Metadata of the chapter that will be visualized in SpringerLink

Book Title	Persuasive Technology
Series Title	
Chapter Title	Persuasive Backfiring: When Behavior Change Interventions Trigger Unintended Negative Outcomes
Copyright Year	2016
Copyright HolderName	Springer International Publishing Switzerland

Corresponding Author	Family Name	**Stibe**
	Particle	
	Given Name	**Agnis**
	Prefix	
	Suffix	
	Division	
	Organization	MIT Media Lab
	Address	Cambridge, MA, USA
	Email	agnis@mit.edu
Author	Family Name	**Cugelman**
	Particle	
	Given Name	**Brian**
	Prefix	
	Suffix	
	Division	Statistical Cybermetrics Research Group
	Organization	University of Wolverhampton
	Address	Wolverhampton, UK
	Division	
	Organization	AlterSpark
	Address	Toronto, ON, Canada
	Email	brian@alterspark.com

Abstract	Numerous scholars study how to design evidence-based interventions that can improve the lives of individuals, in a way that also brings social benefits. However, within the behavioral sciences in general, and the persuasive technology field specifically, scholars rarely focus-on, or report the negative outcomes of behavior change interventions, and possibly fewer report a special type of negative outcome, a backfire. This paper has been authored to start a wider discussion within the scientific community on intervention backfiring. Within this paper, we provide tools to aid academics in the study of persuasive backfiring, present a taxonomy of backfiring causes, and provide an analytical framework containing the intention-outcome and likelihood-severity matrices. To increase knowledge on how to mitigate the negative impact of intervention backfiring, we discuss research and practitioner implications.

Keywords (separated by '-')	Backfire - Taxonomy - Behavior change - Intention-outcome matrix - Likelihood-severity matrix - Persuasive technology - Intervention design

Persuasive Backfiring: When Behavior Change Interventions Trigger Unintended Negative Outcomes

Agnis Stibe[1(✉)] and Brian Cugelman[2,3]

[1] MIT Media Lab, Cambridge, MA, USA
`agnis@mit.edu`
[2] Statistical Cybermetrics Research Group,
University of Wolverhampton, Wolverhampton, UK
`brian@alterspark.com`
[3] AlterSpark, Toronto, ON, Canada

Abstract. Numerous scholars study how to design evidence-based interventions that can improve the lives of individuals, in a way that also brings social benefits. However, within the behavioral sciences in general, and the persuasive technology field specifically, scholars rarely focus-on, or report the negative outcomes of behavior change interventions, and possibly fewer report a special type of negative outcome, a backfire. This paper has been authored to start a wider discussion within the scientific community on intervention backfiring. Within this paper, we provide tools to aid academics in the study of persuasive backfiring, present a taxonomy of backfiring causes, and provide an analytical framework containing the intention-outcome and likelihood-severity matrices. To increase knowledge on how to mitigate the negative impact of intervention backfiring, we discuss research and practitioner implications.

Keywords: Backfire · Taxonomy · Behavior change · Intention-outcome matrix · Likelihood-severity matrix · Persuasive technology · Intervention design

1 Introduction

Scholars have focused on the ways in which technology can produce positive outcomes, such as increasing users' physical activity [29], reducing binge drinking [10], quitting smoking [26], or managing mood and anxiety disorders [14]. There is considerable research on this topic, with several systematic reviews and meta-analyses that focus on a wide variety of positive outcomes [9, 38].

However, few papers report negative outcomes, and possibly fewer report a special class of negative outcomes, called a *backfire*, which we define as an intervention that triggers audiences to adopt the opposite target behavior, rendering the intervention partially responsible for causing the behavior it was designed to reduce or eliminate.

Examples of backfiring interventions include drug use reduction programs that trigger drug use by accidently creating a social norm that triggers some youth to feel like everyone else is trying drugs except for them; traffic safety campaigns that use

shame which accidently triggers denial and resentment which leads to increased dangerous driving; binge drinking screeners that trigger some youth who drink less than average to feel pressured to catch up to their peers; or a tobacco industry sponsored anti-smoking campaign that encouraged parents to lecture their children on not smoking which triggered more youth to smoke [20].

In this paper, we aim to start a wider scientific discussion on intervention backfiring, to provide analytical frameworks to help structure this discussion, to support academic research on the topic, and to raising practitioners' awareness of the potential risks of intervention backfires so they can better manage the potential risks.

2   Background

Numerous fields provide recommendations on how to design behavior change interventions, including social marketing [1, 25], evidence-based behavioral medicine [12, 13], several health behavior change approaches [2, 7, 33], socially influencing systems [36, 37], persuasive technology [15], and classic persuasion literature [32].

However, the application of evidence-based intervention design frameworks does not guarantee that intervention designers will achieve positive outcomes. In practice, scientific models are more likely to inspire interventions, rather than to dictate exactly how they are implemented [31].

Quite often, interventions that start-out with a solid theoretical underpinning, lose their theoretical roots after adapting to real-world necessities, implementation complexities, budget limits, stakeholder feedback, market testing, political tampering, etc.… Then after moving through the process of translating abstract behavioral science principles into concrete intervention materials, such as translating the health belief model into a health app, it can be difficult to make clear links between the foundational theory and applied interventions.

No matter how promising an intervention may have appeared on paper, in practice, they always have the potential to exert unforeseen, and possibly negative outcomes. This is one of the reasons why new behavior change interventions typically undergo stringent monitoring and evaluation, before they are widely disseminated.

Scholars and practitioners, who report that they have disseminated a backfiring technology, can easily feel embarrassed, or worse, find themselves not just stigmatized, but potentially unfunded. Without doubt, there are many practical incentives and disincentives that may motivate people to not publish any information that details how their digital interventions backfired, causing even a small degree of unintended harm, even in marginal population.

We believe that this stigma has created a climate where the existing body of scientific literature may possess a significant degree of publication bias, resulting from too many published studies that only report positive outcomes, and too few studies reporting negative outcomes. This stigma has the potential to create a climate where scientists and practitioners are at greater risk of disseminating harmful interventions.

3 Framework

To aid discussions on intervention backfiring, this section presents two matrices that define categories of backfires while clarifying their potential to undermine the efficacy of behavior change interventions. Figure 1 presents the intention-outcome matrix, which describes different types of outcomes.
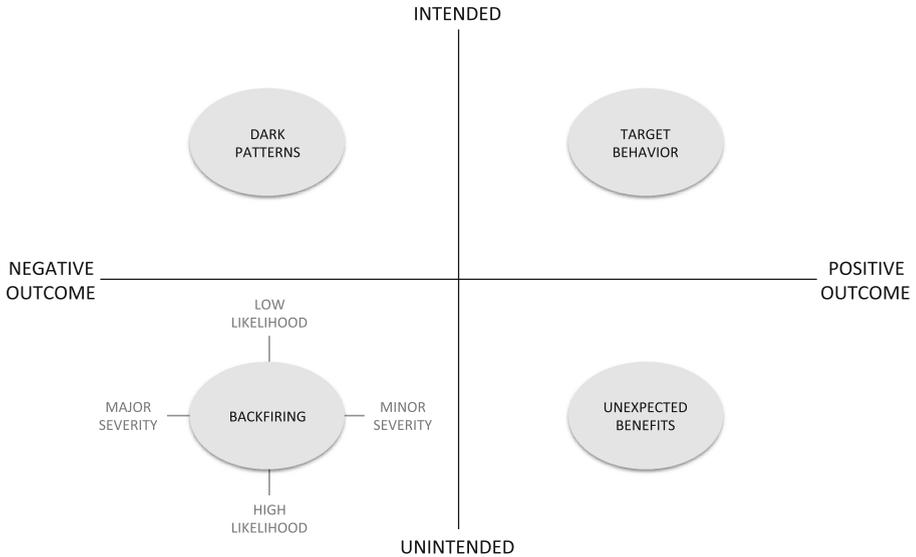

Fig. 1. Intention-Outcome matrix

3.1 Axes of the Intention-Outcome Matrix

The intention-outcome matrix has two axes with four quadrants, which are described below, and illustrated through a fictional binge-drinking reduction intervention.

- **Intended Outcome.** An outcome that was intended by the intervention designer. For example, getting university students to reduce their binge-drinking.
- **Unintended Outcome.** Any outcome that the intervention designer did not intend, whether it is a positive or negative outcome. For example, when a binge-drinking screener accidently motivates some students to adopt other health outcomes, or triggers some students to drink more alcohol after they use it in a competition to see who can achieve the highest binge-drinking score.
- **Positive Outcome.** An outcome that serves the interest of both the intervention designer and the target audience. This is a win-win situation, where both parties benefit. For example, a binge-drinking screener where the target audience achieves reduced alcohol consumption.

- **Negative Outcome.** An outcome that does not serve the interest of the target audience. For example, a binge-drinking screener that causes small segments to drink more alcohol, or exposes them to greater risk.

3.2   Quadrants of the Intention-Outcome Matrix

The intention-outcome matrix has four quadrants, that describes the four types of outcomes, as described below.

- **Target Behavior.** The primary intended positive behavioral outcome being sought, and typically reported.
- **Unexpected Benefits.** A positive behavioral outcome that was not intentionally sought, but which was positive nonetheless, and may be reported as a complimentary benefit of the intervention.
- **Backfiring.** This category includes a number of negative outcomes, when an intervention causes the opposite of the outcome (e.g. more binge drinking instead of less). It also includes "side effects", when the primary behavior is achieved, but it also triggers unintended negative outcomes (e.g. using peer pressure to influence behavior which lowers audiences' self-esteem). This quadrant is further subdivided into a risk management matrix that contrasts the likelihood of backfiring (low to high) with the potential severity (minor to major).
- **Dark Patterns.** When an intervention is used for the benefit of the developer, at the expense of the target audience. This is in the realm of unethical applications, such as coercion, deception, and fraud. For instance, scholars draw attention to dark game design patterns that developers use to provide negative experiences to players, not in their best interests, and without their consent [24, 27].

4   Method

The taxonomy of persuasive backfires presented in this paper was derived through a grounded theory methodology [6, 17], based on a corpus of academic, applied, and personal experiences with backfiring behavior change interventions [3].

   We began the process by defining and limiting our selection criteria to interventions that backfire, that cause the opposite behavior, or unanticipated negative consequences that were contrary to the intentions of the program. We excluded flawed interventions that did not contribute towards any outcomes, positive or negative, as these programs constituted poor implementations, not backfires. The first type of flawed intervention includes programs that audiences did not find motivating, as these programs lacked the capacity to achieve significant outcomes. Similarly, we excluded interventions that faced implementation barriers, or created barriers among its target audiences, as it was not possible to assess the outcomes of these interventions.

   To gather qualifying sources, we ran a call for references and examples across several academic, professional, and personal networks. The types of references we collected

included journal papers, articles, program evaluations, and personal experiences. In total, we collected 47 responses.

We systematically reviewed all sources, and only included submissions that qualified as having demonstrated an unintended negative outcome, or which were presented as having contributed an unintended negative outcome. We also included behavior change interventions that were not implemented within technology per se, but were reasonably implemented in a context that could be applied to online behavior change campaigns or digital products. We also received submissions of backfiring legislation, which is often used in conjunction with communication campaigns, to elicit social change. In total 30 responses were included in our qualitative analysis.

We carried out a qualitative assessment of the corpus, with a view to developing taxonomy of triggers for backfiring interventions.

5   Findings

The findings of our study are presented in Fig. 2, a risk management framework called the likelihood-severity matrix. The four quadrants of backfires include (A) low likelihood and minor severity, (B) high likelihood and minor severity, (C) low likelihood and major severity, and (D) high likelihood and major severity. Through our qualitative assessment of backfires and their potential risks, we have synthesized twelve types of backfires, within six categories: inexperience, fineprint fallacy, personality responses, credibility damage, poor judgment, and social psychology.
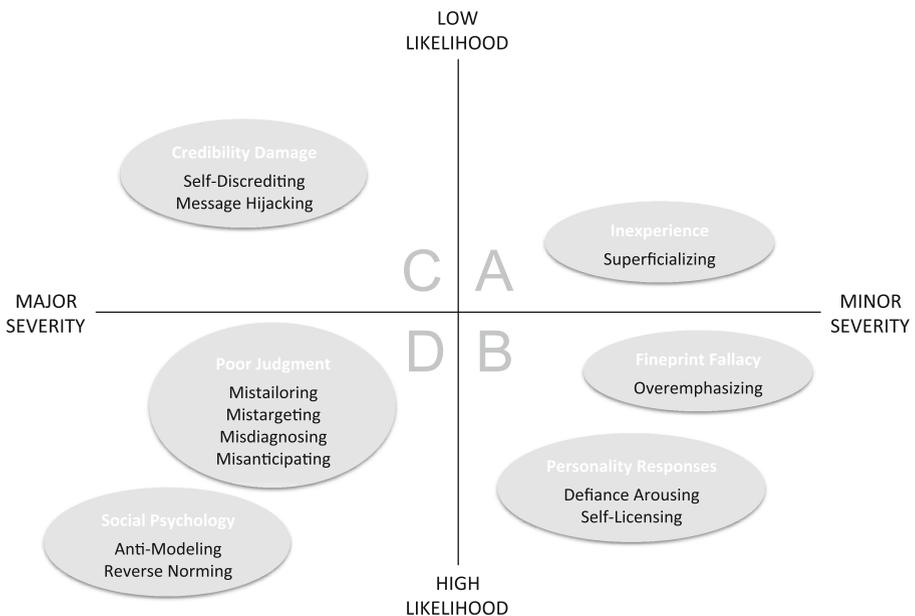

Fig. 2. Likelihood-Severity matrix

The taxonomy of persuasive backfires, presented in Table 1, provides twelve types of backfires within six broad categories.

Table 1. Taxonomy of persuasive backfires

Description	Examples
A: LOW likelihood and MINOR severity	
Inexperience	
Superficializing	
The superficial application of theory, such as copying surface tactics without understanding the underlying strategies, principles, or reasoning.	Research on social media, particularly on Foursquare, looks at driving user motivation through gamification mechanics that compete with intended target behaviors of information sharing [23]. More generally, research that focuses on how gamification elements can drive extrinsic motivation, may cease to be persuasive over the long term, and may potentially deplete intrinsic motivation.
B: HIGH likelihood and MINOR severity	
Fineprint Fallacy	
Overemphasizing	
Motivate people to take action for one strongly emphasized benefit, while omitting (or hiding) harmful factors that are in the fine print.	Stressing "low fat", while still including several unhealthy factors, such as high-sugar, or trans fats. Asking people to take one pill a day to lower their risk of contracting HIV, which causes some groups to engage in riskier sex (and stop using condoms), contributing to an increase in other sexually transmitted diseases [22].
Personality Responses	
Defiance Arousing	
Resistance to messages that are incompatible with a person's self-identity, that can induce unpleasant cognitive dissonance, leading the audience to reject the message, or oppose it.	Guilt and shame messages in anti-drinking ads for drunk drivers are ignored, and in some cases, backfire, when the message is incompatible with how individuals view themselves. Persuasive messaging involving an authority might provoke opposition from groups and individuals who are sensitive or resistant to authorities. One anti-smoking campaign failed due to advocating the message that "teens shouldn't smoke… because they're teens." Youths in the 10th-12th-grade were 12 percent more likely to smoke for each parent-targeted ad they had seen in the last

(*Continued*)

Table 1. (*Continued*)

Description	Examples
	30 days. According to developmental psychologists, teens 15 to 17 years old tend to reject authoritative messages because they believe they are independent, which renders Philip Morris' ad campaign largely useless [16].
	The presence of peer information decreases the savings of nonparticipants who are ineligible for automatic enrollment in a saving plan, while higher observed peer savings rates also decreased savings. Discouragement from upward social comparison seems to drive this reaction [4].
Self-Licensing	
When someone does something good in one area, they sometimes feel like they have a license to misbehave in other.	After donating to charity, people may feel licensed to behave less morally in subsequent decisions [30]. For instance, donating to charity may have a dark side to it, as it negatively affects subsequent, seemingly unrelated moral behavior, such as the intention to be environmentally friendly.
C: LOW likelihood and MAJOR severity	
Credibility Damage	
Self-Discrediting	
When the source disseminates discrediting information, causing a misalignment of source and message credibility.	People report less favorable thoughts and attitudes towards a source, after reading weak arguments presented by a high vs. low expertise source.
	Too much fear mongering may discredit a campaign to the point of disbelief or humor [21].
Message Hijacking	
Third party actors re-contextualize the source's message, bringing a new meaning, which in many cases undermines the intervention by turning it into a public joke.	Creative works designed to cause fear, become a trendy meme with a different meaning, such as humorous cigarette ads of smoking children, reefer madness, fashionable heroin chic [19], or the ad campaign for TV PSA "This is your brain and this is our brain on drugs" which triggered numerous parodies [7].
	England's Beat Bullying Campaign triggered bullying and violence. The campaign was so popular at its launch that supplies of the "Beat Bullying" wristbands quickly sold

Table 1. (*Continued*)

Description	Examples
	out. Because of the scarcity of the bracelets, and theme of the campaign, some kids were bullied for wearing the bracelet [11].
D: HIGH likelihood and MAJOR severity	
Poor Judgment	
Mistailoring	
When a tailored messaging system provides information that produces negative outcomes in some users, that could have been avoided with an appropriate message.	A drinking screener showed both low and high drinking students how much they consume in comparison to an average consumption. Those that were above the norm felt encouraged to drink less, while those below received an implied message to drink more. And a boomerang effect [35], when a descriptive social norm was not accompanied by an injunctive social norm in a similar way as described above.
Mistargeting	
When a message that was intended for one audience segment is misinterpreted by another group of people.	A one-size-approach to persuasive messaging can deter healthy eating behavior change, leading to a negative change in attitudes towards healthy eating over time. The Playpump program was meant for children to pump water while playing, but resulted in adults using the playground pump, leading to back injuries and other health problems [5].
Misdiagnosing	
When a behavior change intervention does not properly diagnose user behavior or psychological processes.	Gaze tracking software, designed to provide proactive help as patients read medical documents, used fixation time as a cue to identify when users were struggling with the material, and might need help. During the trial, the participants with low health literacy had a slower reading rate, causing the system to inappropriately offer help continually, which just annoyed the users, leading to lower comprehension compared to the control condition.
Misanticipating	
Changes in policies or directives that lead to unanticipated shifts in beliefs, attitudes or behaviors.	In the Netherlands, the drinking age was changed from 16 to 18, which news stations linked to an increase in drug use among citizens in this age group.

(*Continued*)

Table 1. (*Continued*)

Description	Examples
	Nebraska's "Give Us Your Troubled Child" law backfired, as the Nebraska Safe Haven law enabled parents to drop off kids of any age and the state for the state to take in, resulting in some parents who dropped off grownups [Gra2008].
Social Psychology	
Anti-Modeling	
Demonstrating negative behavior, which exposes people to memory triggers of bad behaviors or temptations, potentially in moments of the greatest susceptibility.	Being exposed to others experiencing the stress of quitting smoking, for example, triggers people to want to smoke. Anti-bad-behavior interventions can remind people of the bad behavior, thus potentially spark their motivation. A cookie company that introduced a 100-calorie packs of snacks, triggered people to eat far more of the small snack packs [28].
Reverse Norming	
Interventions that use examples of popular bad behaviors can establish the bad behavior as a social norm.	An anti-littering program used campaign posters to stress how widespread littering was, accidently contributed to a social norm for littering, by demonstrating how many people were littering. Two separate studies indicated that D.A.R.E. program was ineffective and in some cases, pushed kids toward drug use and lowered self-esteem. Researchers suspected that the intervention's message made some kids want to try drugs as a way of fitting in, stating and the program's message could be misinterpreted by youth as conveying that "peer pressure is around every corner, because everyone is doing drugs but you!" [34].

6   Scientific Considerations

We have authored this paper to initiate a scientific discussion on intervention backfiring, and to encourage scholars to examine this phenomenon in greater depth. We hope this will contribute to more transparency within the academic community, leading to more well-rounded research on persuasive design and its application.

The scientific contribution of this paper includes the persuasive backfiring framework, its two matrices (intention-outcome and likelihood-severity), and taxonomy. These frameworks can be used to define, discuss, and further research behavior change

interventions that trigger unintended negative outcomes. Although we have not discussed ethics in this paper, it provides a system to further define ethical and unethical uses of persuasive technology.

Perhaps the most important contribution of this paper, is raising awareness of the elephant in the room, the well-known but rarely discussed fact that applied interventions targeting good outcomes, occasionally produce negative outcomes. It also raises questions on the social stigma attached to the people and organizations that deploy backfiring interventions, and how this may contribute to under reporting negative outcomes, or omitting them altogether.

More concerning, this investigation has identified a potentially large source of publication bias, as we believe that there are many incentives and disincentives, including stigma and embarrassment, that motivate researchers to avoid publishing research on negative outcomes.

We believe that scholars will need to develop innovative new research methods to overcome the research barriers that surround this subject, due to the stigma associated with reporting on interventions that backfire, and the limited ability of scientific studies to identify backfires that are more likely to become apparent in evaluations of real-world interventions, and often informally known by intervention staff but not publicly reported.

For instance, given the ability of technology to employ tailoring techniques, where content can be personalized, persuasive technology scholars are better equipped to undertake research on backfiring psychology, and use this knowledge to advise intervention designers when they need to omit influence principles that may be counterproductive to particular segments.

7 Practitioner Considerations

To assist practitioners, the taxonomy and tools presented in this paper provides a list of risks that can be addressed, if identified before they occur. Moreover, these risks can be used to build more effective interventions, by teaching practitioners how to avoid, mitigate, or manage backfires. The examples in this study suggest that backfires may originate from political tampering during the intervention design phase, evaluations that do not distinguish between groups, overusing a principle to the point of triggering mistrust in a message ("your brain on drugs"), misdiagnosis that leads to subscribing the wrong intervention leading to garbage-in-garbage-out interventions.

However, one ethically questionable practice we discovered was the potential intentional use of backfiring as a dark pattern, designed to deploy an intervention that superficially appears to promote a healthy behavior, but which actually promote unhealthy behavior. When corporations are obliged, or volunteer to carry out public health interventions to warn the public against their product, these corporations can easily benefit from the intentional use of backfiring interventions.

For instance, the "Talk: They'll Listen" campaign is frequently cited as an example of a cleaver antismoking ad campaign that on the outside appeared to be a legitimate antismoking campaign, but which in practice caused an increase in youth smoking [19]. Consequently, policy makers and regulators who empower tobacco, alcohol,

and pharmaceutical companies to run their own interventions, need to be fully informed about the potential intentional use, and abuse of backfire-based campaigns, that superficially look effective, but at a deeper level, have been engineered to encourage the opposite effect.

Finally, we believe that backfires are normally present to some degree in all interventions, and that they can never be fully eliminated. It may be more practical to focus on strategies to reduce the riskiest backfires, to manage those that cannot be fully eliminated, and to continually monitor and improve interventions over time.

8   Conclusions

The stigma associated with reporting behavior change interventions that trigger negative outcomes, has relegated the topic of intervention backfiring to an informal observation that is widely known, but rarely discussed or reported. This has created a climate where scholars routinely overemphasize positive outcomes, while failing to report the fact that the same principle, can also lead to unforeseen negative outcomes.

In this paper, we discussed multiple ways how behavior change interventions can backfire. We provided a framework to help facilitate the discussion of this topic, presented tools to aid academics in the study of this realm, and offered advice to practitioners about potential risks. We encourage researchers to build on this work, and take a more systematic look on approaches involving the design of behavior change interventions.

In the future, researchers will need to innovate new ways to study this subject, and extend our scientific and practical knowledge of what pitfalls need to be avoided when designing technology-supported behavior change interventions. We advocate that researchers and practitioners adopt an honest and open attitude towards identifying and removing backfires as soon as possible, and to disseminating strategies to reduce their occurrence, before they cause more harm than good.

References

1. Andreasen, A.: Social marketing in the 21st century. Sage Publications Inc, Thousand Oaks (2006)
2. Bartholomew, L.K., Parcel, G.S., Kok, G., Gottlieb, N.H.: Planning health promotion programs: an intervention mapping approach. Wiley, San Francisco (2011)
3. Beer, M., Eisenstat, R.A., Spector, B.: Why change programs don't produce change (1990)
4. Beshears, J., Choi, J.J., Laibson, D., Madrian, B.C., Milkman, K.L.: The effect of providing peer information on retirement savings decisions. J. Finan. **70**(3), 1161–1201 (2015)
5. Chambers, A.: Africa's not-so-magic roundabout (2009). http://www.theguardian.com/commentisfree/2009/nov/24/africa-charity-water-pumps-roundabouts
6. Charmaz, K.: Constructing grounded theory. Sage, Thousand Oaks (2014)
7. Chatterjee, S., Price, A.: Healthy living with persuasive technologies: Framework, is- sues, and challenges. J. Am. Med. Inf. Assoc. **16**(2), 171–178 (2009)

8. Crano, W.D., Burgoon, M., Oskamp, S. (eds.): Mass media and drug prevention: Classic and contemporary theories and research. Psychology Press, Mahwah (2001)

9. Cugelman, B., Thelwall, M., Dawes, P.: Online interventions for social marketing health behavior change campaigns: A meta-analysis of psychological architectures and adherence factors. J. Med. Internet Res. **13**(1), e17 (2011). http://doi.org/10.2196/jmir.1367

10. Cunningham, J.A., Wild, T.C., Cordingley, J., Van Mierlo, T., Humphreys, K.: A randomized controlled trial of an internet-based intervention for alcohol abusers. Addiction **104**(12), 2023–2032 (2009)

11. Curtis, P.: Anti-bullying wristband scheme backfires (2004). http://www.theguardian.com/education/2004/dec/08/schools.uk2

12. Davidson, K., Goldstein, M., Kaplan, R., Kaufmann, P., Knatterud, G., Orleans, C., Whitlock, E.: Evidence-based behavioral medicine: What is it and how do we achieve it? Ann. Behav. Med. **26**(3), 161–171 (2003)

13. Embry, D., Biglan, A.: Evidence-based kernels: Fundamental units of behavioral influence. Clin. Child Family Psychol. Rev. **11**(3), 75 (2008)

14. Farvolden, P., Denisoff, E., Selby, P., Bagby, R.M., Rudy, L.: Usage and longitudinal effectiveness of a Web-based self-help cognitive behavioral therapy program for panic disorder. J. Med. Int. Res. **7**(1), e7 (2005). http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1550639/

15. Fogg, B.J.: Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufmann, San Francisco (2003)

16. Fraser, J.: Anti-smoking ads cleverly boost smoking among teens (2006). http://www.naturalnews.com/020996.html

17. Glaser, B.G., Strauss, A.L.: The discovery of grounded theory: Strategies for qualitative research. Transaction Publishers, New Jersey (2009)

18. Graham, J.: Father leaves nine children at Nebraska hospital (2008). http://newsblogs.chicagotribune.com/triage/2008/09/father-leaves-n.html

19. Hastings, G.: Social marketing: why should the devil have all the best tunes?. Butterworth-Heinemann, Oxford (2007)

20. Healey, B., Zimmerman, R.S.: The new world of health promotion: New program development, implementation, and evaluation. Jones & Bartlett Learning, Sudbury (2009)

21. Hinkley, K.: 5 Ridiculous Anti-Drugs Posters (2014). http://www.talkingdrugs.org/5-anti-drugs-campaigns

22. Holpuch, A.: Truvada has been called the 'miracle' HIV pill–so why is uptake so slow (2014). http://www.theguardian.com/world/2014/sep/18/truvada-mircle-pill-prevent-hiv-controversy

23. Kietzmann, J.H., Hermkens, K., McCarthy, I.P., Silvestre, B.S.: Social media? Get serious! Understanding the functional building blocks of social media. Bus. Horiz. **54**(3), 241–251 (2011)

24. Kirkland, A., Metzl, J.M. (eds.): Against health: How health became the new morality. NYU Press, New York (2010)

25. Kotler, P., Roberto, N., Lee, N.: Social marketing: improving the quality of life, 2nd edn. Sage Publications Inc, California (2002)

26. Lenert, L., Munoz, R., Perez, J., Bansod, A.: Automated e-mail messaging as a tool for improving quit rates in an internet smoking cessation intervention. J. Am. Med. Inf. Assoc. **11**(4), 235–240 (2004)

27. Linehan, C., Harrer, S., Kirman, B., Lawson, S., Carter, M.: Games against health: a player-centered design philosophy. In: Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems, pp. 589–600. ACM (2015, April)

28. London, L.: Guiltless Girls: Unpacking 100-calorie Snacks (2009)
29. Marshall, A., Leslie, E., Bauman, A., Marcus, B., Owen, N.: Print versus website physical activity programs A randomized trial. Am. J. Prev. Med. **25**(2), 88–94 (2003)
30. Meijers, M.H., Verlegh, P.W., Noordewier, M.K., Smit, E.G.: The dark side of donating: how donating may license environmentally unfriendly behavior. Social Influence, 1–14 (2015) **AQ1**
31. Michie, S., Abraham, C.: Interventions to change health behaviours: evidence-based or evidence-inspired? Psychol. Health **19**(1), 29–49 (2004)
32. O'Keefe, D.: Persuasion: Theory and Research. Sage Publications Inc, London (2002)
33. Prochaska, J.O., Velicer, W.F.: The transtheoretical model of health behavior change. Am. J. Health Promot. **12**(1), 38–48 (1997)
34. Reaves, J.: Just Say No to DARE (2001). http://content.time.com/time/education/article/0,8599,99564,00.html
35. Schultz, P.W., Nolan, J.M., Cialdini, R.B., Goldstein, N.J., Griskevicius, V.: The constructive, destructive, and reconstructive power of social norms. Psychol. Sci. **18**(5), 429–434 (2007)
36. Stibe, A.: towards a framework for socially influencing systems: Meta-analysis of four PLS-SEM based studies. In: MacTavish, T., Basapur, S. (eds.) PERSUASIVE 2015. LNCS, vol. 9072, pp. 172–183. Springer, Heidelberg (2015)
37. Stibe, A.: Advancing typology of computer-supported influence: moderation effects in socially influencing systems. In: MacTavish, T., Basapur, S. (eds.) PERSUASIVE 2015. LNCS, vol. 9072, pp. 253–264. Springer, Heidelberg (2015)
38. Webb, T., Joseph, J., Yardley, L., Michie, S.: Using the internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. J. Med. Internet Res. **12**(1), e4 (2010). http://doi.org/10.2196/jmir.1376

Author Query Form

Book ID :	**419634_1_En**		Springer
Chapter No.:	**6**		the language of science

Please ensure you fill out your response to the queries raised below and return this form along with your corrections

Dear Author
During the process of typesetting your chapter, the following queries have arisen. Please check your typeset proof carefully against the queries listed below and mark the necessary changes either directly on the proof/online grid or in the 'Author's response' area provided below

Query Refs.	Details Required	Author's Response
AQ1	Please supply the publisher location for Ref. [30].	

MARKED PROOF

Please correct and return this set

Please use the proof correction marks shown below for all alterations and corrections. If you wish to return your proof by fax you should ensure that all amendments are written clearly in dark ink and are made well within the page margins.

Instruction to printer	Textual mark	Marginal mark
Leave unchanged	· · · under matter to remain	ⓙ
Insert in text the matter indicated in the margin	⋏	New matter followed by ⋏ or ⋏⊗
Delete	/ through single character, rule or underline or ⊢——⊣ through all characters to be deleted	⌀ or ⌀⊗
Substitute character or substitute part of one or more word(s)	/ through letter or ⊢——⊣ through characters	new character / or new characters /
Change to italics	— under matter to be changed	⌣
Change to capitals	≡ under matter to be changed	≡
Change to small capitals	= under matter to be changed	=
Change to bold type	∿ under matter to be changed	∿
Change to bold italic	≈ under matter to be changed	≋
Change to lower case	Encircle matter to be changed	≢
Change italic to upright type	(As above)	⊥
Change bold to non-bold type	(As above)	⊬
Insert 'superior' character	/ through character or ⋏ where required	⋎ or ⋏ under character e.g. ⋎² or ⋏²
Insert 'inferior' character	(As above)	⋏ over character e.g. ⋏₂
Insert full stop	(As above)	⊙
Insert comma	(As above)	,
Insert single quotation marks	(As above)	⋎ or ⋏ and/or ⋎ or ⋏
Insert double quotation marks	(As above)	⋎ or ⋏ and/or ⋎ or ⋏
Insert hyphen	(As above)	⊢-⊣
Start new paragraph	⌐	⌐
No new paragraph	⌒	⌒
Transpose	⊔⊓	⊔⊓
Close up	linking ⌒ characters	⌒
Insert or substitute space between characters or words	/ through character or ⋏ where required	Y
Reduce space between characters or words	| between characters or words affected	↑