

Note: this is the unabridged methods section of "Threatening communication: A critical re-analysis and extension of meta-analyses to determine the behaviour change potential of threatening health information " (Peters, Ruiter & Kok, 2012). For the entire manuscript and/or supplementary documents, please see <http://fearappeals.com>.

Original Methods section:
(additional information included below)

Methods

In the description of the methods section, we followed the QUOROM guidelines (Moher et al., 2000) as much as possible (where these could be translated to a psychological experiment context, rather than a clinical intervention context).

However, this led to a very lengthy methods section. Therefore, we have decided to make this detailed methods section available at <http://fearappeals.com>, and have included the most relevant information here.

Inclusion (exclusion) criteria

The current meta-analysis used four inclusion criteria. First, threat, or a component of threat (severity or susceptibility) had to be manipulated. Second, efficacy, or a component of efficacy (response efficacy or self-efficacy) had to be manipulated. In these criteria, 'manipulated' not only means 'influenced'; there also had to exist at least two conditions with different values of these variables (e.g. 'low' and 'high', or 'absent' and 'present'), so studies increasing threat for all participants were excluded. Third, these manipulations had to be orthogonal, resulting in (at least) a 2x2 full factorial experimental design. Fourth, the outcome measure had to be behaviour. Only real behavioural measures were accepted. Requests for information or registrations for sessions, albeit technically behavioural measures, were not accepted, as such

behaviours are predicted by very different determinants from target behaviours (e.g. whereas self-efficacy for requesting information about quitting smoking can be assumed to be very high, self-efficacy for actually quitting is likely lower). In addition, because the review is a test of the EPPM which deals with threat to individuals themselves, the behaviour and threat had to concern the participants themselves directly. For example, studies about problems that concern others or about distal problems were excluded (such as a study about industrial whaling by Shelton & Rogers, 1981).

Although the aim of the current meta-analysis is mainly a re-analysis of the study outcomes already examined by previous reviews, we also tried to locate additional studies. Because the most recent meta-analysis was very recent (de Hoog et al., 2007), we limited ourselves to identifying additional articles using queries in bibliographic databases (see below). We imposed no restrictions regarding year of publication or language (but did not encounter any non-English articles).

Data sources

There were two channels for identifying relevant publications. First, a list of studies cited in prior reviews made available by De Hoog (de Hoog et al., 2007) was used to create a spreadsheet with each article's authors, year, title, and journal, which was then complemented with the abstracts (see G.-J. Y. Peters, 2012). In the first screening round, the screener (GJP) excluded studies on the basis of their abstract (i.e., if it was clear that there was no orthogonal manipulation of threat and efficacy, and/or no behavioural outcome measure). The full-text was acquired for studies that could not be excluded (see Figure 1), and these full-texts were screened by GJP in the second screening round to yield 13 initial inclusions (Chu, 1966; Dabbs & Leventhal, 1966; Duval & Mulilis, 1999; Griffeth & Rogers, 1976; Leventhal, Jones, & Trembly,

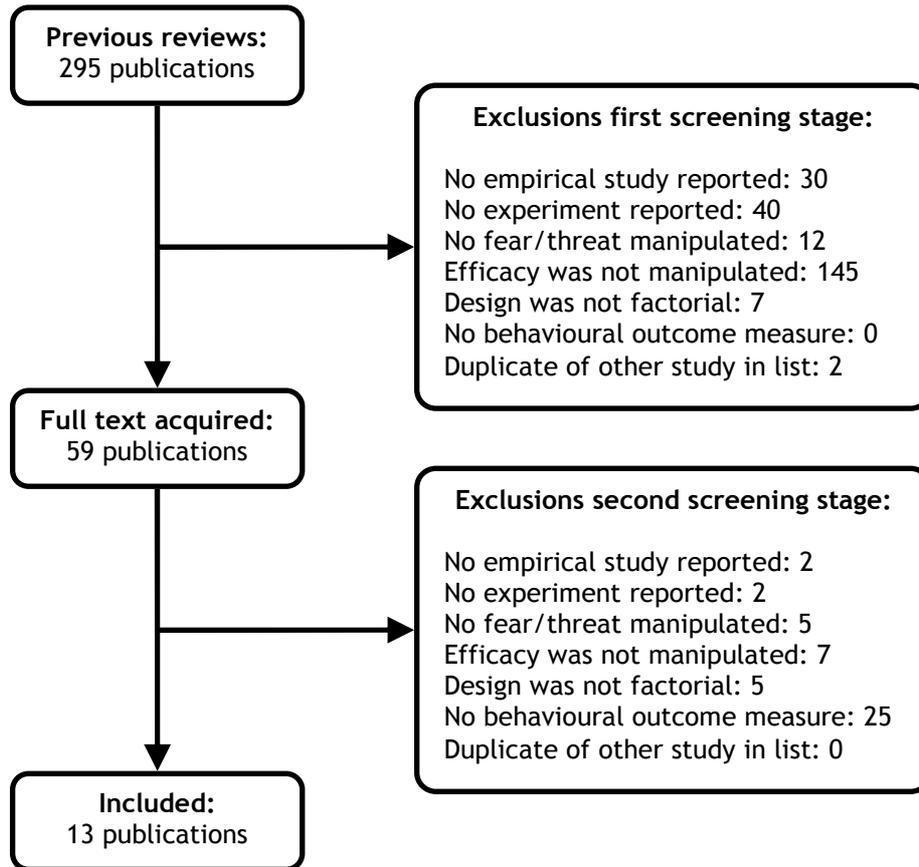


Figure 1: flowchart showing how the final 13 included publications resulted from processing the 295 publications cited in earlier reviews

1966; Leventhal, Singer, & Jones, 1965; Leventhal, Watts, & Pagano, 1967; Mulilis & Duval, 1995, 1997; Mulilis & Lippa, 1990; Witte, 1994; Wurtele, 1988; Wurtele & Maddux, 1987).

Second, additional relevant literature was identified through a series of queries in the databases PsycINFO and MedLine. The description of this procedure is very lengthy, and as these queries yielded only three additional studies (Grala & McCauley, 1976; Muthusamy, Levine, & Weber, 2009; Ordoñana, González-Javier, Espín-López, & Gómez-Amor, 2009), the detailed description of this procedure, including the flowcharts, are not included here (but available at <http://fearappeals.com>).

Data extraction

For the studies that were included on the basis of the first query, data was extracted through independent coding by RR and GK, using a coding form (available at <http://fearappeals.com>). However, the variation in designs, used measures, and analyses, and the scarcity of reported information that allowed straightforward computation of effect sizes, eventually necessitated examination of all original texts by one of the authors (GJP). Therefore, for the studies included on the basis of the second and third query, as well as on the basis of the list of publications cited in previous reviews, the effect data was extracted by GJP (the manipulation quality data was extracted independently by RR and GK, see below). The extracted data was entered into two spreadsheets (available at <http://fearappeals.com>): one summarizing descriptive study data and one to compute effect sizes (and convert effect sizes to Cohen's *d* where necessary).

The quality of the behavioural measure was directly extracted from the paper (self-report versus an objective measure). When several follow-up measurements were reported, the last measure was taken (Grala & McCauley, 1976; Leventhal et al., 1967). Manipulation quality was coded independently by GK and RR on the basis of extracts of the relevant fragments from the methods section. This coding was based, for threat, on validity of the severity manipulation and validity of the susceptibility manipulation; for efficacy, on validity of the response efficacy manipulation and validity of the self-efficacy manipulation; and for both, on the contrast between the conditions (as difference between the groups, not just the contents of the manipulation for the experimental group, determines effect size, see also de Bruin, Viechtbauer,

Hospers, Schaalma, & Kok, 2009). The two judgements were then averaged and dichotomised (see Table 1^{*}).

While extracting data, it became clear that a number of included studies did not report data that allowed effect size computation (e.g. only significant statistics from multivariate analyses of variance were reported). In these cases, the authors were contacted (Dabbs & Leventhal, 1966; Griffeth & Rogers, 1976; Leventhal et al., 1966; Mulilis & Duval, 1995, 1997; Mulilis & Lippa, 1990; Witte, 1994; Wurtele, 1988; Wurtele & Maddux, 1987). In all cases where authors replied, the data had been lost, with two exceptions. One author still had the original data and sent this (typed up as an appendix to a thesis; Wurtele & Maddux, 1987), and another author sent the appendix to a meta-analysis she conducted, which contained useable statistics (Witte, 1994). In the first case, it proved impossible to reconstruct which data belonged to which conditions (see G.-J. Y. Peters, 2012 for more information), so unfortunately this study could still not be included. In the second case, only the main effects of threat and efficacy were available. This was also the case for one other study (Leventhal et al., 1966). Thus, in the end, nine studies were included, seven of which provided effect sizes for the main effects of threat and efficacy, the interaction between those two, and the resulting simple effects; and two of which only provided effect sizes for the main effects (see Table 2^{*}).

Analyses

For each study, effect sizes were calculated for the main effects of threat and efficacy, their interaction, and the simple effects. When a study examined additional factors, these were collapsed to yield 2x2 designs (e.g., imminency in Chu, 1966), and when a study's threat and/or efficacy manipulation had three levels, only the lowest and

^{*} Note that Tables 1 and 2 are included in the full manuscript.

highest levels were used (e.g., Duval & Mulilis, 1999). When the dependent variable was dichotomous and had empty cells, 0.5 was added to all frequencies in the study to enable odds ratio calculation (cf. Deeks & Higgins, 2010). Odds ratios, the effect size calculated for studies with dichotomous dependent variables, were converted to Cohen's *d* (J. Cohen, 1988) to enable synthesis (Borenstein, Hedges, Higgins, & Rothstein, 2009; or see for a simpler formula Chinn, 2000). The values of Cohen's *d* were corrected for small sample sizes (i.e., *d* was converted to Hedges' *g*) by multiplication with *J* (Borenstein et al., 2009).

Finally, the data were imported into R (R Development Core Team, 2012) and the *metafor* package was used to fit fixed and random effects models (Viechtbauer, 2010). Fitting a random effects model in *metafor* provides a number of estimates of heterogeneity, of which we report *Q* (to test for significance of heterogeneity), and *I*² (as indicator of percentage of variation attributable to between-study effects; Higgins & Thompson, 2002; Huedo-Medina, Sánchez-Meca, Marín-Martínez, & Botella, 2006). Funnel plots and forest plots were generated and funnel plot asymmetry was tested using the regression test (with standard error as the predictor).

Additional information for this methods section:

(substitute this text for the second paragraph of the "Data Sources" section)

Second, additional relevant literature was identified through a series of queries in the databases PsycINFO and MedLine. The resulting hits were then downloaded as text-files and imported into a reference management program (Thomson Reuters, 2005), where duplicate entries (defined as entries having the same values in the author, year, title and publication type fields) were automatically detected and subsequently marked as such. The database was then exported to another reference management

program (JabRef Development Team, 2007), which enabled screeners to independently screen the title, abstract and keywords fields of each entry without being exposed to the other screener's result or additional information such as authors or journal. The screening procedure was slightly different for the first query and the last two queries, and is described below.

Queries

We have conducted several queries, each an improvement over the last version. The first query was conducted using the Ovid SilverPlatter WebSpirs interface (version 5.12) at the 11th of August 2008. At this time, our inclusion criteria were still less strict: we accepted soft outcome measures (i.e. intention in addition to behaviour) and accepted measurement, rather than manipulation, of efficacy. We only realised the flaws in this approach through studying the relevant literature while processing the results from these queries. This first query therefore had two components: synonyms of 'fear appeal' and synonyms of 'behaviour' or 'intention':

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((fear appeal? OR threat appeal? OR scare tactic? OR shock tactic? OR risk message? OR risk perception? OR risk communication? OR negative message? OR protection motivation OR threat perception? OR perceived risk? OR perceived threat? OR threat communication? OR risk appraisal? OR threat appraisal? OR fear arousal? OR warning label? OR extended parallel process model) AND (behavio?r OR intention OR action OR performance OR motivation OR acceptance)) IN TI,AB,SU:PSYI,SU:PY,KW:MEDS,MESH:MEDS) AND (LA=English) AND ((PT = JOURNAL) OR (PT = PEER-REVIEWED-JOURNAL) OR (PT = JOURNAL-ARTICLE))
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This query yielded 1887 hits. These were screened by two independent screeners (RR and GJP). These screeners attempted to establish for each entry whether the respective manuscript would meet the inclusion criteria. This was done by flagging every entry when one of the following (progressive) exclusion criteria applied: article is not empirical, not quantitative, or not about humans; article is not experimental (e.g.

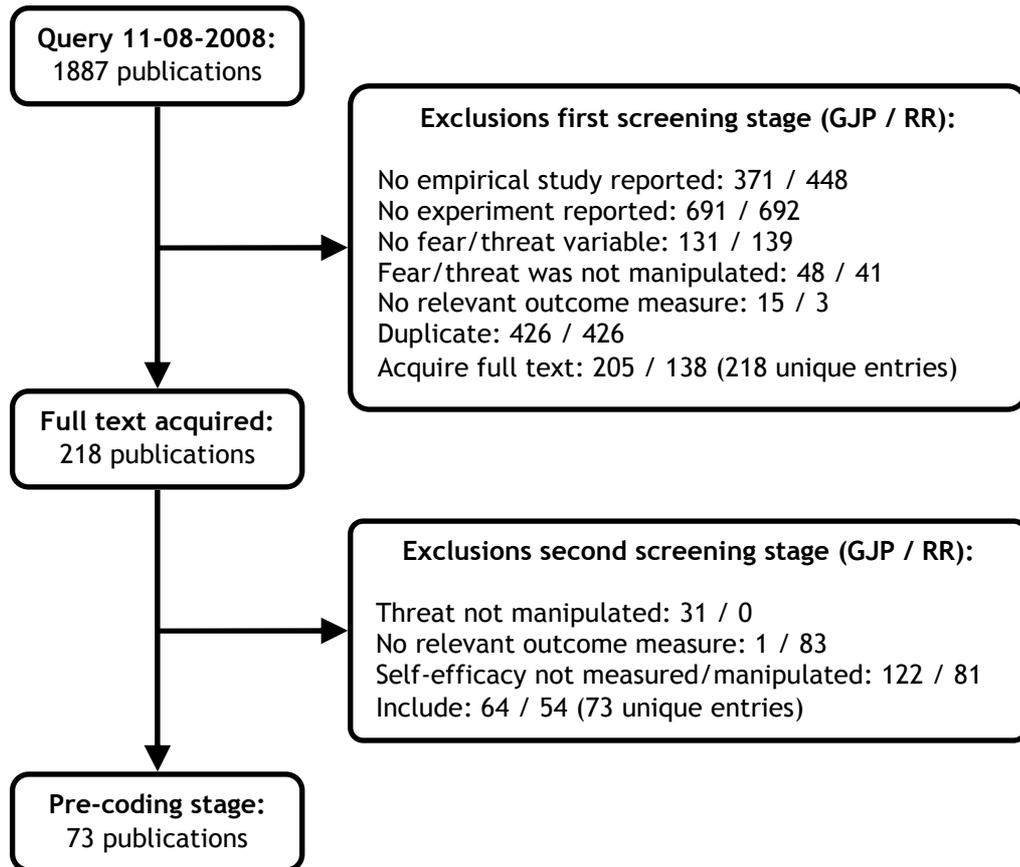


Figure 2: flowchart showing how the final 73 publications that entered the pre-coding stage resulted from processing the 1887 publications from the query at the 11th of August 2008.

nothing was manipulated between two or more conditions); article did not include a fear/threat variable; article did not manipulate threat, susceptibility or severity; article did not measure behaviour (or a proxy of behaviour) as a dependent variable (see Figure 2). Articles that could not be excluded were acquired (218 publications) and the full text was examined in the second screening stage. Here, the independent screeners applied these exclusion criteria: does not manipulate threat (or one of its components); does not measure or manipulate efficacy (or one of its components); does not measure behaviour or intention.

The second screening phase resulted in a final sample of 73 studies to be included. These studies were numbered, and the authors, journals and publication years were removed from the full texts by GJP. In the pre-coding phase, GK and RR

assessed each full text and indicated whether the dependent measure was indeed behaviour and whether self-efficacy was manipulated or only measured. All studies where at least one coder indicated that behaviour was measured and at least one author indicated that self-efficacy was manipulated were finally included and subsequently coded. This eventually yielded nine studies. Eight of these were duplicates of studies retrieved through inspection of the citations of earlier reviews (Griffeth & Rogers, 1976; Leventhal et al., 1965; Milne, Orbell, & Sheeran, 2002; Mulilis & Lippa, 1990; Sutton & Hallett, 1989; Tay & Watson, 2002; Witte, 1994; Wurtele & Maddux, 1987) and one was added to the pool of included studies (Grala & McCauley, 1976).

Perhaps because both screeners were conservative when excluding studies (e.g. when an abstract was insufficiently clear to allow a decision, an article was included and full-text was examined), agreement between the screeners was perfect (all articles that were eventually included, had been marked as 'include' by both screeners (Cohen's kappa = 1; Cohen's kappa after the first screening round was .7, but the disagreements in this round clearly never concerned relevant studies). Therefore, subsequent screening (and this includes the screening of the articles cited in previous reviews) was done by one screener (GJP).

The second query was improved in two ways. First, because a number of relevant studies were not included because they did not report that they used a behavioural outcome measure (rather using more specific terms like "smoking" or "exercise"), the second term was dropped entirely from the query. Second, two new requirements (and therefore terms) were introduced: the requirement that efficacy was mentioned and the requirement that the relevant study was labelled an experiment (as

the first query had yielded many surveys). This second query was input into PsycINFO through Ebsco on the 8th of November 2011)

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(TI(fear appeal? OR threat appeal? OR scare tactic? OR shock tactic? OR risk message? OR risk perception? OR risk communication? OR negative message? OR threat perception? OR perceived risk? OR perceived threat? OR threat communication? OR risk appraisal? OR threat appraisal? OR fear arousal? OR arousal of fear OR warning label? OR extended parallel process OR protection motivation OR health belief) OR AB(fear appeal? OR threat appeal? OR scare tactic? OR shock tactic? OR risk message? OR risk perception? OR risk communication? OR negative message? OR threat perception? OR perceived risk? OR perceived threat? OR threat communication? OR risk appraisal? OR threat appraisal? OR fear arousal? OR arousal of fear OR warning label? OR extended parallel process OR protection motivation OR health belief) OR KW(fear appeal? OR threat appeal? OR scare tactic? OR shock tactic? OR risk message? OR risk perception? OR risk communication? OR negative message? OR threat perception? OR perceived risk? OR perceived threat? OR threat communication? OR risk appraisal? OR threat appraisal? OR fear arousal? OR arousal of fear OR warning label? OR extended parallel process OR protection motivation OR health belief))
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AND

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(TI(self-efficacy OR efficacy OR effectiveness OR capability OR instruct* OR recommendat* OR confidence) OR AB(self-efficacy OR efficacy OR effectiveness OR capability OR instruct* OR recommendat* OR confidence) OR KW(self-efficacy OR efficacy OR effectiveness OR capability OR instruct* OR recommendat* OR confidence))
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AND

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(TI(experiment* OR manipul* OR independent variable? OR independent measure? OR factorial) OR AB(experiment* OR manipul* OR independent variable? OR independent measure? OR factorial) OR KW(experiment* OR manipul* OR independent variable? OR independent measure? OR factorial))
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(this query is less straightforward, as the query parsing system of Ebsco is substantially less sophisticated than the one used by the WebSpis interface)

This query yielded 261 hits. On the basis of the first screening round, the full-text was acquired for 32 publications, and these 32 publications were combined with the full texts of the third query for the second screening (see Figure 3).

The final, third query was input into PsycINFO through the Ebsco interface at the 26th of January 2012. In this more inclusive query, only the 'fear appeal' synonyms were combined with the single term 'efficacy':

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(TI(fear appeal? OR threat appeal? OR scare tactic? OR shock tactic? OR risk message? OR risk perception? OR risk communication? OR negative message? OR threat perception? OR perceived risk? OR perceived threat? OR threat communication? OR risk appraisal? OR threat appraisal? OR fear arousal? OR arousal of fear OR warning label? OR extended parallel process OR protection motivation OR health belief) OR AB(fear appeal? OR threat appeal? OR scare tactic? OR shock tactic? OR risk message? OR risk perception? OR risk communication? OR negative message? OR threat perception? OR perceived risk? OR perceived threat? OR threat communication? OR risk appraisal? OR threat appraisal? OR fear arousal? OR arousal of fear OR warning label? OR extended parallel process OR protection motivation OR health belief) OR KW(fear appeal? OR threat appeal? OR scare tactic? OR shock tactic? OR risk message? OR risk perception? OR risk communication? OR negative message? OR threat perception? OR perceived risk? OR perceived threat? OR threat communication? OR risk appraisal? OR threat appraisal? OR fear arousal? OR arousal of fear OR warning label? OR extended parallel process OR protection motivation OR health belief))
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AND

efficacy

This query yielded 1045 results. On the basis of the first screening round, six full texts were acquired (see Figure 3). Therefore, in the second screening round, the full texts of 38 publications were screened (the results of the last two queries, see Figure 3), and two more publications were eventually included (Muthusamy, Levine, & Weber, 2009; Ordoñana, González-Javier, Espín-López, & Gómez-Amor, 2009) to yield a total of 16 included studies.

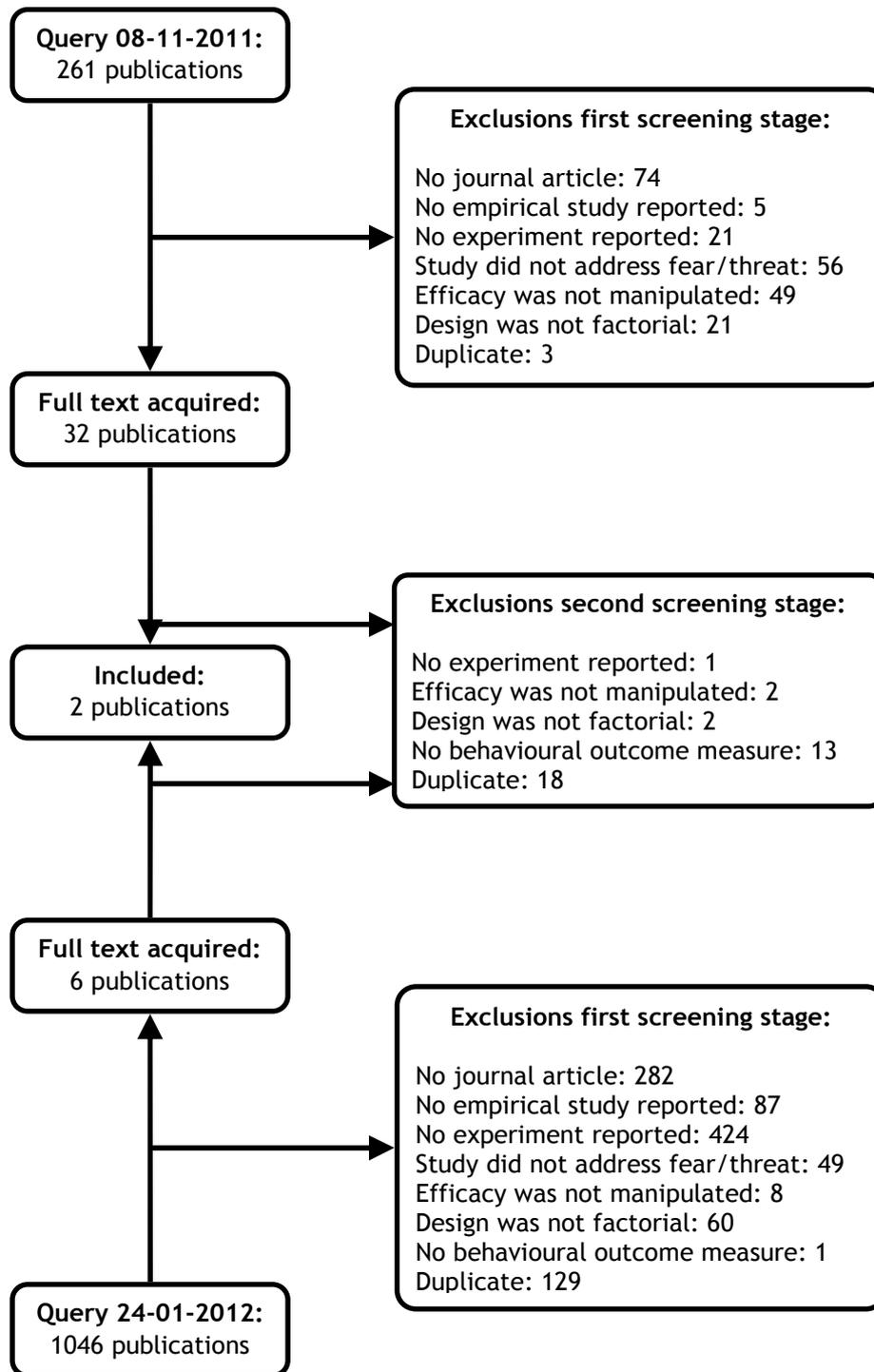


Figure 3: flowchart showing how the final 2 included publications resulted from processing the 261 publications from the query of the 8th of November 2011 and the 1046 publications from the query of the 24th of January 2012

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