

Origins of Inoculation Theory

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Currently, inoculation research is experiencing a renaissance, with recent theoretical and methodological innovations driving research production at unprecedented levels for the theory. A search of Google Scholar for “inoculation theory” yields over 4,500 citations. Inoculation theory is so popular that our friends and colleagues are publishing an edited volume entirely on the subject. Theoretical innovations in resistance research have yielded new insights about the mechanisms behind inoculation effects. Banas and Richards (2017) proposed a new measure, *motivational threat*, which reconceptualized threat as less of an apprehensive state and more of a catalyst for attitudinal defenses. Maertens et al. (2024) integrated cognitive science and memory research in their memory-motivation model of inoculation. Recent advancements in inoculation message formats resulted in the proliferation of serious-gaming inoculations, where interactive gameplay facilitates resistance to misinformation (e.g., Roozenbeek & van der Linden, 2019), inauthentic social-media accounts, and their influence (Lees et al., 2023), attempting to improve media literacy and build resilience to misinformation online.

During this prolific era of inoculation research, it is instructive to look at inoculation’s origins, as understanding the past allows us to see that many threads of the original questions about inoculation are still being pursued by scholars today. After discussing the inspiration for and origins of the theory, the chapter will define the two original mechanisms identified to support the process of inoculation: threat and counterarguing. It will then link the theory to the biomedical inoculation metaphor and will review the early testing of the theoretical processes and their contributions to advancing our understanding of the theory. The conclusion of the manuscript will consider the significance of the biomedical analogy for the inoculation theory advancements, focusing on both its empowering and limiting properties.

Inspiration and Origins

Early Greek Rhetoricians

Although inoculation theory was formalized by McGuire, the influence strategy traces back to Aristotle (Compton, 2005; van der Linden, 2023), who was interested in helping people reject deceitful manipulation by exposing invalid argumentation. Aristotle recognized that resistance to persuasion should include both arguments for one's position and exposure to arguments from the other side:

The orator should be able to prove opposites as in logical arguments; not that we should do both (for one ought to not persuade people to do what is wrong), but that the real state of the case may not escape us, and that we ourselves may be able to counteract false arguments, if another makes unfair use of them. (Aristotle, n.d., *Rhetoric*, I.I., 11–14)

Aristotle also acknowledged the importance of preemptive communication to maximize effectiveness as well as the crucial role of refutation: “He who speaks first should state his own proofs and afterwards meet the arguments of the opponent, refuting or pulling them to pieces beforehand” (*Rhetoric*, III, chapter XVII). Although McGuire did not explicitly connect his theorizing to Aristotle, his theory is clearly grounded in Aristotelian principles, which are implicit in the foundational research on inoculation as well as its contemporary extensions.

Hovland and Two-Sided Message-Effects Research

The explicit influences of McGuire's theory of inoculation come from his work with Carl Hovland, a renowned psychologist who studied how propaganda (i.e., counterattitudinal persuasion) affected attitudes and the morale of the US troops during World War II, with the research on message-sidedness being one of the best-known lines of that war-time research program (Briñol & Petty, 2012). Later, Hovland went on to direct Yale's pioneering program on Communication and Attitude Change, where McGuire was one of the students, who completed their dissertation research under his mentorship (Shepard, 1998).

Inoculation theory was an extension of the empirical message-effects scholarship from the research conducted by the Yale group, comparing the effects of *one-sided messages* (i.e., messages that do not mention the other side of a debate) and *two-sided messages* (i.e., messages that acknowledge points from both sides) on persuasion outcomes. Hovland et al. (1953) found that one-sided messages work better for audiences predisposed to favor the message position immediately after message reception, but their study did not address how message-sidedness would fare against counterpropaganda later. Other collaborators from the Yale group, Lumsdaine and Janis (1953), conducted a follow-up study focusing on message-sidedness and resistance, finding that two-sided messages were superior to one-sided messages in producing lasting attitude change in participants who were subsequently exposed to counterpropaganda. Importantly, in their discussion of the results, Lumsdaine and Janis (1953) conjectured that two-sided messages may have “inoculated” participants against counterpersuasion (p. 318).

Lessons from Korean War

As noted in McGuire and Papageorgis (1961), the aftermath of the US conflict with Korea also played a role in the inspiration for inoculation theory. During that conflict, the cooperation with the enemy by American prisoners-of-war shocked and alarmed civilians and military personnel alike, especially since it was not due to coercion or torture but instead the result of

sustained persuasion through messages undermining the prisoners' beliefs in American ideological principles. Numerous investigations of actions of American prisoners-of-war (Kinkead, 1959) attributed the rejection of American ideology to insufficient knowledge of American ideals and the reasoning behind them. Therefore, officials concluded that civilian and military education should teach more unequivocally the underlying reasons for American values to reduce vulnerability to Communist counterpropaganda. In contrast, McGuire predicted, "preexposure to the counterarguments themselves (in weakened form) is more effective as an immunizing agent than is the presentation of arguments supporting the cultural truism" (McGuire & Papageorgis, 1961, p. 328). This prediction became the core tenet of inoculation theory.

Inoculation Theory

Definition

Inoculation theory is different from other approaches to inducing resistance to persuasion due to its biological analogy. In a typical biological inoculation (e.g., a seasonal flu vaccine), people are made resistant to an attack from a flu virus by preexposing them to a weakened dose of the virus via a flu shot. The flu-virus dose in the vaccination is minor enough not to overwhelm one's immune system, but it is substantial enough to stimulate immune defenses so they will be better prepared to withstand later exposure to the flu. Additionally, one can attempt to resist the flu by employing a supportive approach of getting plenty of rest, eating healthfully, and taking vitamin supplements. However, when facing sudden exposure to a massive dose of a virus, inoculation is a superior method of preventing sickness.

McGuire's genius insight was to apply this analogy to attitude change. Just as immune systems in an aseptic environment appear to be healthy but are quite vulnerable to a viral attack, McGuire recognized that attitudes that have gone unchallenged may be similarly defenseless against counter-persuasion. McGuire predicted that preexposing people to weakened arguments challenging their beliefs would provide the motivation and preparation necessary to resist future persuasive attempts.

Main Theoretical Mechanisms

McGuire's inoculation theory is predicated on the notion that preexposure to counter-persuasion provides the motivation and preparation necessary to successfully resist influence attempts. Motivation and preparation are represented by the main theoretical mechanisms of threat and counterarguing: The *threat mechanism* corresponds to the motivation for resistance, and the *counterarguing mechanism* corresponds to the preparation for resisting influence attempts. In early inoculation research, threat was thought to be induced merely by exposing people to potential counterarguments to their current position, and counterarguing was induced through the introduction of refutational preemptive messages that modeled the counterarguing practice essential to attitudinal defenses.

Early Tests of the Theoretical Processes

McGuire took the metaphor of inoculation very seriously. He wanted to test his theory in a similar manner to how one would test viral vaccinations. He realized that the metaphor might be a stretch when applied to human beliefs, and so he chose to test his theory with cultural truisms, or "beliefs maintained in an aseptic environment[,]. . . germ-free beliefs"

(McGuire, 1970, p. 37). Of course, deciding on using such beliefs was considerably easier than locating them. McGuire (1970) reported that even beliefs such as “God is good” or “Capitalism is better than Communism” scarcely drew more than 50% taking a strongly positive position. Ultimately, the subjects of health and medicine provided four cultural truisms for testing that met McGuire’s standards (above 90% complete agreement): importance of yearly chest X-rays to check for tuberculosis, the benefits of penicillin, the utility of frequently brushing one’s teeth, and value of annual medical checkups.

Underlying Assumptions

McGuire’s inoculation theory assumes that resistance to persuasion is a function of motivation and practice. Specifically, successful inoculation must address two challenges: a lack of practice in defending one’s beliefs and a lack of motivation to practice (McGuire, 1964). The practice deficit arises from not having encountered situations that require defending one’s belief, while the deficit in motivation stems from perceiving the belief as irrefutable.

Given these assumptions, inoculations need to provide the motivation and practice necessary to resist subsequent persuasive attacks. McGuire (1964) contended that motivation can be induced by making a person aware of the vulnerability of their belief. McGuire believed that people need to feel threatened rather than reassured about their beliefs, and the easiest way to do so “is by pre-exposure to weakened forms of the attacking arguments” (p. 201). Furthermore, motivation alone should be ineffective for defending one’s position because, in the case of unchallenged beliefs, the believer has never had practice defending their position, and therefore, they may lack the knowledge necessary to defend their position without guidance.

Based on these assumptions, McGuire tested several predictions about the relative efficacy of inoculation. In the following section, we discuss the three main variables featured in most experiments in his research.

Supportive vs. Refutational Threat Manipulation

The first set of variables concerns the amount of threat present in the defenses. The two basic manipulations of threat were supportive versus refutational. The *supportive treatment* was designed to be nonthreatening: It merely provided various arguments in support of the cultural truism. The *refutational defense* was designed to be more threatening: It introduced several arguments attacking the cultural truism, followed by refutations of those attacking arguments. As a result, attacking arguments were *weakened* by refutations. McGuire predicted that the refutational preexposure would be threatening enough to simulate defenses without being strong enough to turn people against believing the truism.

Additionally, the refutational defenses were divided into two types, depending on their relationship to the content of subsequent attacks. The refutations McGuire used in his experiments either noted and refuted arguments identical to the ones in the subsequent attack, or they mentioned and refuted arguments different from those used in the subsequent attack. McGuire (1964) labeled these as *refutational-same* and *refutational-different defenses* (see below for further discussion) and compared these variations to assess whether attitudinal defenses were the result of motivation or having specific content to refute counterattitudinal attacks.

It is important to distinguish how McGuire operationalized threat in these early inoculation experiments from how threat is treated in modern inoculation research. As social science has shifted toward measuring and modeling cognitive mediating states, threat has moved from being a primitive term (i.e., unmeasured) in the theory to a measured construct. Currently,

there are two measures of threat that are commonly used in inoculation: the traditional threat measure (Burgoon et al., 1978) and the motivational threat measure (Banas & Richards, 2017). These measures are sometimes used as manipulation checks, while in other studies, they serve as mediating variables in models of the inoculation process.

Active vs. Passive Defenses

The second variable commonly manipulated in McGuire's inoculation research concerned the active versus passive nature of the defense. In the relatively passive condition, participants read an essay, and in the active condition, participants wrote their own essays. In some studies, active and passive conditions were further divided into their more- and less-demanding versions, with each nested within the respective defense condition. For example, the two variations of an active condition in McGuire and Papageorgis (1961) were writing without guidance in the more-demanding condition and guided writing using a brief summary of defensive arguments in the less-demanding condition. In contrast, the less-demanding version of their passive condition was operationalized as simply reading the inoculation materials, while the more-demanding task required participants to read the materials and underline key ideas (McGuire & Papageorgis, 1961). Overall, comparing active and passive defenses along with their variations helped address both the motivation and practice assumptions of the theory (McGuire, 1964). We detail the key findings comparing active and passive attitudinal defenses further below.

Time Delay

The third variable frequently manipulated in the initial inoculation experiments was the time interval between the defense treatment and the attack to determine the optimal delay between inoculation inductions and counterattitudinal attacks. McGuire (1964) initially suggested that a delay was key to resistance, aligning with the biological analogy of medical inoculations, which require time to build immunity. Some research has supported McGuire's idea that delay strengthens resistance (Freedman & Sears, 1965; Hass & Grady, 1975; Petty & Cacioppo, 1979). However, other studies have shown that the effectiveness of inoculation treatments declines over time (McGuire, 1962; Pfau, 1997; Pryor & Steinfatt, 1978). This decay has been attributed to a decrease in motivation to defend one's attitudes, as initial heightened motivation to counterargue fades (Insko, 1967). In early inoculation research, the time intervals varied from a few minutes to seven days (McGuire, 1964). The time variable was of particular concern to McGuire as a way to examine temporal interactions with other variables.

Overall, in early inoculation research the three variables—supportive vs. refutational defenses, active vs. passive defenses, and temporal inductions—were the main theoretical independent variables within McGuire's research. The experimental design and procedures testing the effects of these three independent variables are described next.

Standard Method

In all of McGuire's early inoculation experiments, the basic method was quite similar. The experiments involved two sessions: the first focused on defenses and the second on strong attacks along with measures of ensuing beliefs (we describe both sessions in more detail in the following sections). The time interval between the two sessions ranged from a few minutes to a week. Typically, the participants were college students enrolled in introductory psychology courses. The cover story for the experiments was a study of verbal skills, and the issues used in the experiments were the cultural truisms noted earlier.

First (Defensive) Session

In the first session, which took about 50 minutes, the participants partook in several defensive conditions (vs. just one as is common in contemporary inoculation research), with each defense dealing with a different truism. For example, the same participant might have received active and passive-refutational defenses, as well as active- and passive-supportive-message defenses, all within the first session, as long as each defense corresponded to a different cultural truism. In terms of topics, this design results in the same participant in the control condition for toothbrushing, also receiving a supportive message on X-rays, and a refutational message on regular checkups. Recent research employing the same experimental design and message topics found evidence of cross-protection (i.e., the defenses in different conditions influencing one another; Parker et al., 2016). Such interdependence across experimental conditions is problematic; thus, such experimental designs are no longer used in inoculation research today.

As noted, active-refutational defenses required participants to write paragraphs refuting counterarguments against their position, whereas passive-refutational defenses provided participants with paragraphs to read that refuted counterarguments against their position. For example, an active refutational defense that presented a participant with a sheet of paper with a cultural truism (e.g., “Everyone should brush his teeth after every meal if at all possible.”), followed by a one-sentence counterargument to the truism (e.g., “Too frequent brushing tends to damage the gums and expose the vulnerable parts of the teeth to decay.”), which was then followed by instructions to use the space to write a paragraph refuting the counterargument. Halfway down the page, another counterargument was presented along with additional instructions to write a paragraph refuting it. For passive-refutational defenses, the truism and two counterarguments against it would be presented in an introductory paragraph, followed by two additional paragraphs that refuted each of the counterarguments. The active- and passive-supportive defenses were similar to the format of the refutational defenses, but instead of counterarguments against the cultural truism, participants were presented with two arguments supporting it, followed by instructions for the participant to either write two paragraphs supporting the truism (in the active conditions) or read two paragraphs supporting the truism (in the passive condition; McGuire, 1964).

In McGuire’s initial research on inoculation, some of the experiments asked participants to fill out surveys containing belief measures after the completion of the defensive session. This was done to be able to capture direct belief-strengthening effects of various defenses before the attacks. The most notable effect from beliefs measured after defenses but prior to attacks is known as the *paper tiger effect*, in which supportive defenses appeared to strengthen beliefs when compared to the refutational defenses *prior* to attacks; however, the supportive defenses proved less effective than refutational defenses *after* attacks (McGuire, 1964).

Second (Attacking) Session

Either immediately, or two or seven days after the defensive session, another 50-minute session began, this time dedicated to introducing participants to attacks on cultural truisms and administering surveys to measure their final beliefs in those truisms. The attack typically took the form of an essay, three paragraphs in length. The first paragraph stated the cultural truism, noted that some knowledgeable people have begun to question its validity, and specified two arguments attacking the truism. In the next two paragraphs, each of those arguments were developed in detail. For the participants who received refutational defenses, half were presented with attacks that used the same arguments against the truism that had been refuted in the defense, and half were presented with attacks that used different arguments against the truism. Typically, and as mentioned, each subject would also be in at least one control condition, such as defense-only or neither-defense-nor-attack condition. The specific truisms were rotated based on conditions and topics to ensure correspondence to the defenses and counterbalancing.

After the attack message exposure, participants were asked to complete personality tests (again, to assist with the cover story that the experiment sought to explore the relationship between personality and verbal skills). Subsequently, participants answered survey questions about the cultural truisms, preceded by an additional explanation to maintain the cover story about using the information to determine if attitudes toward the topics moderated the relationship between personality and verbal skills. The survey contained four statements corresponding to each truism. Each participant was asked to check their agreement with the statement on a 15-point scale. The direction of the statement was varied to avoid response bias.

Upon survey completion, participants were asked a series of questions about their perceptions of the experiment. Participants were debriefed about the true purpose of the study twice: immediately after the experiment, and approximately three months later, reminding participants that the attack messages were not true and were only used for research purposes.

Key Findings

Active and Passive Defenses

Theorizing about the differences between active and passive defenses, McGuire (1964) reasoned that, contrary to the findings of prior research attesting to the superiority of active participation (e.g., Culbertson, 1957; Janis & King, 1954), active defenses of cultural truisms would be counterproductive. In an experiment, McGuire and Papageorgis (1961) tested the effect of active participation (writing an essay) in defense of cultural truisms relative to passive participation (reading an essay) on resistance to persuasion. Given the general lack of practice in defending cultural truism, McGuire and Papageorgis (1961) hypothesized that to “actively participate, without guidance, in the defense should have a deleterious effect on the amount of immunity to later persuasion that the defense confers[,] ... and the time could be more efficiently used in presenting [people] with already developed defensive material” (p. 328).

Indeed, across four different topics—on noncommunicative nature of mental illness, the importance of oral hygiene, the benefits of penicillin in fighting infections, and the significance of X-ray in tuberculosis screening—that were used to cross-validate the results, passive defenses (reading) consistently generated greater resistance than active (writing) defenses. These results suggest that cultural truisms are vulnerable to counterattitudinal attacks due to both a practice deficit (not being previously in the position to defend the truism) and a motivational deficit (not having an incentive to accumulate defensive arguments useful for resistance). As evident from McGuire and Papageorgis (1961), resistance without motivation and practice is abysmal if no substantive guidance is provided.

Supportive vs. Refutational Treatments

Building on the medical analogy, McGuire and Papageorgis (1961) theorized that supportive therapy, wherein an individual is preexposed to arguments reassuring their initial beliefs, has a reduced immunizing effect relative to refutational inoculation, wherein a person is preexposed “to weakened, defense stimulating forms of the counterarguments” (p. 327). Supportive treatments are akin to exercise or increased vitamin C in the analogy, whereas inoculation treatments are akin to live-attenuated virus vaccinations in the analogy. As noted previously, relative to the supportive defense, the refutational approaches were designed to be more threatening: Rather than offering statements in support of the truism, the message provided arguments opposing it, followed by the refutations of those opposing arguments. Being faced with an attack against the truism should stimulate defenses, and the exposure to refutations

should prevent counter-persuasion, attempting to undermine the validity of the truism (McGuire, 1964). Explaining why supportive treatments were inferior to refutational preemptions, McGuire argued that supportive arguments were simply not motivational enough to generate resistance.

The superiority of refutational (vs. supportive) treatments was tested in several experiments. McGuire and Papageorgis (1961) found supportive arguments to be less potent at fostering resistance to counterattitudinal-attack messages relative to the inoculation style refutational-same preemptions, containing the same arguments as the attack message. Furthermore, as McGuire's (1961) findings demonstrate, combining supportive defenses with inoculation treatments, containing implicit threat (i.e., the threat perceived from reading arguments attacking the truism) and refutational preemptions, bolstered the efficacy of supportive treatments relative to when supportive messages were used alone. Finally, when supportive treatments were paired with explicit threat (i.e., a forewarning, directly stating that participants will encounter a counterattitudinal attack) without preemptive refutations, such messages were able to facilitate greater resistance than supportive treatments that did not contain explicit threat (McGuire & Papageorgis, 1962).

Refutational-Same vs. Refutational-Different Treatments

An important theoretical extension in early inoculation research focused on the content of the refutational preemption examining the difference between refutational-same treatments, wherein the defense refuted the specific arguments featured in the attack message, relative to the refutational-different treatments, wherein the arguments refuted in the message were not mentioned in the attack. Papageorgis and McGuire (1961) were the first to examine their relative immunizing efficacy. They reasoned that if threat (here, implicit threat, stemming from refutational treatment) is the main driver of resistance, inoculation messages should be effective even against new arguments presented in counterattitudinal attacks (i.e., refutational-same treatments = refutational-different treatments); and if refutational preemption is what drives resistance, then inoculation messages tailored specifically to counterattitudinal attacks should be more effective (i.e., refutational-same treatments > refutational-different treatments). Papageorgis and McGuire's (1961) results demonstrate that refutational defenses conferred resistance regardless of whether the inoculation message targeted specific arguments presented in the attack or contained non-attack-message-specific refutations. These results highlight the central role of threat in inoculation.

Early inoculation research also examined the interaction effects between refutational defenses (same vs. different) and participation (active vs. passive). McGuire (1961) reasoned that what makes refutational-same defense effective is both (1) its subtle implicit threat, arising from the exposure to arguments challenging the truism, highlighting how ill-prepared individuals are to defend against counter-persuasion; and (2) the refutational preemption that uses the same arguments to be encountered in the attack message. In contrast, what makes refutational-different defense effective only comes with the implicit threat. From this reasoning, it follows that, for refutational-same defenses, asking people to read counterarguments useful in a future defense against the counterattitudinal attack (i.e., passive defense) should be more effective at fostering resistance relative to making participants generate counterarguments that they do not have to begin with on their own (i.e., active defense). Thus, for refutational-same defenses, passive defense should outperform active. For refutational-different defenses, the motivational forces of the refutational preemption are key, and the content is less important. Given that active messages are more effective at delivering the threat than passive messages, for refutational-different defenses, active defense should outperform passive. McGuire (1961) found partial support for the predicted interaction:

His results confirmed the relative superiority of passive defenses (vs. active) for refutational-same messages; however, the differences between active and passive defenses in the refutational-different condition were not significant.

Double Defenses

McGuire (1964) conceptualized double defenses as a combination of an active and a passive defense. Based on inoculation predictions regarding the differences in active vs. passive defenses and refutational-same vs. different preemptions summarized above, McGuire hypothesized:

The attacking arguments are refuted less well in the single defense and, hence, the single defense supplies the motivation-inducing threatening component more effectively, while the double (active plus passive) defense more effectively supplies the reassuring refutational content ... For refutational-same defenses, the double defense will be superior to the single, but for the refutational-different defense the single will be superior to the double. (p. 220)

Examining the interaction effect between defense type (active-only vs. passive-only vs. active-plus-passive with order counterbalanced) $\times$ refutation (same vs. different), McGuire (1961) found that double defense outperformed the single in the refutational-same condition, however, in the refutational-different condition, the difference between double vs. single defense appeared to be not significant.

Threat vs. Reassurance

As noted, given the lack of motivation to assimilate defensive material in the case of resistance to persuasion against cultural truisms, supportive defenses have been shown to be sometimes inadequate, whereas refutational defenses have shown greater promise in their ability to generate resistance. Further examining the motivational properties of inoculation, McGuire and Papageorgis (1962) showed that the threat implicitly inherent in the observation of a cultural truism being attacked could be enhanced if the threat is not implied but is instead directly mentioned. To operationalize explicit threat, participants were told that the goal of the experiment was to estimate “how persuasible they were by asking them to read attacks on ... health truisms which they took for granted” (McGuire, 1964, p. 211). This manipulation is a precursor of a contemporary threat component in inoculation research.

Building on these ideas, researchers tested how the alternatives to explicit threat affected resistance, focusing, for instance, on reassurance induction rather than explicit manipulations of threat. Defined as an affirmation that the accuracy of truisms was beyond reproach based on the consensus among the study participant's in group, reassurance was hypothesized to diminish the efficacy of attitudinal defenses as it would further dampen the already deficient motivation to ward off counterattitudinal attacks (McGuire, 1964). Testing these ideas, Anderson (1962) compared the effect of a reassurance feedback delivered prior to the defenses (passive essay reading) to a no-reassurance control. In his study, similar to previous inoculation research, participants were tasked with providing their opinions about different health truisms. Participants in the reassurance condition were informed that there was an almost unanimous consensus among people participating in this study regarding the veracity of those health beliefs. Consistent with inoculation predictions, study results indicated that receiving reassurance prior to exposure to attitudinal defenses reduced their immunizing effectiveness.

Conclusion

Inoculation theory has not just stood the test of time, but it is more popular than ever, both in terms of theoretical advancements and creative applications to important problems. Inoculation scholarship has increased the boundary conditions of theory to include meta-cognition, as with the research on inoculating against reactance (Richards & Banas, 2015, 2018; Richards et al., 2016, 2021, 2022) or inoculation itself (Banas & Miller, 2013). Scholars have also extended the theory to account for contagion effects as inoculation moves through networks via postinoculation talk (i.e., discussion of inoculation-related topics after study participation; Ivanov et al., 2012, 2015, 2018). Applied research has examined the role of inoculation in preventing such timely problems like misinformation (Maertens et al., 2024; Roozenbeek & van der Linden, 2019; Roozenbeek et al., 2020) and conspiracy endorsement related to QAnon (e.g., Banas & Bessarabova, 2023), vaccines (Banas et al., 2024; Bessarabova & Banas, 2024), and 9/11 Truth Movement (i.e., the US government masterminded the 9/11 attacks; Banas & Miller, 2013, Bessarabova et al., 2024). The theoretical advancements on inoculation cross-protection (Parker et al., 2012, 2016) have also extended the practical utility of inoculation by demonstrating that inoculation can not only buffer against arguments not addressed in the inoculation treatment but can also provide protection against attacks on a different and untargeted topic. Compton's (2020) theorizing on prophylactic vs. therapeutic inoculation explicitly adopts the language of vaccination to label traditional preventative inoculation (prophylactic) and extend the theory to include those already afflicted with a sickness (therapeutic; e.g., rabies vaccine). All these theoretical and practical advancements were inspired by the original inoculation scholarship discussed in this chapter, with the inoculation metaphor often playing a central role.

During this era of abundant inoculation scholarship, it is valuable to reflect on the origins of inoculation scholarship: not simply to understand how those initial studies were conducted, but also because the main theoretical issues behind the early inoculation investigations continue to inspire contemporary inoculation research. Indeed, the theoretical issues implicated in the study of time delays, active participation, and refutational content are driving many modern inoculation research programs. Regarding time, scholars have moved away from the notion of the optimal amount of time between treatment and attack, focusing instead on preventing message decay. This can be seen in the scholarship on inoculation *boosters* that seek to maintain inoculation effects over time. Maertens et al. (2024) recently investigated various types of booster inoculations attempting to uncover booster treatments that were memorable enough to provide lasting resistance to misinformation.

Regarding active versus passive participation, the rise in gamification inductions have led to a resurgence of research attention devoted to active participation in inoculation (Lees et al., 2023; Roozenbeek & van der Linden, 2019; Roozenbeek et al., 2020). These approaches are not surprising, given the findings from serious videogame research (e.g., Bessarabova et al., 2016; Dunbar et al., 2017; Lee et al., 2016, 2021), suggesting that videogames offer an engaging method for inoculation inductions that easily facilitate active participation through gameplay. Although serious gaming is currently the dominant area of scholarship on active participation, Ivanov et al. (2024) continued to advocate for the effectiveness of double (active plus passive) defenses in their work, believing, in combination, both defenses provide superior resistance in applied settings.

Regarding refutational treatments, there continues to be a great deal of research attention on the refutational content; however, some issues from the original inoculation studies appear to have been resolved. Since Banas and Rains' (2010) meta-analysis, there has been a decline in studies comparing same versus different refutations. The meta-analysis found no significant difference between the two, rendering further testing of this distinction unnecessary. Similarly, the meta-analysis clearly demonstrated inoculation to be superior to both supportive treatments

and no-treatment controls, so contemporary scholarship has been more focused on content issues like fact- versus logic-based inoculations (e.g., Banas & Miller, 2013; Banas et al., 2024) or *broad spectrum* inoculation, persuasive techniques aimed at facilitating resistance across a range of topics (e.g., Maertens et al., 2024).

Although the metaphor has inspired extensive research and continues to guide theorizing in contemporary scholarship, there have been some criticisms that the metaphor may also be limiting (Banas, 2020; Compton, 2013). Banas (2020) argued that overreliance on the analogy led researchers to hold onto ideas that were not supported by empirical data, such as the insistence that inoculation required a delay of two to seven days between treatment and attack to be effective. Although this is true of a flu vaccine, the cognitive aspect of inoculation allows people to immediately process messages to acquire defensive material. Furthermore, will modern inoculation technology (mRNA) be integrated as a new metaphor for inoculation? Are mRNA-based inoculations—where there is no weakened virus—a problem for the inoculation metaphor, or are they more akin to meta-cognitive inoculations that teach the body to recognize the spike protein? See the rest of this Handbook for answers to some of these exciting research questions.

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