strategies for judgement of covariation. All of the judgement strategies appear to be relatively good predictors of illusory correlation for estimation measurements, and all of the judgement strategies appear to be better predictors of estimation than of assignment. For estimation, the part correlations and the corresponding focused comparisons gauge the predictive power of each strategy after partialling out

Table 5. Results of combinations and focused comparisons involving judgement strategies

	Estimation (k = 28)	Assignment (k = 23)
CELL A		
r	.342	.157
z	2.335	0.948
p	.00977	.17157
part r	−.087	
z	0.599	
p	.27459	
CELL D		
r	−.343	−.180
z	2.335	1.075
p	.00977	.14108
part r	−0.360	
z	2.488	
p	.00642	
CELL A – CELL B		
r	.388	.157
z	2.666	0.948
p	.00383	.17157
part r	0.097	
z	0.678	
p	.24889	
Sum of diagonals		
r	.342	.157
z	2.335	0.948
p	.00977	.17157
part r	−.087	
z	0.599	
p	.27459	

the variability of each of the other strategies. These analyses reveal that the 'paired distinctive' CELL D strategy emerges as the strongest independent predictor of the illusory correlation effects. Equivalent analyses were not feasible for assignment because all four strategies formulated predictions which were almost perfectly correlated.

Interactive effects of valence of distinctive behaviour

Given the influence of the valence of the distinctive behaviour demonstrated above, the possible influence of valence on the effects of the number of exemplars and on the predictive power of the various judgement strategies was examined. However, for both measurements, there were no apparent trends for the effects of the number of exemplars or the various judgement strategies to vary as a function of the valence of the distinctive behaviour.

Discussion

First and foremost, the general combinations and comparisons reveal that, for both estimation and assignment operationalizations, the illusory correlation effect is highly significant and of moderate magnitude. These effects seem to be quite robust and not easily characterized as lacking in strength or replicability. Therefore, the illusory correlation in stereotyping effect appears to have genuine potential 'practical relevance' as well as theoretical interest.

Several interesting patterns emerge from these analyses. Notably, these effects were significantly greater, for both measurements, when the distinctive behaviour was negative in valence. This is consistent with both the expectation-based account and the salience account for illusory correlation effects. Two facets of this particular pattern should be emphasized. First, although the benefit of hindsight may make this pattern seem unsurprising, it is entirely possible that this very reasonable pattern might not have obtained. Indeed, the few studies that have considered the valence of the distinctive behaviour have conveyed the impression that it has no effect (e.g. Hamilton & Gifford, 1976; Schaller & Maass, 1988). These meta-analytic results provide the first demonstration of the effect of valence on the illusory correlation in stereotyping effect. Second, this pattern has the problem of being *too* reasonable. That is, there are two good reasons for its occurrence, and we do not yet know which reason provides the more compelling account. Stronger illusory correlation effects for negative distinctive behaviours makes perfect sense in terms of an expectation-based contribution to distinctiveness-based illusory correlation (Spears *et al.*, 1986, 1987). It also makes perfect sense in terms of a salience contribution to distinctiveness-based illusory correlation effects (Spears *et al.*, 1985). Future research should be directed towards delineating the specific mechanisms for these effects of valence.

The demonstration of an increase in the illusory correlation effect as a function of the number of exemplars indicates that the basic illusory correlation effect increases as a function of the memory requirements of the task. Once again, this is a pattern which may seem to be completely unsurprising through the benefit of hindsight. However, this perfectly reasonable pattern might not have occurred. These meta-analytic results represent the first demonstration of the effect of the number of exemplars on illusory correlation in stereotyping effects. These results suggest a particularly disturbing component of the extension of this paradigm to the natural development of stereotypes. In everyday processing of information about different groups engaging in different types of behaviour, the individual is likely to be exposed to many times the 40 exemplars which subjects saw in the laboratory experiment. Future research might be directed towards identifying the upper limit of the effects of memory load on illusory correlation in stereotyping.

The most predictive strategy for covariation judgement appears to be the paired distinctive strategy. Again, it is not necessary to assume that subjects intentionally follow this strategy by performing intricate calculations (cf. Lewicki, 1986). However, the significant predictive power of the paired distinctive strategy indicates that subjects seem to be integrating and responding to the information being presented in the illusory correlation paradigm – they simply seem to be doing so in a suboptimal fashion. Moreover, the predictive power of the paired distinctive strategy suggests that subjects are especially responsive to the paired distinctive cell representing the performance of the rare behaviour by members of the smaller group. The so-called distinctiveness-based illusory correlation effect really does seem to be based, at least in part, on distinctiveness.

The present approach to judgement strategies represents a meta-analytic implementation of what Shaklee (1983) has identified as the 'correlational technique': subjects' covariation judgement ratings (or, in this case, the magnitude of illusory correlation effects) are correlated with predictions formulated by judgement strategies. The 'rule analytic technique', as described by Shaklee (1983), involves the use of stimulus arrays in covariation judgement problems which optimally differentiate between the various judgement strategies (for example, see Arkes & Harkness, 1983; Shaklee & Mims, 1982). The uneven and narrow distribution of stimulus arrays used in this research domain was obviously not devised in an effort to determine the judgement strategies employed by subjects. Social psychologists studying illusory correlation effects should begin to employ more intentionally designed configurations of exemplars, in order to provide more powerful tests of the covariation judgement strategies used by subjects in the illusory correlation paradigm.

It is interesting to note that effects were generally stronger for estimation hypothesis tests than for assignment hypothesis tests. For example, collapsing all of the hypothesis tests in Table 1 into a single database, a focused comparison of effect sizes between estimation and assignment hypothesis tests gave a rsult of $z = 1.708$, $p = .04383$. This is an aspect of the paradigm which has not been mentioned in the primary level examinations of illusory correlation effects. We recall that the effects under consideration in this domain represent errors of deviation from a true correlation of zero. Thus, the assignment–recognition measurements may be eliciting slightly less biased, more accurate judgements than the more susceptible estimation – recall measurements. The greater sensitivity of reconstruction/recall to memory load requirements has been demonstrated elsewhere in the judgement of covariation (e.g. Arkes & Harkness, 1983; Beyth-Marom, 1982; Shaklee & Mims, 1982; Ward & Jenkins, 1965). Also consistent with this interpretation is the fact that the overall effects of the number of exemplars were slightly stronger for estimation hypothesis tests than they were for assignment hypothesis tests. This is to be expected if the assignment measurement involves more recognition, and the estimation measurement involves more recall.

In conclusion, these analyses reveal that the basic illusory correlation effect is highly significant and of moderate strength. There is a considerable amount of variability in these effects. However, this variability seems attributable to some predicted effects of valence of the distinctive behaviours and the number of exemplars in the stimulus array presented to subjects. As always, patterns identified at the level of a meta-analysis should be examined at the primary level of analysis where spurious influences can be better controlled. Researchers wishing to pursue illusory correlation effects might be best advised to use a large number of exemplars and to construct the 2×2 stimulus array such that the distinctive behaviour is negatively valenced, so as to maximize the magnitude of these effects. Future research should be directed towards further delineation of the precise judgement strategies followed in making these covariation judgements, perhaps using Shaklee's rule-analytic technique. In addition, future research should be directed towards determining the upper limit of the effects of memory load requirements on illusory correlation effects, and towards contrasting the expectation-based and the salience accounts for the effects of valence of the distinctive behaviour on illusory correlation effects.

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References

Acorn, D. A., Hamilton, D. L. & Sherman, S. J. (in press). Generalization of biased perceptions of groups based on illusory correlations. *Social Cognition.*

Adi, H., Karplus, R., Lawson, A. & Pulos, S. (1978). Intellectual development beyond elementary school: VI. Correlational reasoning. *School Science and Mathematics*, 78, 675–683.

Arkes, H. R. & Harkness, A. R. (1983). Estimates of contingency between two dichotomous variables. *Journal of Experimental Psychology: General*, 112, 117–135.

Beyth-Marom, R. (1982). Perception of correlation reexamined. *Memory and Cognition*, 10, 511–519.

Chapman, L. J. (1967). Illusory correlation in observational report. *Journal of Verbal Learning and Verbal Behavior*, 6, 151–155.

Chapman, L. J. & Chapman, J. P. (1967). Genesis of popular but erroneous psychodiagnostic observations. *Journal of Abnormal Psychology*, 12, 193–204.

Chapman, L. J. & Chapman, J. P. (1969). Illusory correlation as an obstacle to the use of valid psychodiagnostic signs. *Journal of Abnormal Psychology*, 74, 271–280.

Cohen, J. (1977). *Statistical Power Analysis for Behavioral Sciences*. New York: Academic Press.

Cooper, H. M. (1982). Scientific guidelines for conducting integrative research reviews. *Review of Educational Research*, 52, 291–302.

Crawley, D. M. & Regan, D. T. (1984). Illusory correlation and stereotype formation: Replication and extension. Paper presented at the annual meeting of the American Psychological Association, Toronto, Ontario.

Feldman, J. M., Camburn, A. & Gatti, G. M. (1986). Shared distinctiveness as a source of illusory correlation in performance appraisal. *Organizational Behaviour and Human Decision Processes*, 37, 34–59.

Fiedler, K., Hemmeter, U . & Hofman, C. (1984). On the origin of illusory correlations. *European Journal of Social Psychology*, 14, 191–201.

Gilman, S. L. (1985). *Difference and Pathology: Stereotypes of Sexuality, Race, and Madness*. Ithaca, NY: Cornell University Press.

Glass, G. (1976). Primary, secondary, and meta-analysis of research. *Educational Research*, 5, 3–8.

Hamilton, D. L. (1976). Cognitive biases in the perception of social groups. In J. S. Carroll & J. W. Payne (Eds), *Cognition and Social Behavior*. Hillsdale, NJ: Erlbaum.

Hamilton, D. L. (1979). A cognitive-attributional analysis of stereotyping. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology*, vol. 12. New York: Academic Press.

Hamilton, D. L. (1981). Illusory correlation as a basis for stereotyping. In D. L. Hamilton (Ed.), *Cognitive Processes in Stereotyping and Intergroup Behavior*. Hillsdale, NJ: Erlbaum.

Hamilton, D. L., Dugan, P. M. & Trolier, T. K. (1985). The formation of stereotypic beliefs: Further evidence for distinctiveness-based illusory correlation. *Journal of Personality and Social Psychology*, 48, 5–17.

Hamilton, D. L. & Gifford, R. K. (1976). Illusory correlation in interpersonal perception: A cognitive basis of stereotypic judgements. *Journal of Experimental Social Psychology*, 12, 392–407.

Hamilton, D. L. & Rose, T. L. (1980). Illusory correlation and the maintenence of stereotypic beliefs. *Journal of Personality and Social Psychology*, 39, 832–845.

Hamilton, D. L. & Sherman, S. J. (in press). Illusory correlations: Implications for stereotype theory and research. In D. Bar-Tal, C. F. Graumann, A. W. Kruglanski & W. Stroebe (Eds), *Stereotypes and Prejudice: Changing Conceptions*. New York: Springer-Verlag.

Jones, R. A., Scott, J., Solernou, J., Noble, A., Fiala, J. & Miller, K. (1977). Availability and formation of stereotypes. *Perceptual and Motor Skills*, 44, 631–638.

Kanouse, D. E. & Hanson, L. R. (1972). Negativity in evaluations. In E. E. Jones *et al.* (Eds), *Attribution: Perceiving the Causes of Behavior*. Morristown, NJ: General Learning Press.

Lewicki, P. (1986). *Nonconscious Social Information Processing*. Orlando, FL: Academic Press.

Miller, N. (1988). Meta-analytic model testing in social psychology. Symposium presented at the Annual Meeting of the American Psychological Association, Atlanta, GA.

Mullen, B. (1989). *Advanced BASIC Meta-analysis*. Hillsdale, NJ: Erlbaum.

Mullen, B. & Hu, L. (1988). Social projection as a function of cognitive mechanisms: Two meta-analytic integrations. *British Journal of Social Psychology*, 27, 333–356.

Mullen, B. & Hu, L. (in press). Perceptions of ingroup and outgroup variability: A meta-analytic integration *Basic and Applied Social Psychology*.

Mullen, B. & Rosenthal, R. (1985). *BASIC Meta-analysis: Procedures and Programs*. Hillsdale, NJ: Erlbaum.

Nisbett, R. & Ross, L. (1980). *Human Inference: Strategies and Shortcomings of Social Judgement*. Englewood Cliffs, NJ : Prentice-Hall.

Nisbett, R. & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, 84, 231–259.

Pryor, J. B. (1986). The influence of different encoding sets upon the formation of illusory correlations and group impressions. *Personality and Social Psychology Bulletin*, 12, 216–226.

Ritchie, M. H., McClelland, L. & Shimkunas, A. M. (1967). Relative importance of positive and negative information in impression formation and persistence. *Journal of Personality and Social Psychology*, 6, 322–327.

Rosenthal, R. (1980) (Ed.). *Quantitative Assessment of Research Domains*. San Francisco, CA: Jossey-Bass.

Rosenthal, R. (1984). *Meta-analytic Procedures for Social Research*. Beverly Hills, CA: Sage.

Rothbart, M. (1981). Memory processes and social beliefs. In D. L. Hamilton (Ed.), *Cognitive Processes in Stereotyping and Intergroup Behavior*. Hillsdale, NJ: Erlbaum.

Ruvolo, C. & Hamilton, D. L. (1988). Unpublished data. University of California–Santa Barbara.

Schaller, M. & Maass, A. (1987). Illusory correlations and social categorization: Toward an integration of motivational and cognitive factors in stereotype formation. Unpublished manuscript, Arizona State University.

Shaklee, H. (1983). Human covariation judgement: Accuracy and strategy. *Learning and Motivation*, 14, 433–448.

Shaklee, H. & Mims, M. (1982). Sources of error in judging event covariation: Effects of memory demands. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 8, 208–224.

Shaklee, H. & Tucker, D. (1980). A rule analysis of judgements of covariation between events. *Memory and Cognition*, 8, 459–467.

Sherman, S. J., Hamilton, D. L. & Roskos-Ewoldsen, D. R. (1988). Attenuation of illusory correlation. Unpublished manuscript, Indiana University.

Smedslund, J. (1963). The concept of correlation in adults. *Scandinavian Journal of Psychology*, 4, 165–173.

Spears, R., Eiser, J. R. & van der Pligt, J. (1987). Further evidence for expectation-based illusory correlations. *European Journal of Social Psychology*, 17, 253–258.

Spears, R., van der Pligt, J. & Eiser, J. R. (1985). Illusory correlation in the perception of group attitudes. *Journal of Personality and Social Psychology*, 48, 863–875.

Spears, R., van der Pligt, J. & Eiser, J. R. (1986). Generalizing the illusory correlation effect. *Journal of Personality and Social Psychology*, 51, 1127–1134.

Titus, W. C. (1982). Illusory correlation-based biases in the processing of implicational information. Unpublished PhD dissertation, Miami University.

Tversky, A. & Kahneman, D. (1974). Judgement under uncertainty: Heuristics and biases. *Science*, 185, 1124–1131.

Ward, W. & Jenkins, J. (1965). The display of information and the judgement of contingency. *Canadian Journal of Psychology*, 19, 231–241.

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