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PERCEIVED CONTROL AND THE OPTIMISTIC BIAS: A META-ANALYTIC REVIEW

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People consistently believe that negative events are less likely to happen to them than to others. Research suggests a relationship between this optimistic bias and perceived control such that the greater control people perceive over future events, the greater their optimistic bias. We conducted a meta-analysis of 27 independent samples to quantify the size of this relationship and examine what variables moderated the relationship. Greater perceived control was significantly related to greater optimistic bias, but this relationship was moderated by participant nationality, student status, risk status, and the type of optimistic bias measure used. We discuss the findings in the context of primary versus secondary control.

Keywords: Perceived control; Optimistic bias

The optimistic bias refers to people's tendency to think their risk is less than that of their peers. It is a remarkably resilient phenomenon that researchers have investigated extensively (Weinstein and Klein, 1996). People believe that they are less at risk than their peers for many negative events, such as getting cancer, becoming alcoholics, getting divorced, or getting injured in a car accident (Weinstein, 1980). The optimistic bias exists for both men and women and across age and educational levels (Weinstein, 1987).

The optimistic bias can be assessed either directly or indirectly (Weinstein and Klein, 1996). When the optimistic bias is assessed directly, an individual makes a single comparative risk estimate of his or her likelihood of experiencing a future event relative to a target's likelihood of that same event. The target is usually "an average other" of similar age and gender. When the optimistic bias is assessed indirectly, the individual makes two estimates, one estimate of his or her own likelihood and a separate estimate of a target's likelihood of an event occurring in the future. To create a comparative risk estimate, the researcher subtracts the two estimates. Some evidence suggests that the direct method tends to produce greater bias than the indirect method, and that fewer response choices on the scale results in greater bias than a greater number of response choices (Otten and van der Pligt, 1996; although see Welkenhuysen *et al.*, 1996).

The optimistic bias is relatively rarely investigated as the difference between actual risk and perceived risk likely because of the difficulty associated with accurately assessing the actual likelihood of an event occurring in the future (see Kreuter and

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Stretcher, 1995; Rothman *et al.*, 1996). Interestingly, when comparing people's risk estimates with the actual objective outcome, it appears that people are realistic (that is, relatively accurate) about their own risk but pessimistic about the risk of other people (Shepperd, 2000).

The Link Between Optimistic Bias and Perceived Control

Numerous studies report a positive relationship between perceptions of control and the optimistic bias such that the greater perceived control over the outcome of an event, the greater the optimistic bias for that event (for review see Harris, 1996). For instance, Weinstein (1980) reported that people possessed greater optimism for controllable events (e.g., attempting suicide) than for uncontrollable events (e.g., being victimized by burglary). In addition, a recent review of the optimistic bias literature revealed that controllability functions primarily as a personal risk moderator (Helweg-Larsen and Shepperd, 2001). That is, perceptions of control are associated with perceptions of personal risk estimates rather than target risk estimates. The greater one's perception of control, the lower one's personal risk estimates. However, the evidence is inconsistent as to whether control also serves as a target risk moderator, e.g., whether perceptions of personal control influence judgments of other people's risk. The authors concluded that the optimistic bias was only weakly related to perceptions of other people's risk. From this evidence, it seems that the strong optimistic bias and perceived control link is primarily due to control influencing perceptions of own risk rather than perceptions of target risk.

Despite the large number of studies supporting a positive relationship between perceived control and the optimistic bias, some studies have failed to replicate this effect (Darvill and Johnson, 1991; van der Velde *et al.*, 1992; Sparks *et al.*, 1994; van der Velde *et al.*, 1994; Welkenhuysen *et al.*, 1996). For example, van der Velde *et al.* (1994) found that prostitutes' self-reported comparative risk estimates of contracting a sexually transmitted disease, although optimistically biased, were not related to their perceptions of control. These studies may provide useful information when investigating potential underlying mechanisms of the relationship. Studies that have not replicated the positive correlation may systematically differ from studies that do find this correlation.

We conducted a meta-analysis to gain a better understanding of the mechanisms underlying the relationship between the optimistic bias and perceived control. Harris (1996) presented an overview of the articles investigating the relationship between the optimistic bias and control, but did not present a statistical average of the effect sizes nor attempt to identify moderators. In the present meta-analysis, we examined the overall strength of the optimistic bias and control relationship. Furthermore, we examined potential moderators of this relationship, including participant nationality, student status, risk status, and the type of optimistic bias measure used. We did not make any specific predictions regarding the effects of the moderators.

METHOD

Three criteria for inclusion in the meta-analysis were established to ensure that each study was a valid estimation of the relationship in question. First, given that the optimistic bias is defined as estimation of personal risk relative to estimation of a target's risk, we included only studies that measured both personal risk estimates and target risk estimates using either the direct or indirect method. Second, we included only studies that contained a measure of perceived control. Third, we included only studies that contained a statistical estimation of the relationship between optimistic bias and perceived control.

Based on these criteria, we identified 22 research studies (yielding 27 independent samples) by searching references in relevant literature reviews (i.e., Harris, 1996; Helweg-Larsen and Shepperd, 2001) and the computerized database PsycINFO (1967–July 2001). Keywords used in the database search included "unrealistic optimism," "optimistic bias," "comparative optimism," "relative risk estimates," "comparative risk estimates," "control," "self-efficacy," "perceived efficacy" and "preventability". We coded the following variables for each study: (a) name of journal, (b) year of publication, (c) number of participants, (d) nationality of participants (U.S. or non-U.S. country), (e) type of participant (student or non-student, high or low risk)[1], (f) operationalization of control (general or specific), (h) measure of comparative optimism (direct or indirect), (i) effect size estimate, and (j) significance level.

The effect size for each study was represented by the correlation coefficient between perceptions of control and optimistic bias. When the correlation coefficient *r* was not reported, it was computed based on available (a) *ts* or *Fs*, or (b) means, standard deviations and sample sizes. We used the meta-analytic procedures as described by Hedges and Olkin (1985). The computation of *d* was based on the transformation of the correlation coefficient *r* using the meta-analytic statistical package, DSTAT (Johnson, 1989). Because studies with larger sample sizes generally produce more reliable effect size estimates, we adjusted for sample size. This allowed each study to contribute proportionally in the calculation of average effect sizes. One of the studies provided data from three independent samples (Quadrel *et al.*, 1993) and another study (Welkenhuysen *et al.*, 1996)[2] provided two effect size estimates for a single sample, one based on the direct measure of optimistic bias and the other based on the indirect measure. A single effect size was calculated for the latter study by averaging the two estimates as suggested by Rosenthal (1991).

Confidence intervals were computed to assess the statistical significance of average effect sizes. To test for homogeneity within average effect sizes, QW was calculated as the variance found within a group of studies. To test for differences between effect sizes, QB was calculated as the variance found between groups compared in the moderator analyses.

RESULTS

Table I presents a summary of the studies included in the meta-analysis and their attributes. The correlation coefficients ranged from −0.01 to 0.95 with the average control-optimistic bias effect size $r = 0.31$ ($N = 27$). The average *d* was 0.64 with

[1]High risk participants were defined as those participants who were at increased risk for experiencing the event for which they made risk estimates. Low risk participants were not at any increased risk.

[2]For each of the independent samples in this study, a non-exact *p*-value was provided. In the case that a *p*-value was described as non-significant, a conservative *p*-value of 0.50 was assumed for calculations.

TABLE I Studies included in the meta-analysis

Study	*Total N*	*Effect size*	*Subject population*	*Nationality*	*Optimistic bias measure*
Abele and Hermer (1993)	96	0.74	Students	German	Indirect
Darvill and Johnson (1991)	109	0.67	Students	U.S.	Direct
DeJoy (1989)	106	6.04	Students	U.S.	Direct
Drake (1987)	26	0.80	Right-handed students	U.S.	Direct
Higgins *et al.* (1997)	78	0.20	Students	Canadian	Indirect
Hoorens and Buunk (1993)	82	0.69	High school Students	Dutch	Indirect
McKenna (1993), Study 1	99	1.00	Students	U.K.	Direct
McKenna (1993), Study 2	60	1.37	Students	U.K.	Direct
Murray and Holmes (1997)	406	1.75	Married students/Others	U.S.	Direct
Quadrel *et al.* (1993), Sample 1	86	0.17	Adults	U.S.	Indirect
Quadrel *et al.* (1993), Sample 2	86	0.08	Students	U.S.	Indirect
Quadrel *et al.* (1993), Sample 3	95	0.12	Students	U.S.	Indirect
Sparks and Shepherd (1994)	216	4.68	General population	U.K.	Direct
Sparks *et al.* (1994)	209	−0.02	General population	U.K.	Direct
Sparks *et al.* (1995)	598	0.58	General population	U.K.	Direct
van der Velde *et al.* (1992)	462	0.01	Visitors of STD clinic	Dutch	Indirect
van der Velde *et al.* (1994)	881	0.02	High risk adults	Dutch	Indirect
Vaughan (1993)	268	0.30	Farm workers	Mexican	Indirect
Weinstein, C.S. (1988)	118	1.61	Education students	U.S.	Indirect
Weinstein, N.D. (1980)	120	1.21	Female students	U.S.	Direct
Weinstein, N.D. (1982)	100	0.65	Students	U.S.	Direct
Weinstein, N.D. (1987)	296	1.01	General adult population	U.S.	Direct
Welkenhuysen *et al.* (1996)	164	−0.02	Students	Belgian	Direct/Indirect
Whalen *et al.* (1994), Study 1	244	2.01	Sixth graders	U.S.	Indirect
Whalen *et al.* (1994), Study 2	73	2.24	Sixth graders	U.S.	Indirect
Zakay (1984), Study 1	32	1.16	Male students	Israeli	Indirect
Zakay (1984), Study 2	32	1.07	Male students	Israeli	Indirect

a 95% confidence interval of 0.60 to 0.68. Combined, the significance level of the control-optimistic bias effect sizes was $Z = 30.48$, $p < 0.0001$. This finding is robust, but it only estimates the relationship between control and optimistic bias in published studies. It is possible that unpublished studies (if included) would render this result insignificant. However, the 'fail-safe *N*' indicates that 385 unpublished studies reporting zero correlations would be required to invalidate this result (Mullen, 1989; Rosenthal, 1991). Because it is unlikely that there are so many unpublished studies, the average control-optimistic bias effect size can be reported with confidence as significantly different from zero.

Further analyses revealed that the estimates of this relationship are not homogenous, $QW = 1605.66$, $p < 0.0001$, $N = 27$. This test provides sufficient justification to search for systematic differences between studies.

Moderator Variables

We chose moderator variables based on theoretical interest as well as availability of information. With only 27 independent samples included in the analysis, there were insufficient data to examine some moderators, such as type of event (most articles report all events combined) or positive *vs.* negative events (most optimistic bias articles examine only negative events). We examined the following moderator variables: participant nationality, student status, risk status of participants, and the type of measure of optimistic bias and control. The results and test statistics are summarized in Table II.

Nationality

We speculated that the relationship between the optimistic bias and perceived control might differ based on the participants' nationality. We divided the studies into two categories: those with U.S. participants and those with non-U.S. participants. The results revealed that studies using U.S. participants ($N = 13$, $r = 0.53$) had a significantly larger average control-optimistic bias effect size than studies whose sample was non-U.S. participants ($N = 14$, $r = 0.18$).

Student vs. Non-student Samples

We split the studies into two categories: those with student samples and those with non-student samples. The average effect size for studies using students of all ages ($N = 18$) was $r = 0.43$, and for studies using non-students of all ages ($N = 9$) the average effect size was $r = 0.24$. The difference in effect sizes between these two categories was significant. Thus, the correlation between control and optimistic bias was greater among students than non-students.

Because U.S. samples were more likely than non-U.S. samples to use student participants, we investigated the student/non-student differences in U.S. and non-U.S. samples separately. In the U.S. sample, students ($r = 0.48$) showed greater average effect sizes than non-students ($r = 0.42$). In the non-U.S. sample students

TABLE II Moderators of the relationship between control and optimistic bias

		Weighted					
		k	*r*	*d*	*CI (d)*	*Q (bet)*	*p*
Population	Student	18	0.43	0.94	0.87–1.02	95.54	<0.0001
	Non-Student	9	0.24	0.50	0.45–0.55		
Non-Student	High Risk	3	0.04	0.09	0.02–0.16	285.73	<0.0001
	Low Risk	6	0.43	0.95	0.88–1.02		
Nationality	U.S.	13	0.53	1.23	1.16–1.31	378.66	<0.0001
	Other	14	0.18	0.36	0.31–0.41		
Optimistic Bias Measure	Direct	13	0.43	0.94	0.88–1.00	187.78	<0.0001
	Indirect	15	0.18	0.37	0.32–0.42		
Control Measure	Specific	24	0.30	0.64	0.60–0.68	0.74	<0.50
	General	3	0.34	0.73	0.53–0.93		

Note: r = correlation coefficient, d = unweighted effect size estimate, CI = confidence interval, QW = test for homogeneity, QB = test for differences between groups.

($r = 0.30$) also showed greater average effect sizes than non-students ($r = 0.23$). Thus, the difference between students and non-students is not merely a reflection of U.S. samples using student participants. It appears that U.S. samples show greater effect sizes than non-U.S. samples and that (in both countries) student samples show greater effect sizes than non-student samples.

Non-student Samples: High Risk vs. Low Risk Samples

Further tests revealed that the non-student sample was not homogenous, QW = 943.58, $N = 9$, $p < 0.0001$, indicating differences within the sample. Based on this evidence and a closer inspection of the types of non-student samples used, we split the studies in the non-student category into two subcategories: high risk samples and low risk samples. We found a large difference in the average effect size for each group such that the control-optimistic bias relationship for the not at-risk sample ($N = 6$, $r = 0.43$) was much larger than the relationship for the at-risk sample ($N = 3$, $r = 0.04$).

Direct vs. Indirect Measure of Optimistic Bias

We divided the studies into two categories based on whether they used a direct or indirect measure of the optimistic bias. Past research reveals that the direct method tends to produce greater optimistic bias than the indirect method (Otten and van der Pligt, 1992). We found that studies using the direct method reported a stronger association between optimistic bias and control ($N = 13$, $r = 0.43$) than studies using the indirect method ($N = 16$, $r = 0.18$).

General vs. Specific Measure of Control

Studies were divided into two categories based on their use of general or specific measures of control. Specific measures of control were operationalized as those asking about perceived control regarding a specific event whereas general measures of control were operationalized as control scales such as the Locus of Control (Rotter, 1966) or Desirability of Control (Burger and Cooper, 1979). We found that studies using specific measures of control ($N = 24$, $r = 0.30$) did not produce a significantly stronger optimistic bias–control relationship than studies using general measures of control ($N = 3$, $r = 0.34$).

In sum, we found that there is an overall effect between control and optimistic bias accounting for 10% of the variance. Greater perceived control was clearly related to greater optimistic bias. In addition, this relationship was relatively stronger among U.S. samples (as opposed to non-U.S. samples), students (as opposed to non-students), not-at-risk non-students (as opposed to at-risk non-students), when using the direct method of measuring the optimistic bias (as opposed to the indirect method), and was not significantly stronger for more specific (as opposed to general) measures of control.

Multiple Regression Analysis

In order to assess the simultaneous impact of the moderator variables, we conducted a weighted least squares multiple regression analysis. For this analysis, the moderator variables were dummy coded. The model included Student Status (Student *vs.* Non-Student), Nationality (U.S. *vs.* Non-U.S.), Measure of Optimistic Bias (Direct *vs.* Indirect), Measure of Control (General *vs.* Specific) and the constant as predictors. The effect size for each study was entered as the dependent variable. Furthermore, the model was weighted by sample size. The multiple regression analysis revealed that the model was significant, $F(4,25) = 4.71$, $p = 0.007$. The only significant predictor in this multiple regression analysis was Measure of Optimistic Bias, $b = -0.24$, $B = -0.41$, $SE(b) = 0.10$, $p = 0.02$, although Nationality was marginally significant, $b = 0.21$, $B = 0.35$, $SE(b) = 0.11$, $p = 0.08$. Of the remaining predictors, neither Student Status nor the Measure of Control contributed significantly to the model.

DISCUSSION

This meta-analysis of the relationship between optimistic bias and perceived control showed a strong association between the two constructs. In addition this relationship was moderated both by sample variables (such as nationality, student status, and risk status) as well as how optimistic bias was operationalized.

Sample Characteristics as Moderators

These results can be understood in the context of research on primary and secondary control (Rothbaum *et al.*, 1982). Primary control involves direct action taken by the individual to change his or her situation or outcomes (i.e., behavioral control). Secondary control involves indirect or passive ways of influencing the situation (i.e., cognitive control). According to Rothbaum *et al.* (1982) secondary control can include predictive control (changing expectations or attributions of success), illusory control (relying on luck or fate), vicarious control (relying on powerful others), and interpretive control (understanding and deriving meaning from the situation). For discussion of other types of secondary control, see also Fiske and Taylor (1984) and Thompson (1981). It appears that populations that rely more heavily on primary control (U.S. samples, students, and low risk adults) are more likely to show a strong association between perceived control and optimistic bias.

We found that studies using U.S. participants exhibited a stronger association between optimistic bias and control than did studies using non-U.S. participants. Primary control is based on the individual taking action and responsibility. In general, capitalistic societies emphasize power and responsibility of the individual. Personal responsibility and control is deeply ingrained in American culture, especially with respect to financial status and health (Brownell, 1991). American adults generally believe they have a great deal of control over their future health and believe that behavioral actions can keep them healthy (Brownell, 1991). Looking specifically at primary control research shows that it plays an important role in the U.S. especially in health related decisions. Similarly, it appears that primary control is less important and less pervasive as a coping mechanism for non-U.S. individuals (Weisz *et al.*, 1984). Thus, in a culture (such as the U.S.) where primary control is seen as essential and prevalent it is not surprising that control is more highly related to other judgments such as risk estimations.

The importance of people's place on primary control may also vary across age. We found that the control–optimistic bias association was stronger among college students (that is, younger adults) than non-college students (that is, older adults). Again research on the use of primary versus secondary control can help interpret these findings. Primary control first increases from birth through middle age and then decreases in old age. Thus, as people lose their ability to use primary control effectively they tend to switch to secondary types of control (Schulz *et al.*, 1991). Thus, young people are more likely to have strong beliefs in personal control and it is therefore not surprising that we find that control beliefs are more likely to be associated with other beliefs, such as risk judgments.

Finally, we found that low risk samples compared with high risk samples showed a stronger association between optimistic bias and control. Again primary control can help us understand these results. It is possible that people who are at risk (such as prostitutes visiting a STD clinic) have learned to rely on secondary control strategies rather than primary control. People at high risk might also have learned that they are in fact not good at controlling their risk outcomes and therefore do not see such a high correspondence between control and risk judgments. Similarly, high risk individuals may see the negative event as inevitable and feel that they might be able to delay it but not avoid it forever. Again this may help explain the weak relationship between optimistic bias and control for high risk samples.

Measurement of Optimistic Bias and Control as Moderators

In the present meta-analysis, we found a stronger correlation between the optimistic bias and control in studies using the direct measure as opposed to the indirect measure. In addition, the regression analysis showed that the moderating effect of measure of optimistic bias held even when accounting for the influence of the other moderating variables. Past research has noted that the optimistic bias is more prevalent when measured directly rather than indirectly (Otten and van der Pligt, 1992; Klar *et al.*, 1996). When comparative optimism is measured directly, participants report in a single item whether their risk is greater than, less than or equal to a target person's risk for a particular event. When measured indirectly, participants respond to two items: one assessing their personal risk and one assessing the target's risk.

When assessing perceptions of risk via the direct measure, the contingency between personal estimates and behaviors might be more salient than when assessing risk via the indirect measure. Specifically, people's perception of their ability to control future behaviors may play a larger role in risk estimation if they are asked to estimate their risk relative to the risk of another person rather than if they are asked to estimate their risk independent of another person. Responding to the direct measure explicitly requires people not only to consider their own risk, but also to consider how their risk may differ from other people's risk. Thus, introducing the target (using the direct method) in the judgment process might introduce a second level of control that adds to the control–optimistic bias relationship. The indirect measure may be less likely to force such a comparison.

The method by which control was measured did not moderate the relationship between optimistic bias and control. Research shows that the more specific the measure, the more likely it will predict beliefs on a similar, specific domain. Likewise, the more general the measure of control, the less likely it is to predict specific beliefs (Ajzen and Fishbein, 1977; Ajzen, 1982). The lack of relationships here could possibly be attributed to the number of studies that used a general ($N = 3$) as opposed to a specific ($N = 24$) measure of control.

CONCLUSION

We suggest two directions for future research. First, the distinction between primary and secondary control appears to help explain when the optimistic bias and perceived control association varies in strength. Thus, it seems important that future research examine the effects of secondary control on risk estimates. People who believe that they have little primary control might believe they can do little to engage in health improving behavior (e.g., stop smoking). However, people in this situation might exert secondary control (e.g., trust a hypnotist to make them stop smoking). It is not clear if secondary control is also associated with risk perceptions.

Second, it is not clear in what causal direction the relationship between perceived control and optimistic bias flows. It is possible that beliefs in control over an outcome leads to more optimistic beliefs about the probability of that outcome. For example, if a woman believes she can control her HIV exposure she will make optimistic predictions about the likelihood of contracting HIV. However, it is also possible that optimistic beliefs lead to greater perceived control. For example, if the woman believes that her risk of contracting HIV is smaller than other people's (maybe it reduces her anxiety to believe this) this optimistic bias leads to greater perceived control. Of course these associations may be mediated or moderated by other variables, such as engaging in health protective behaviors. Clearly experimental studies are one avenue for examining these questions.

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