



## Science and Pseudoscience in Communication Disorders: Criteria and Applications

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**Purpose:** The purpose of this tutorial is to describe 10 criteria that may help clinicians distinguish between scientific and pseudoscientific treatment claims. The criteria are illustrated, first for considering whether to use a newly developed treatment and second for attempting to understand arguments about controversial treatments.

**Method:** Pseudoscience refers to claims that appear to be based on the scientific method but are not. Ten criteria for distinguishing between scientific and pseudoscientific treatment claims are described. These criteria are illustrated by using them to assess a current treatment for stuttering, the SpeechEasy device. The authors read the available literature about the device and developed a consensus set of decisions about

the 10 criteria. To minimize any bias, a second set of independent judges evaluated a sample of the same literature. The criteria are also illustrated by using them to assess controversies surrounding 2 treatment approaches: Fast ForWord and facilitated communication.

**Conclusions:** Clinicians are increasingly being held responsible for the evidence base that supports their practice. The power of these 10 criteria lies in their ability to help clinicians focus their attention on the credibility of that base and to guide their decisions for recommending or using a treatment.

**Key Words:** science, pseudoscience, evidence-based practice, stuttering

The discipline of communication disorders is so remarkably diverse that it often appears to have no single overarching or guiding theme (Dawes, 1994; Stanovich, 2001). Siegel and Ingham (1987) argued, however, that there is a consistent theme across the discipline: the application of the scientific method to the nature and treatment of communication disorders. Without claiming that absolutely all aspects of all clinical work can or should be described as an application of the scientific method, certainly the fact remains that the scientific profession of speech-language pathology does rely on two assurances to the general public. First, we warrant that our conclusions about communication processes are derived from, and supported by, scientific evidence. Second, we warrant that our practical applications, including assessment and treatment methods, have been evaluated by empirical methods. In both cases, the general theme is that our discipline's information about the nature and treatment of disorders should be developed through research and other empirically based activities, not solely

through any of the many other possible ways of knowing (e.g., faith, authority, or introspection). These ideas are currently widespread in many forms, including as an emphasis on research-based or evidence-based practice in medicine (Sackett, Straus, Richardson, Rosenberg, & Haynes, 1997), allied health (e.g., Law, 2002), and speech-language pathology in particular (e.g., American Speech-Language-Hearing Association, 2005; Bothe, 2004; Yorkston et al., 2001).

One ramification of the importance of science is that it has become a virtual "touchstone of truth," so that even the superficial appearance of being scientific can convey a credibility or trustworthiness that, in actuality, does not exist (Shermer, 1997). The term *pseudoscience* has been applied to this appearance of being scientific: "A pretended or spurious science; a collection of related beliefs about the world mistakenly regarded as being based on scientific method or as having the status that scientific truths now have" (Simpson & Weiner, 1989, para. 1).

The term *pseudoscience* also has a history of being misused, having been employed unnecessarily to attack others who disagree with one's point of view. As a result, it has developed a strong negative connotation (Still & Dryden, 2004). This connotation, however, is in danger of potentially obscuring the pedagogical value and legitimate utility of pseudoscience as a concept that is distinct from science. First of all, when the term is appropriately used it engenders a healthy sense of skepticism among clinicians and the public, especially when they are confronted with claims that appear to be too good to be true (Herbert, 2003). Second, the differences between scientific and pseudoscientific claims are more than just simply whether the claims are evidence-based or not (cf. McNally, 2003). As will be discussed further below, the quality of that evidence and the manner in which it was obtained and presented publicly are critical for evaluating the scientific credibility of those claims (O'Donohue, 2003). Third, scientists are quite capable of making erroneous claims; the critical distinction is whether they have played by the rules of science and are prepared to admit when they are wrong and open to change (Lilienfeld, Lynn, & Lohr, 2003a). Finally, science itself is sufficiently complex, in terms of method and practice, that it is impossible to characterize it by a single attribute; rather, a battery of criteria are needed to distinguish it from pseudoscience (Bunge, 2003).

Based on such formal definitions as Simpson and Weiner's (1989), and acknowledging the complexities in the use of the word as described immediately above, pseudoscientific treatment claims may be defined as those that appear to be, but are not, objective, empirically based, and rooted in the larger methods and overarching traditions of science and scientists. Pseudoscientific treatment claims are antithetical to the purposes of a true science-based or evidence-based clinical service discipline such as speech-language pathology, and as such they deserve careful scrutiny. The purposes of this tutorial, therefore, are twofold. First, a set of criteria is presented that professionals and consumers in communication sciences and disorders could adopt for recognizing the difference between scientific and pseudoscientific treatment claims. As described in further detail below, these criteria have been previously discussed in some depth for other disciplines. Second, the application of the criteria for two different purposes is illustrated: (a) to examine a new and widely publicized treatment approach (in this case, the SpeechEasy [Janus Development Group, 2003, 2005]) and (b) to examine debates or controversies about treatments (in this case, regarding Fast ForWord [Scientific Learning Corporation, 1996] and facilitated communication [Biklen, 1990, 1993]).

## Criteria for Distinguishing Between Science and Pseudoscience

The differences between scientific and pseudoscientific claims are not always straightforward; in fact, the distinction between science and pseudoscience is more a matter of degree than of kind (Lilienfeld, 1998). Several warning signs are necessary to alert the consumer that a

claim may only appear to be scientific, when it is not. The more such signs are evident, the more likely it is that a belief system or treatment approach is pseudoscientific rather than scientific. These relevant criteria have been widely discussed for both the social and natural sciences (Bunge, 1984, 1991; Hines, 2003; Lilienfeld, Lynn, & Lohr, 2003b; Park, 2003; Ruscio, 2002; Sagan, 1995; Shermer, 1997; Stanovich, 2001), with most authorities agreeing on a core set that includes those described below. The following were patterned after criteria originally described by Lilienfeld et al. (2003b) for the field of clinical psychology because they had been demonstrated as applicable to the helping professions (see, e.g., Herbert et al., 2000) and thus appeared to be relevant to communication sciences and disorders.

### *1. Untestable: Is the Treatment Unable to Be Tested or Disproved?*

The first, and perhaps most convincing, sign of a pseudoscientific claim is that the treatment's supposed benefits are unable to be tested or disproved. Scientific claims, including claims about a treatment's benefits, must be testable through direct observation. A claim that is untestable or incapable of being disproved is, in effect, insulated from the real world (Ruscio, 2002) and for all practical purposes is pseudoscientific. If no test can be conducted, then the credibility of a treatment's benefit relies solely on its developer's assertions or, in some cases, on its logical consistency with some theory or other viewpoint about the disorder. Neither is sufficient for scientific acceptance of claims of treatment benefits. Pseudoscientific approaches to treatment are difficult to evaluate because they are often vague, circumspect, or tautologous in their descriptions, thus making it impossible to envision a definitive empirical test (Bunge, 1991).

There is an important distinction, however, between claims that are untestable in practice, as described above, and claims that are untestable in principle. Many, if not most, pseudoscientific claims are in principle testable, but clear-cut empirical tests that refute their claims are never acknowledged by proponents of the treatment. Thus, even when an empirical test raises serious doubts about the credibility of a treatment's proclaimed benefits, this does not necessarily ensure its removal. Proponents of a treatment—both scientific and pseudoscientific for that matter—can choose to simply ignore the findings and continue to promote the purported benefits. Alternatively, they can respond to troublesome issues by impromptu construction of ad hoc hypotheses that are often designed to deflect concerns rather than to address them directly. For example, a common response to evidence that questions a treatment's benefits is to make the empty retort that "one size does not fit all" (Ruscio, 2002). The implication is that the problem does not lie with the treatment but is instead related to some idiosyncratic characteristic of the client and, thus, the client's problem. The real issue has been skirted; no explanation has been provided for why the treatment does not work, nor have specific guidelines been

presented for making treatment decisions based on reliable individual differences. Eventually, there is some point in time when the frequency of treatment failures accumulate sufficiently that ad hoc hypotheses are no longer viable. This usually becomes an incentive for the scientific community to find other pathways for managing the disorder, whereas the proponents of a pseudoscientific treatment will usually remain steadfast in their support of their original approach.

## ***2. Unchanged: Does the Treatment Approach Remain Unchanged Even in the Face of Contradictory Evidence?***

One of the chief reasons it is critical to be able to test a treatment claim is because it is only through contradictory or disconfirming evidence that a scientific discipline is able to correct mistakes, misconceptions, or inaccuracies. This process, when combined with a receptive attitude to new ideas and a willingness to change, lies at the heart of a scientific approach to knowledge (Sagan, 1995). The goal of science is not to prove that something is correct but to determine what is true. Self-correction is an effective mechanism for reducing errors and eliminating ineffective treatments, and thus it is one of the main means for scientists' success in understanding and alleviating human problems.

In contrast, claims based on pseudoscientific approaches are rarely submitted to empirical tests, and, thus, any errors are rarely self-corrected. In particular, treatments that might be described as "assertion-based" approaches are often founded on the charismatic nature of the treatment's developers and on a firm conviction and trust in the beliefs that form the basis for the approach (Onslow, 2003). If such treatments are never subjected to an adequate empirical test, then they are unlikely to undergo change or self-correction. As a result, a treatment's components will remain much the same as originally developed and its basic concepts unchanged from their initial conception.

## ***3. Confirming Evidence: Is the Rationale for the Treatment Approach Based Only on Confirming Evidence, With Disconfirming Evidence Ignored or Minimized?***

Sometimes there is confirming evidence available that appears to support pseudoscientific treatment claims. Supportive evidence does, indeed, increase the credibility of a treatment claim, especially when independent investigators replicate the original findings. Nonetheless, scientists have long recognized that when people are asked to determine the credibility of a claim they almost invariably look for evidence that confirms rather than disconfirms it (Nickerson, 1998). Moreover, studies have shown that once people find support for their beliefs, they are often reluctant to change their views—even when presented with evidence that demonstrates they are wrong (Dawes, 1994). This does not mean that they necessarily ignore the disconfirming evidence; rather, they are unreceptive to it and likely to discredit it or explain it

away by developing ad hoc hypotheses that can incorporate new ideas while saving the original idea (Gilovich, 1991). Surprisingly, people will do this even if they have no special concern or interest in a hypothesis. Similarly, when people expect or believe that a relationship exists between two variables, they are more likely to find evidence consistent with this belief, even when in reality there is none to be found (i.e., interpreting a chance co-occurrence of two events as suggesting a causal relationship), and are less likely to look for evidence that would disconfirm it (Garb & Boyle, 2003).

Scientists have long recognized these fallibilities in human reasoning; therefore, most scientists accept the principle that the only way to demonstrate the truth of a claim is not to gather confirmatory information but to eliminate the possibility that it is false (Popper, 1959). As applied to treatments, this principle is similar to the notion of testability discussed above; treatments must be tested within a framework that allows for the possibility they will fail, or else there will never be a basis for modifying or eliminating ineffective treatments. As mentioned earlier, this does not mean that confirmation of a hypothesis is uninformative; supportive evidence does increase the credibility of a treatment claim, especially when independent laboratories can replicate the original findings. However, as Nickerson (1998, p. 194) has indicated, the history of science and the behavior of scientists reveals that

it is not so much the critical attitude that individual scientists have taken with respect to their own ideas that has given science the success it has enjoyed as a method for making new discoveries, but more the fact that individual scientists have been highly motivated to demonstrate that hypotheses that are held by some other scientist(s) are false. The insistence of science, as an institution, on the objective testability of hypotheses by publicly scrutable methods has ensured its relative independence from the biases of its practitioners.

Pseudoscience, on the other hand, is characterized by a strong confirmation bias (Gilovich, 1991; Lilienfeld et al., 2003b). Treatment claims are often based only on positive cases, and it is difficult if not impossible to find any cases or evidence that are inconsistent with these claims—or at least any negative evidence that the proponents are willing to acknowledge. As a result, any false assumptions, inefficiencies, or errors in the treatment approach are less likely to be uncovered and corrected.

## ***4. Anecdotal Evidence: Does the Evidence in Support of the Treatment Rely on Personal Experience and Anecdotal Accounts?***

When there is supportive evidence for a treatment claim, it is very important to carefully consider the kind and quality of evidence that supports it. For example, the intensive study of an individual, sometimes known as a case study, has unquestionably played a useful role in

science, especially in clinical research.<sup>1</sup> A clinical case study typically consists of a richly detailed and cohesive narrative that vividly describes such issues as how a problem developed, why the client has certain characteristics, and why and how the treatment worked (Kazdin, 2003). The primary scientific merits of case studies are that they can provide a source for new ideas and hypotheses, describe the basis for developing therapy techniques, and illustrate rare disorders or phenomena. A well-constructed case study, much like a well-crafted story, can make a strong impression, because it often makes an otherwise abstruse idea into something tangible and provocative.

As convincing as case studies may seem, scientists generally recognize that they actually provide only a very weak basis for drawing valid inferences about treatment. Clinical case studies, for the most part, are based on anecdotal information that is difficult to replicate and verify. Furthermore, anecdotal information can be highly selective and susceptible to biased interpretations (Spence, 2001). In sum, a case study does not have the kinds of experimental controls that allow scientifically defensible claims about a treatment's benefits (Kazdin, 2003), and scientists tend to expect more and different types of evidence that a treatment will be effective or efficient (e.g., from experimental study of the treatment).

Pseudoscience, in contrast, relies almost solely on case studies, testimonials, and personal experience as sources of evidence for its treatment claims (Hines, 2003; Stanovich, 2001). Like case studies, client testimonials and personal experience offer vivid and cogent descriptions of a treatment's apparently ameliorative effects. Such stories can be highly persuasive, especially when presented by people who appear to be honest or are clearly motivated by a genuine desire to help others. The problem is that even sincere, well-intentioned people can deceive themselves or misconstrue the cause for the amelioration or cure of their own problems (Ruscio, 2002), because several other factors may account just as readily for perceived benefits. For example, it is well-known that clients' expectations of recovery can sometimes lead to feelings of improvement (i.e., the placebo effect).

The bottom line is that positive testimonials are far too easy to generate, and there are people who seem willing to testify to almost anything (Hines, 2003). This does not mean that resolving a client's complaint is not necessary for documenting the benefits of treatment, only that the elimination of that complaint is not, on its own, sufficient evidence that the treatment was responsible for whatever changes the client perceives. A scientific approach to treatment expects changes in clients' problems to be documented with objective measures, experimental controls minimizing bias, and independent replication of the findings.

<sup>1</sup>Case study, in this context, is being used specifically to refer to an unsystematic and descriptive type of research design (see, e.g., Schiavetti & Metz, 2002, pp. 67–68), and it should not be confused with single-case experimental designs that have sufficient experimental controls that allow investigators to draw reasonably valid inferences (Kazdin, 1982).

## ***5. Inadequate Evidence: Are the Treatment Claims Incommensurate With the Level of Evidence Needed to Support Those Claims?***

The more a treatment claim appears to be “almost too good to be true,” the more the kind, quality, and amount of evidence provided to support that claim become increasingly relevant considerations. Scientists are required to provide evidence to support their claims about a phenomenon or about the efficacy of a treatment approach. The more remarkable the claim (e.g., that the treatment will cure the disorder), the more exacting the evidence that is expected. It is generally recommended that scientific demonstrations of treatment effectiveness follow a phased model of outcome research, in which each phase addresses different questions based on different methods (Robey & Schultz, 1998). At each stage, scientists are expected to publicly report their findings in peer-reviewed journals and at scientific conferences or colloquia (National Academy of Sciences, 1995). Thus, the scientific credibility of treatment claims is based on prescribed levels of evidence that are presented to the scientific community for review and criticism.

As already mentioned, pseudoscientists rarely provide sufficient evidence for the extraordinary treatment benefits they often proclaim (Hines, 2003; Lilienfeld et al., 2003b; Sagan, 1995; Shermer, 1997). Rather than offering supporting evidence, they may insist that it is their critics' responsibility to prove them wrong (Hines, 2003; Lilienfeld et al., 2003b; Sagan, 1995; Shermer, 1997). Such reversals are troublesome when there is no contradictory evidence because treatment claims cannot be assumed to be correct simply because there is no evidence to prove they are wrong. In short, it is a logical fallacy to argue that a claim must be correct from a position of ignorance (Shermer, 1997).

Instead of providing evidence, proponents of pseudoscientific claims will often ask others to believe them on the basis of their personal authority (Ruscio, 2002; Stanovich, 2001). Their credibility may reside in some personal characteristic, such as a personal history of the disorder in question. The implication is that this experience provides some unique insight that makes them more credible, which can appear even more compelling if they personally confronted and overcame the disorder. As discussed above with respect to other reports based on personal experience, this kind of information is subjective and cannot confer scientific credibility or become objective knowledge.

## ***6. Avoiding Peer Review: Are Treatment Claims Unsupported by Evidence That Has Undergone Critical Scrutiny?***

A final consideration concerning the quality of evidence to support a treatment claim is whether that evidence has undergone critical scrutiny. In most cases, this means that the evidence has appeared in a peer-reviewed publication. The publication and communication of research findings are essential to progress in science, and peer-reviewed journals are usually the venue for sharing

information about treatment claims (Kazdin, 1998). Peer review requires scientists to submit a report of their research to a scientific journal to be considered for publication. The report is subsequently sent to several experts in the area so that it can be critically examined for the pertinence, importance, clarity, and scientific credibility of the findings reported. This process is also designed to increase the likelihood that scientists are honest and careful in how they conduct their research. If the results of the peer review are favorable, the report will be published and available for scrutiny by the wider scientific community.

Peer review is admittedly an imperfect process, primarily because it depends on the limitations of human judgment. For example, research has demonstrated that a reviewer's point of view can bias how favorably or unfavorably a report is judged (Mahoney, 1976). Furthermore, reviewers with different viewpoints who examine the same report often disagree on its scientific merits or methodological strengths and weaknesses (Fiske & Fogg, 1990). These and other problems concerning peer review have been studied (Rennie & Flanagan, 2002), and various recommendations have been suggested to improve the process, such as requiring open and signed reviews (Godlee, 2002). Though not always apparent to the casual reader, most scientists recognize that there is a hierarchy of peer-reviewed journals, a hierarchy that consists of the most rigorous and critically demanding at the top, all the way down to the soft review and so-called throwaway journals at the bottom (Rochon et al., 2002). At the same time, it is clear that peer-reviewed journals are highly respected by most scientists, research institutions, and grant funding agencies, because it is widely accepted that this process, despite its flaws, helps to ensure the integrity of the scientific literature.

Pseudoscientific approaches to treatment typically use other methods for disseminating information about treatment claims. Probably the most efficient route for disseminating treatment claims is to bypass the peer review process and present them directly to the public, and pseudoscientists have often been highly effective in using promotion and persuasion to encourage public and professional acceptance of their treatment approaches (Herbert et al., 2000). Wilson (2003), for example, described how the entertainment industry has popularized a variety of pseudoscientific mental health treatment approaches. Such coverage can accelerate acceptance of a treatment, because the popular media usually craft stories that emphasize concrete, personal, and emotional content, which are often easier to accept and believe because it is easier to relate to them (Heaton & Wilson, 1995). Unfortunately, the media rarely raise tough questions about the validity of a treatment claim and often fail to follow up when questions are subsequently raised about its validity (see, e.g., Marlatt, 1983, regarding the controlled drinking controversy). As a result, the public's understanding of pseudoscientific claims is likely to remain

one-sided and unchallenged, which is far less likely if the claims have been peer-reviewed.

### ***7. Disconnected: Is the Treatment Approach Disconnected From Well-Established Scientific Models or Paradigms?***

Scientists often employ paradigms or models to guide them in understanding, explaining, and investigating disorders and their treatment. Couched in terms of overarching themes, theories, belief systems, and established practices, paradigms serve the scientific purpose of defining that which is accepted as given at any point in the ongoing development of a complete knowledge system. Paradigms can, and often do, change over time as new evidence is discovered, making it necessary to adapt them to the current state of knowledge. In some cases, these shifts can seem dramatic or even revolutionary in nature (Kuhn, 1970). In most cases, though, historians and philosophers of science agree that scientific progress is usually incremental, moving forward in fits and starts rather than in great leaps (Bunge, 1991). The accumulating body of evidence is likely composed of contradictory results and inconclusive findings, and it is only when a consensus concerning the overall meaning of the findings emerges among the majority of scientists that a widespread paradigm shift occurs. At the same time, the paradigm remains grounded in widely accepted facts and well-established scientific principles (Bordens & Abbott, 2002; Lilienfeld et al., 2003b) and continues to be consistent with those of other disciplines with which it shares similar methods and concepts (Bunge, 1991). It should be acknowledged that there are rare occasions when there is an emergence of a novel, but correct, paradigm that posits markedly different theoretical assumptions regarding a disorder. But even on these rare occasions, proponents of these paradigms will almost always present scientifically compelling evidence for their superiority beyond currently existing models.

A scientific claim about treatment effectiveness, then, is usually expected to be consistent with the reigning paradigms with respect to the study, nature, and treatment of the disorder in question. Even if it represents a change from previous treatments, a scientific treatment will usually represent an improvement or variation on existing knowledge or practice, rather than an entirely new approach with no links at all to previous knowledge. Pseudoscientific claims, in contrast, are rarely connected to a scientific or empirical tradition (Lilienfeld et al., 2003b). Instead, they are often portrayed as unique, self-contained paradigms, with little or no connection to established scientific principles and procedures, and scant evidence for their validity (Sagan, 1995). Ironically, this can create an impression among casual observers that pseudoscientific paradigms are offering new, exciting, and even revolutionary perspectives. In turn, this novelty effect can make the pseudoscientific claim appear more compelling than the supposedly stodgy, passé, and not always perfect scientific viewpoint (Stanovich, 2001).

## **8. New Terms: Is the Treatment Described by Terms That Appear to Be Scientific but Upon Further Examination Are Found Not to Be Scientific at All?**

Scientific terms and concepts are part of a precisely defined language that scientists use to communicate with each other. Many of these terms and concepts are operationalized such that they become linked to observable, measurable events. Such links serve to isolate those terms and concepts from the feelings and intuitions of observers. In effect, well-defined terms and concepts can be tested by anyone who can carry out the same operational procedures (Stanovich, 2001). Perhaps the biggest obstacle to accurate definitions is when scientific terms are similar to the words used in everyday language. For example, common words such as *language*, *deaf*, or *stuttering* often lead to misunderstanding and confusion among nonscientists who do not appreciate that scientific and clinical definitions of these same terms are more technical, specific, and even different from popular usage. There are, of course, many other scientific terms that are so unique that the language of scientists often appears esoteric and obtuse.

Pseudoscientific terms and concepts can also seem esoteric and obtuse, thus appearing by this criterion alone to be scientific, when, in fact, they are not (Van Rillaer, 1991). Some terms may even resemble those used in a scientific discipline. The key omission is that pseudoscientific terms lack consistent operationalization and cannot be observed or measured by others. Instead, as Ruscio (2002) suggests, pseudoscientific terms are often designed to evade careful scrutiny or even to hide their lack of meaning.

## **9. Grandiose Outcomes: Is the Treatment Approach Based on Grandiose Claims or Poorly Specified Outcomes?**

Scientists are not only careful about the precision of the terms they use, but they are also careful to specify the conditions or boundaries under which a treatment can be studied and to define the factors that are understandable within its scope of interest. These defined boundaries establish the limits of what is and is not scientifically applicable and predictable. Clinical scientists, for example, cannot predict accurately and precisely who will benefit to what extent from a treatment and who will not, because such predictions would require precise knowledge about all variables that might influence each individual at any given time. Instead, scientific predictions are based on groups, likelihoods, or probabilities, with the remaining uncertainty always acknowledged.

Pseudoscientists, in contrast, are less likely to recognize limitations or boundaries in their scope of understanding or in their predictions of treatment-related benefits (Lilienfeld et al., 2003b). In many respects, pseudoscience is not constrained by reality because its success is dependent on making extravagant claims that appear to be designed to appeal to people's fears or wishful thinking, or to raise false hopes (Ruscio, 2002). These are treatment claims that

fall outside the boundaries of any responsible scientist, such as "problem solved," "results in only minutes," and "miracle cure," to name a few.

## **10. Holistic: Is the Treatment Claimed to Make Sense Only Within a Vaguely Described Holistic Framework?**

Another facet of the precision that scientists insist on when studying a treatment is exemplified when they seek to identify and analyze the reasons for a treatment's effectiveness. Such reductionism, however, can be problematic. On the one hand, it leads to more thorough examination of the most relevant characteristics of the disorder or the components of the treatment. On the other hand, it can misleadingly appear as if the investigators are moving farther away from the original problem of interest. Thus, an unintended impression can be conveyed that scientists have lost sight of the bigger picture of what is commonly assumed to really matter about the disorder, such as larger issues that might concern the families' coping or the clients' reactions to the problem.

Pseudoscience often tries to appease such concerns by claiming that a disorder can only be understood within a larger context, or that the whole is greater than the sum of its parts (Lilienfeld et al., 2003b; Ruscio, 2002). In other words, holistic treatment approaches often claim to be directed at the whole person, not just the person's specific complaints. On the face of it, such a view appears to have obvious benefits. The problem is that such thinking can also devolve into increasingly vague and elusive approaches to the problem. This is particularly true if the complex relationships and interactions alluded to by a holistic approach cannot be specified in detail. If they cannot, then the claim to think holistically quickly becomes empty and meaningless (Gilovich, 1991; Ruscio, 2002). Communication disorders, for example, are based on interrelationships between biological, behavioral, and social systems. This complexity oftentimes makes it all too easy for pseudoscientists to describe treatments that seem plausible because they appear to address the "whole" system, but the actual cause-and-effect relationships are far too general or fuzzy to be scientifically meaningful or testable.

## **Summary**

Taken together, the preceding criteria provide a means for evaluating whether a claim of treatment effectiveness appears to share more of the characteristics of a scientific claim or more of the characteristics of a pseudoscientific claim. As an extreme example, a more pseudoscientific treatment claim might be presented to the general public through the mass media with no published research and only by persons who tell dramatic stories about how they themselves have been helped by this entirely new, groundbreaking treatment that they themselves developed. A more scientific treatment claim might come as the result of an uninvolved third party reviewing the results of many years of large-scale, published treatment studies that had been designed according to the principles of falsifiability and self-correction. Of course,

no single study, and no single claim of treatment effectiveness, is solely pseudoscientific or solely scientific, but the series of questions provided above can assist informed consumers to structure their thinking and decision making.

## Applications to Treatments and Controversies in Speech-Language Pathology

To provide further clarification of the criteria presented above, and to exemplify their application to communication disorders, this section provides examples of two slightly different applications of these criteria. First, the criteria are used to assess a currently popular treatment for stuttering, the SpeechEasy device (Janus Development Group, 2005). SpeechEasy was selected because it is new and also widely publicized in the mass media; it represents a timely example of a treatment option that most speech-language pathologists would not have learned about during their training and yet are probably being asked about by their clients. Thus, it represents a realistic example of the use of the pseudoscience criteria by clinicians to evaluate a previously unknown treatment option. Second, the criteria are used to assess the controversies that have surrounded two treatment approaches, Fast ForWord (Scientific Learning Corporation, 1996) and facilitated communication. In this case, the examples were chosen because of the longstanding and widely known nature of the controversies; they provide good opportunities to evaluate whether the pseudoscience criteria might provide a useful framework for clinicians seeking to understand the nature of the arguments about a treatment option.

### Evaluating a Treatment Approach: The SpeechEasy

The SpeechEasy is an in-the-ear prosthetic device intended to enhance fluency for people who stutter (Janus Development Group, 2003, 2005). Fluency-enhancing devices for stuttering are not new (see, e.g., Meyer & Mair, 1963), but they have never been in what might be termed the “mainstream” of stuttering treatment; most graduate fluency courses, for example, rarely address them (Kuster, 2005). The SpeechEasy itself is a relatively new device, and it has been the subject of much national and international attention in recent years, including in such widely known forums as ABC television’s “Good Morning America” (ABC News, 2002, 2005) and “The Oprah Winfrey Show” (Hudson, 2003). It has also come under substantial scrutiny from the stuttering research community (e.g., Ingham & Ingham, 2003). For all these reasons, the SpeechEasy provides an excellent example of a treatment option that clinicians might need to make decisions about; it thus provides an excellent example of the application of the pseudoscience criteria.

To evaluate the SpeechEasy with respect to the pseudoscience criteria, two steps were completed. First, three judges with expertise in stuttering (the three authors) read essentially all the available literature and commentary about the SpeechEasy and developed a consensus set of decisions about the 10 criteria. Second, to test the possible influence of preexisting knowledge on those decisions,

eight 1st-year master’s students independently read a representative set of papers about the SpeechEasy (see the Appendix for procedural details). Each student made independent decisions about each criterion and wrote a narrative summary of his or her reasoning; their opinions were then summarized by two additional students. All 10 students had essentially no previous knowledge of stuttering treatment, the politics that surround it, or the SpeechEasy in particular.

As shown in Table 1, the authors and the independent judgments of the eight 1st-year master’s students provided very similar results, largely in the direction of finding the SpeechEasy to meet most of the criteria of pseudoscience. This result was not unexpected, given some of the existing controversy about the SpeechEasy, but some of the specific differences and explanations are worthy of discussion.

First, with respect to Criterion 1, Untestable, the experts and the student judges disagreed; most of the students found the SpeechEasy to be testable, but the current authors did not. The students’ comments emphasized, correctly, that substantial research has been published testing the underlying features of the SpeechEasy, including frequency-altered feedback (FAF; Stuart, Kalinowski, Armson, Stenstrom, & Jones, 1996; Stuart, Kalinowski, & Rastatter, 1997) and delayed auditory feedback (DAF; Goldiamond, 1965; Ingham, 1984). In the authors’ view, however, part of the untestable nature of the SpeechEasy comes from some of the claims being made, such as that “the device inhibits my stuttering within my neurological system and allows me to create spontaneous, immediate, and natural sounding speech without avoidance, substitutions, and circumlocution” (Kalinowski, 2003, p. 109). In addition, very little research has been published about the SpeechEasy itself, as opposed to about its underlying features, which are discussed in further detail below.

The next four criteria (Unchanged, Confirming Evidence, Anecdotal Evidence, and Inadequate Evidence) were agreed unanimously by all judges to be characteristics of the SpeechEasy. Despite the long reference list provided on the SpeechEasy Web site, no published clinical research is available about this device that describes its long-term,

**TABLE 1. Pseudoscience criteria judged to be characteristic of the SpeechEasy by two groups of judges: the present authors and eight master’s students.**

Criterion	Authors <sup>a</sup>	Students <sup>b</sup>
1. Untestable	Yes	3/7
2. Unchanged	Yes	8/8
3. Confirming evidence	Yes	7/7
4. Anecdotal evidence	Yes	8/8
5. Inadequate evidence	Yes	8/8
6. Avoiding peer review	No	7/7
7. Disconnected	Yes	6/6
8. New terms	Yes	6/7
9. Grandiose outcomes	Yes	8/8
10. Holistic	No	5/7

<sup>a</sup>Entries represent the consensus of the authors.

<sup>b</sup>Entries show the number of students who addressed this criterion who judged it to be present (not all students addressed every criterion).

real-world effectiveness and efficiency with a wide range of persons who stutter (Ingham & Ingham, 2003). Indeed, there are only two published pieces of clinical research about the SpeechEasy device. The first is an “autobiographical case study” by one of the device’s developers (Kalinowski, 2003). The second is a study of only 8 participants in a one-group pretest–posttest design whose posttesting after a 4-month period with the device consisted of one 300-word sample of monologue speech and one 300-word sample of oral reading, both produced in the clinic (Stuart, Kalinowski, Rastatter, Saltuklaroglu, & Dayalu, 2004). Among the most intriguing results of this study was that stuttering was actually worse in the with-device monologue condition after 4 months of wearing the device than in the with-device monologue condition at the initial assessment.

Similarly, there are only two published studies about the underlying FAF component of the SpeechEasy that used spontaneous speech as opposed to reading or scripts, and their results were not promising. Armson and Stuart’s (1998) results did not support the efficacy of FAF; 10 of 12 participants showed no reduction in stuttering frequency during the monologue task. Ingham, Moglia, Frank, Ingham, and Cordes (1997) similarly reported that FAF was not effective for 2 participants, was marginally effective at reducing stuttering but with decreased speech naturalness for a third participant, and had a noticeable positive effect for only the fourth participant. The implications of these negative results are certainly somewhat mediated by Stuart et al.’s (2004, p. 102) report of “an approximately 81% reduction” in in-clinic stuttering frequency for clients using a SpeechEasy device, but, again, that finding comes from the device’s developers. Overall, research publications do not show that the FAF component reduces stuttering in more than a small minority of speakers, and they do not show that the SpeechEasy is an effective approach to reducing stuttering in real-world speaking situations; the SpeechEasy’s developers have yet to adjust their claims to reflect such results. Thus, despite claims of a peer-reviewed research base, the published support for the SpeechEasy appears to be unchanged in the face of contradictory evidence (Criterion 2), based primarily on confirming and anecdotal evidence (Criteria 3 and 4), and based on research that provides inadequate evidence of the claims made (Criterion 5).

For Criterion 6, Avoiding Peer Review, the pattern of results was opposite the pattern obtained for Criterion 1. In this case, all of the student judges concluded that the SpeechEasy has not provided sufficient peer-reviewed information. The students commented on the extensive media coverage, the lack of well-designed published treatment studies with the device itself, and the use of unpublished evidence on the SpeechEasy Web site in support of the device. While these comments are not incorrect, and while there are certainly weaknesses in some of the published information, the present authors nevertheless had to conclude that there is peer-reviewed information available about the SpeechEasy.

The next two criteria assess whether the treatment recommendations appear to be distanced from existing

science, either in underlying procedures or paradigms (Criterion 7) or in terminology (Criterion 8). As shown in Table 1, the current authors and six out of seven student judges who addressed this criterion agreed that the SpeechEasy literature reflects efforts to create new paradigms, hypotheses, or terminology about stuttering treatment that are not well tied to established scientific principles and that overtly attempt to describe new paradigms; several of the relevant papers even have explicit titles along these lines (Kalinowski & Dayalu, 2002; Kalinowski & Saltuklaroglu, 2003; Saltuklaroglu, Dayalu, & Kalinowski, 2002; Stuart & Kalinowski, 1996). Similarly, with respect to terminology, the device is described as depending on personalized combinations of FAF, which “can be set at 500, 1000, 1500, or 2000 Hz shifts up or down” for “eight frequency channels (sixteen for Advanced)” (Janus Development Group, 2003, p. 4), and DAF, which “can be programmed from 25 to 120 ms (25 to 220 ms for Advanced)” (Janus Development Group, 2003, p. 4). Such descriptors may sound technical or scientific, but their use in these contexts is problematic. There is, for example, no relationship between the device’s FAF settings and the shifts studied in the published research, which used shifts from one quarter to two octaves, usually one half to one octave. In particular, the research examined relative changes, such as halving or doubling the frequencies of the speech signal within a certain range, whereas the SpeechEasy is described (including in Stuart et al., 2004) as making absolute adjustments in frequency, some of which are physically impossible: Although any set of frequencies can be halved or doubled, reducing the typical 100–120-Hz fundamental frequency (or reducing the lowest formants or the lowest bands of frequencies) of an adult male speaker by 500 Hz, much less by 2000 Hz, is not possible.

Criterion 9, regarding grandiose claims, was again agreed by all judges to be characteristic of the SpeechEasy. Its developer has described it as “soul-saving” (Hunt, 2002, p. 2) and claimed in a peer-reviewed research article, as mentioned above, that it allows him to produce “spontaneous, immediate, and natural sounding speech without avoidance, substitutions, and circumlocution” (Kalinowski, 2003, p. 109). The SpeechEasy marketing materials and related research articles also often make multiple claims that have not been tested by scientific research and appear to be aimed at people who might be particularly vulnerable: “designed to dramatically reduce stuttering ... remarkable reduction or elimination of stuttering in a short period of time ... other benefits include improved levels of confidence” (SpeechEasy, p. 2). Similarly, in televised presentations, the developers and marketers of the SpeechEasy have described it as all but magical—“People come in and they are totally disfluent and with, like, a wave of a wand, these people are speaking” (Rastatter, in Hudson, 2003, p. 8)—and have made no attempt to counteract equally grandiose claims made by other persons with whom they were speaking—the SpeechEasy is “amazing ... a miracle ... the Holy Grail” (Winfrey, in conversation with Babcock and Kalinowski, in Hudson, 2003, p. 8).



The issue of claims made is complicated, however, by published statements that the SpeechEasy was never intended to be used in the absence of traditional speech-training forms of therapy (Kalinowski, Rastatter, & Stuart, 1998). This combination has never been investigated in published research (Ingham, Ingham, Cordes, Moglia, & Frank, 1998), and marketing literature about the device, as well as examples distributed by the developers through the mass media, show and imply the device, not the device plus therapy. While it therefore must be acknowledged that more complex statements about the intended use of the device have been made, it nevertheless remains quite clear in the vast majority of claims made to the public that the SpeechEasy is intended to “dramatically reduce stuttering ... usually within 20 to 90 minutes” (Janus Development Group, 2005) with no mention of other treatment or strategies.

Criterion 10, the problem of claiming vaguely holistic frameworks for making sense of treatment, does not appear to the present authors to characterize the SpeechEasy. Some of the students who believed this criterion was applicable mentioned such features as the broad claims made by Kalinowski (2003) that there were improvements in his life due to the SpeechEasy that went well beyond speech production itself. But, in our view, generalization of improvements such as this does not necessarily constitute a problem with holistic claims.

In summary, it does appear that several characteristics of the SpeechEasy can be described in terms of the 10 pseudoscience criteria presented above. These descriptions certainly cannot prove the SpeechEasy to be pseudoscientific, if for no other reason than that the distinction between science and pseudoscience is largely a matter of degree, as stated above. Rather, the power of the 10 criteria lies in their ability to focus clinicians’ attention on these important issues, all of which are relevant to the clinical decision to recommend or use a treatment.

### ***Evaluating Existing Controversies: Fast ForWord and Facilitated Communication***

Another useful application of the pseudoscience criteria stems from their ability to help readers or clinicians evaluate not a treatment but an argument about a treatment. It is not uncommon for treatment approaches or recommendations to be met with some discussion in the literature, in the form of reviews, critiques, or letters to the editor. In the absence of complete and balanced information, it can often be difficult for clinicians to determine whether those critiques are valid, or whether the treatment approach is scientific or empirically supported, regardless of the critical opinions. Considering the criticisms and arguments in terms of the characteristics of pseudoscience can be of some benefit, as demonstrated below using two examples, both selected because they have been the subject of substantial and widespread controversy.

*The Fast ForWord controversy.* Fast ForWord (Scientific Learning Corporation, 1996) is a computer-based treatment program for children with language-learning impairment. It was developed by, and is primarily

associated with research completed by, Merzenich, Tallal, and colleagues (e.g., Merzenich et al., 1996; Tallal, 1980, 1990; Tallal et al., 1996), who report that the underlying deficit in language impairment is a general temporal processing deficit. Fast ForWord is therefore intended to help children with language impairment by assisting them with the perception of rapidly changing acoustic signals. The program is designed as a set of seven sound and word exercises, and it is intended to be used in an intensive format.

Fast ForWord has been controversial for a number of reasons, as discussed below. The controversy, in the form of much of the literature about Fast ForWord and much of the conflicting opinion, was evaluated independently for this review by the second author and by two master’s students. The three then worked together to develop a consensus version, which is presented in Table 2 and forms the basis of the following discussion. The goal was to identify the basic nature of the arguments and to determine whether those arguments seemed to be well characterized by the pseudoscience criteria or could be illuminated by the pseudoscience criteria.

Overall, the pseudoscience criteria were remarkably successful in capturing the existing debates about Fast ForWord. Criterion 1, Untestable, does not seem to have been an issue; all parties seem to agree that the treatment is testable.

There is some controversy, however, about whether Fast ForWord has remained unchanged in the face of contradictory evidence (Criterion 2) or might be building its basis only on the existing confirming evidence, without considering evidence that might point to other conclusions (Criterion 3). Essentially, these arguments focus on whether Fast ForWord fixes the temporal processing deficits that its developers propose; Thibodeau, Friel-Patti, and Britt (2001), for example, showed minimal changes in temporal processing skills during and after Fast ForWord treatment. There is also a substantial body of research and criticism that claims that the effects of Fast ForWord are not significantly different from, or in some cases are even worse than, the effects that can be obtained using an equally intensive schedule for treatments that do not use the acoustic signal changes that are said to be critical (e.g., Friel-Patti, DesBarres, & Thibodeau, 2001; Frome Loeb,

**TABLE 2. Pseudoscience criteria at issue in existing controversy about Fast ForWord, by consensus among three judges.**

Criterion	At issue
1. Untestable	No
2. Unchanged	Yes
3. Confirming evidence	Yes
4. Anecdotal evidence	Yes
5. Inadequate evidence	Yes
6. Avoiding peer review	Yes
7. Disconnected	Yes
8. New terms	No
9. Grandiose outcomes	Yes
10. Holistic	No

Stoke, & Fey, 2001; Gillam, Crofford, Gale, & Hoffman, 2001; Marler, Champlin, & Gillam, 2001; Pokorni, Worthington, & Jamison, 2004).

Criteria 4, 5, and 6 similarly have also been raised as potential problems with Fast ForWord. Essentially, the program's critics note that the results of its initial large field trial were circulated in other ways than through peer-reviewed publication (Friel-Patti, Frome Loeb, & Gillam, 2001). As such, the successful results are being emphasized (Criterion 4, Anecdotal Evidence) in a format that has not provided sufficient peer-reviewed evidence of the claims made (Criteria 5 and 6). Criterion 7 (Disconnected) also captures a substantial point of disagreement about Fast ForWord. Tallal and colleagues' theories about the existence of a general underlying temporal processing deficit in children with language impairment definitely differ from other theories of language impairment, and critics question whether they can be upheld (e.g., Friel-Patti, Frome Loeb, & Gillam, 2001; Gillam, 1999). All of these issues combine, finally, to create a situation that reflects Criterion 9: The critics' complaint, essentially, is that Fast ForWord's developers are simply making unsupported grandiose claims.

As also shown in Table 2, the present authors found no evidence of controversy about idiosyncratic terminology (Criterion 8) or working only in a vaguely holistic framework (Criterion 10). There also did not appear to be any point of disagreement that could not be classified as reflecting 1 of these 10 criteria of scientific or pseudoscientific research; that is, it certainly appeared that the existing debates about Fast ForWord can be described in terms of these criteria. These criteria might therefore be useful, as a framework, for clinicians seeking to understand the points at issue in the Fast ForWord controversy or any other similar debate.

*The facilitated communication controversy.* Facilitated communication, as a final example, refers to a procedure in which a facilitator physically supports the hand or the arm of another person who is using a keyboard or possibly another system of augmentative or alternative communication (Biklen, 1990, 1993; Crossley, 1992). Biklen (1990, p. 303), in particular, refers to the "natural language" produced through facilitated communication by persons previously not believed to be capable of complex linguistic expression. He and other proponents of facilitated communication argue that it allows persons with such disorders as autism or mental retardation to communicate in a manner that reflects accurately their relatively high, but previously hidden, cognitive abilities (Biklen, 1990, 1993). Critics argue, in short, that it is the facilitator who is doing the communicating (Green & Shane, 1994; Mostert, 2001). The American Psychological Association (1994) took a very strong stand against facilitated communication in a 1994 resolution, concluding that it is a "controversial and unproved communicative procedure with no scientifically demonstrated support."

The goals for this section and the method of reviewing the literature, relative to the pseudoscientific criteria, were the same as described above for Fast ForWord. As shown in Table 3, the 10 criteria again seemed to capture the

characteristics of the debate, with most of the 10 criteria judged to be present in the debates about facilitated communication. The largest point of contention in the facilitated communication debates is, essentially, that the demonstrations of effectiveness seem to come from situations in which the facilitator knows the answer or could be the source of the information, and that tests in which the facilitator cannot know the answer tend to show that facilitated communication breaks down (e.g., Mostert, 2001; Shane & Kearns, 1994). This issue appears as arguments that can be described in terms of several of the criteria for pseudoscience: whether claims of facilitated communication's effectiveness are phrased clearly enough to be testable (Criterion 1; see Mostert, 2001); why facilitated communication's proponents have allowed it to continue to be used, essentially unchanged, in the face of conflicting evidence (Criterion 2; see Biklen & Cardinal, 1997); whether the support for facilitated communication is based only on confirming evidence (Criterion 3) or anecdotal evidence (Criterion 4), failing to incorporate the conflicting evidence and the evidence from controlled studies (e.g., Mostert, 2001; Shane & Kearns, 1994); and whether adequate proof is provided to support the rather amazing claims that persons with moderate to profound disabilities can write complex language after all (Criteria 5 and 9; see, e.g., Green & Shane, 1994; Mostert, 2001). There are also substantial debates about what Mostert (2001) calls the theoretical or conceptual underpinnings of facilitated communication, including Biklen's (1990) original explanations that autism is a disorder simply of expression, not of language or cognition; these are debates about whether facilitated communication is disconnected (Criterion 7) from more generally accepted descriptions of autism, mental retardation, and other problems. The debates also clearly address questions related to what facilitated communication's critics see as grandiose claims (Criterion 9) of almost unbelievable outcomes.

The debates about facilitated communication also provide an example, finally, of what the pseudoscience criteria refer to as holistic claims (Criterion 10). Biklen and Cardinal (1997), for example, addressed the negative results of nonconfirming experiments by discussing the specific tasks or conditions used in those tests. They

**TABLE 3. Pseudoscience criteria at issue in existing controversy about facilitated communication, by consensus among three judges.**

Criterion	At issue
1. Untestable	Yes
2. Unchanged	Yes
3. Confirming evidence	Yes
4. Anecdotal evidence	Yes
5. Inadequate evidence	Yes
6. Avoiding peer review	No
7. Disconnected	Yes
8. New terms	No
9. Grandiose outcomes	Yes
10. Holistic	Yes

rejected the conclusion generally reached in such studies, that facilitated communication is not effective, by arguing that the available nonconfirming tests did not consider enough of the larger issues (e.g., the need to observe facilitated communication users in their natural environment with familiar facilitators, in order to gather enough data in the relevant larger context). In summary, proponents of facilitated communication explain that a broad enough, or holistic enough, vantage point will allow critics to see that it does work, whereas critics of facilitated communication explain that, at a more controlled level that proponents reject as irrelevant, it does not work.

Consideration of the facilitated communication debates also revealed one issue that does not seem to be captured by the pseudoscience criteria: the ethics of using, or not using, this approach. Proponents of facilitated communication raise such points as an ethical responsibility to provide all possible assistance, to evaluate each case individually (e.g., Koppenhaver, Pierce, & Yoder, 1995), and to use anything that works for a particular client, regardless of the outcome of group-design research (Biklen, 1990, 1993; Biklen & Cardinal, 1997). Critics, similarly, raise such ethical issues as the problems inherent in providing what they see as false hopes to the family or other loved ones of severely impaired individuals, as well as the ethical issues involved in allowing facilitators to speak for individuals who have no way of correcting what the facilitator has just said on their behalf (Mostert, 2001; Shane & Kearns, 1994). Thus, in the case of facilitated communication, it appears that the points of debate begin to be captured by the pseudoscience criteria, but at least one additional important issue, ethics, also needs to be raised.

## Summary and Implications

The 10 characteristics of pseudoscience presented in this paper have been widely discussed in the social sciences literature as markers of potentially pseudoscientific treatment claims. As exemplified throughout this discussion, no single one of these criteria provides necessary or sufficient evidence that any treatment is pseudoscientific or is scientific; similarly, there is no number of characteristics that must be present or absent to establish the scientific nature of a treatment. It is also important to note that science is not impervious to the problems described as weaknesses of pseudoscience; scientists are also susceptible to self-deception, bias, and errors of judgment. The scientific community, however, tries to minimize such limitations by working within a larger system that is designed to subject all treatment claims to scientific skepticism, doubt, and public criticism. Indeed, the most telling difference between scientists and pseudoscientists may be how they respond to valid criticism of their treatment claims. Scientists ultimately respond with additional empirical studies that examine the validity of such concerns; in contrast, pseudoscientists are likely to ignore or evade even the most compelling counterevidence.

With those caveats in mind, it does seem possible to emphasize some of the elements of the pseudoscience

criteria for clinicians seeking to determine the validity of a new treatment claim or seeking to understand the arguments about a controversial treatment. First, professionals must be skeptical of success rate claims that are not supported by acceptable levels of scientific research or evidence (Criteria 3, 4, 5, and 9). Considerable time, effort, and financial resources are required to develop and obtain the evidence needed to support treatment claims (e.g., Onslow, Packman, & Harrison, 2003), but bypassing these steps, or rushing to promote or use a treatment before it has been evaluated scientifically, carries substantial risks. If a treatment is, in fact, ineffective, there is a cost to both the clients who did not benefit and to the professional whose image may be tarnished in the public eye.

Second, professionals should resist adopting a treatment approach that is presented first to the public, especially through the mass media, rather than through established scientific channels (Criterion 6, Avoiding Peer Review). Bypassing scientific scrutiny is a serious issue because the media rarely raise the kinds of critical questions that scientists are trained to ask about the evidence used to support a treatment claim. Personal testimonials on television or in print are simply not sufficient evidence to support adopting a treatment, no matter how convincing such portrayals may appear (Criterion 3, Confirming Evidence, and Criterion 4, Anecdotal Evidence).

Third, professionals should be wary about trusting their own clinical experience as the sole basis for determining the validity of a treatment claim. Experience is a teacher: It helps us to be more proficient and efficient in administering treatment. Neither clinical experience nor client report, however, serves as adequate protection against confirmation bias and judgment errors (Finn, 2004). Even if positive changes occur during or after a treatment, that treatment cannot be said, with scientific certainty, to be the cause of those changes, and the same benefits cannot necessarily be predicted for any future clients (Criteria 3 and 4).

Finally, professionals need to keep in mind their responsibilities to clients, other professionals, and the public. Increasingly, the profession of speech-language pathology is adopting evidence-based approaches for managing communication disorders (American Speech-Language-Hearing Association, 2005), an orientation that emphasizes the individual clinician's responsibility to identify and use scientifically grounded procedures (Sackett et al., 1997). Many of the ideas presented in discussions of evidence-based practice are similar to the ideas presented in discussions of pseudoscience, including most importantly the notion that decisions about assessment and treatment should be based in large part on empirical evidence from well-constructed and conservatively interpreted research. Similar ideas have also been presented in terms of the notion of a scientist practitioner (Hayes, Barlow, & Nelson-Gray, 1999) and in terms of the search for "empirically supported" treatments (Chambless & Hollon, 1998). The general point in all such discussions is essentially the same: It is the profession's and each professional's responsibility to

determine whether a treatment claim is pseudoscientific and therefore should not serve as the basis for clinical practice, or scientific and therefore should serve as a basis for a well-supported clinical practice. Whether the terminology is in terms of evidence-based practice, scientist practitioners, empirically supported treatments, or pseudoscience, the point is that clients, professionals, and the general public are all best served when we have a solid scientific basis to support our discipline and our profession.

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## Appendix

### Student Judgment Procedures

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Eight students at the University of Arizona self-selected to complete a midterm assignment, which was one of three topic options, as part of a requirement for a course on stuttering. The assignment was to apply the criteria for distinguishing between science and pseudoscience to two treatment approaches, the SpeechEasy and the Lidcombe Program. The Lidcombe Program is a well-established, scientifically based treatment for managing early childhood stuttering (Onslow et al., 2003) that was included to determine whether students could accurately distinguish between a scientifically based approach and one that was less so. Prior to the assignment's due date, students were only exposed to course material and readings that addressed the nature and assessment of stuttering. Thus, there was no class exposure to the characteristics of science and pseudoscience or these two treatment approaches.

To complete the assignment, students were provided with the questions for distinguishing between science and pseudoscience, as described in this article. They were also provided with a total of 14 articles (Armson & Stuart, 1998; Bonelli, Dixon, Bernstein Ratner, & Onslow, 2000; Harris, Onslow, Packman, Harrison, & Menzies, 2002; Kalinowski, 2003; Kalinowski, Armson, Roland-Mieszkowski, Stuart, & Gracco, 1993; Kalinowski, Stuart, Sark, & Armson, 1996; Kingston, Huber, Onslow, Jones, & Packman, 2003; Lincoln & Onslow, 1997; Onslow, Andrews, & Lincoln, 1994; Onslow, Costa, & Rue, 1990; Onslow, Menzies, & Packman, 2001; Saltuklaroglu et al., 2002; Stuart et al., 1996; Stuart et al., 2004), selected to be representative of each approach in terms of showing the range of supporting evidence available from the developers of each treatment (7 for each). Students were instructed to visit the Web sites for each treatment approach in order to obtain a general overview of its purpose and principal components. They were required to write an 8–10-page double-spaced report that provided a well-reasoned and evenhanded evaluation of each treatment in terms of whether it appeared to be one that was generally scientific or pseudoscientific. Finally, two independent readers, who were graduate students at the University of Georgia and not involved in any other aspect of this tutorial, read anonymous copies of the student reports and tabulated their consensus view of the students' main points for or against each treatment in terms of the criteria for distinguishing between science and pseudoscience. The results for the SpeechEasy are described in the text. The results for the Lidcombe Program revealed that the students unanimously agreed that it appeared to meet none of the criteria for pseudoscience, thus suggesting that the criteria adequately distinguished between science and pseudoscience.

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