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Deconstructing Common Bidirectional Naming: A Proposed Classification Framework

Emma Hawkins[1] · Grant Gautreaux[2] · Mecca Chiesa[3]

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Abstract

Conceptually, the use of the technical term *naming* appears to be a broad term that describes several subtypes of emergent verbal behavior. Miguel (*The Analysis of Verbal Behavior, 32,* 125–138, Miguel, 2016) introduces the concept of subtypes of naming, specifically common bidirectional naming and intraverbal bidirectional naming. He defines common bidirectional naming as "the process of different stimuli evoking the same speaker and listener behaviour and becoming members of the same class" (p. 130). A review of the literature on common bidirectional naming yielded some ambiguities related to differences in how researchers in the field defined naming. This article suggests that common bidirectional naming may be further dissected to yield six subtypes of naming. We aligned previous research on emergent verbal behavior with a unified taxonomy as part of a larger proposed classification framework on naming. The impact of identifying the subtypes of common bidirectional naming on skill acquisition and curriculum design is discussed. Finally, recommendations are made for future research based on this framework.

Keywords Naming · Common bidirectional naming · Emergent verbal behavior · Incidental learning

The importance of specificity and technicality in writing within a science is essential. Within the field of behavior analysis, the technical term *naming* has

✉ Emma Hawkins
emmahawkins@jigsawschool.co.uk

[1] Jigsaw CABAS® School, Building 20, Dunsfold Park, Stovolds Hill, Cranleigh, Surrey GU6 8TB, UK

[2] College of Education, Nicholls State University, Thibodaux, LA, USA

[3] Tizard Centre, University of Kent, Canterbury, Kent CT2 7NF, UK

been used by numerous researchers to describe a phenomenon that accounts for the emergence of untaught verbal behavior (e.g., Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer, Corwin, & Buttigieg, 2011; Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005; Greer, Stolfi, & Pistoljevic, 2007; Hawkins, Charnock, & Gautreaux, 2007; Hawkins, Kingsdorf, Charnock, Szabo, & Gautreaux, 2009; Horne, Hughes, & Lowe, 2006; Horne, Lowe, & Randle, 2004; Lowe, Horne, Harris, & Randle, 2002; Lowe, Horne, & Hughes, 2005; Pérez-González, Cereijo-Blanco, & Carnerero, 2014; Pérez-González, García-Conde, & Carnerero, 2011; Speckman-Collins, Lee Park, & Greer, 2007). Greer and Speckman (2009) inferred that the term *naming* may be too generic and recommended the subtle changing of the term *naming* to *Naming* (from lowercase *n* to uppercase *N*) to distinguish between the technical term *naming* and other similar terms, such as *labeling* and *tacting*. Miguel (2016) argues further that a clearer and more decisive term for naming should be established in order to avoid this confusion with other similar terms. He posits an initial bifurcation of two subtypes of naming.

Common Bidirectional Naming and Intraverbal Bidirectional Naming

Miguel (2016) introduced the concept of subtypes of naming, specifically common bidirectional naming and intraverbal bidirectional naming. He defined common bidirectional naming as "the process of different stimuli evoking the same speaker and listener behaviour and becoming members of the same class" (p. 130). The example provided by Miguel (2016) involved an individual learning to tact "cow" in the presence of a cow (speaker behavior). He posits that common bidirectional naming is established once the individual learns to look at the cow or select the cow when hearing "cow" (listener behavior). Thus, in this example, both speaker behavior and listener behavior are established for a common stimulus.

Miguel (2016) differentiates common bidirectional naming from intraverbal bidirectional naming, defining intraverbal bidirectional naming "as the establishment of stimuli as related or equivalent intraverbal relations" (p. 134). For example, Miguel (2016) suggested that learning to say "milk comes from the cow" may establish the stimuli "milk" and "cow" as intraverbally related.

This article focuses on deconstructing common bidirectional naming into six subtypes. This proposed classification framework is not intended to replace Miguel's subtypes of naming but instead seeks to extend his work and add further specificity. The rationale for this proposed classification framework emanates from an analysis of how researchers have used the global term *naming*. This analysis has yielded information showing that a multitude of naming behaviors have been studied under the term *naming*. These variations make comparisons between studies and analyzing their results difficult. The proposed classification framework enables researchers to identify specific subtypes of naming in order to compare research studies more accurately, test the presence and absence of each subtype, determine what subtype may need to be induced, and isolate potential missing prerequisite naming behaviors. The importance of identifying different subtypes of naming is essential to making cohesive thoroughgoing contributions to existing research on verbal behavior.

Conceptual Research Contributions

Horne and Lowe (1996) attempted to account for the emergence of untaught verbal operants. Their naming theory was an extension of Skinner's (1957) theory on verbal behavior. Their theory is akin to other accounts for the emergence of untaught verbal behavior, such as stimulus equivalence (e.g., Sidman, 1971, 1977) and derived relational responding theories (e.g., Hayes, Barnes-Holmes, & Roche, 2001). Horne and Lowe (1996) defined naming as "a higher order bidirectional behavioural relation that combines conventional speaker and listener functions so that the presence of either one presupposes the other" (p. 207). They suggested "higher order" refers to verbal operants that produce generalized, emergent, or novel behavior. Once naming behavior is established, directly taught listener behavior results in the emergence of corresponding untaught speaker behavior and vice versa. Thus, naming behavior is the integration of speaker and listener behavior.

In addition to the emergence of untaught speaker and/or listener behavior (the first component[1] of naming), Horne and Lowe (1996) included a second component that involved the acquisition of names of items without direct teaching. They referred to research by Nelson and Bonvillian (1973), which reported children 18 months and older naming new objects after an adult named the objects in their presence only once or twice. The direct teaching of either listener or speaker behavior was not required to establish naming behavior. It was established solely by hearing the name of the new item in the presence of the stimulus. These two components of naming are incorporated within Miguel's (2016) definition of common bidirectional naming.

Catania (1998) provided a definition of naming that closely aligned with the definition of the first and second components of naming described by Horne and Lowe (1996). He also defined naming as a higher order class and also as a bidirectional relationship between listener and speaker behavior.

Consistent with Horne and Lowe's (1996) second component of naming and Catania's (1998) second feature[2] of naming (acquiring both untaught listener and untaught speaker behavior without direct teaching), Greer and Ross (2008) described naming behavior as "the capacity to acquire a tact and a listener response by simply hearing another person tact a stimulus" (p. 149). They drew from these previously identified components and features to describe what they termed "full naming" (p. 149). Greer and Ross (2008) used the term "full naming" to identify the acquisition of novel listener and speaker behavior without direct teaching. It does appear appropriate that a different term ("full naming") is adopted for this aspect of naming because it is more complex than the first component and first feature of naming as described by Horne and Lowe (1996) and Catania (1998). Full naming is likely more complex than the first component/feature because the names of novel items are acquired without direct teaching. This appears to be an important distinction because individuals with full naming acquire names of novel items via observation rather than via direct teaching. Of course, this hypothesis assumes that learning via observation is more complex than learning via direct teaching. Subsequently, researchers whose work

[1] For clarification, Horne and Lowe (1996) used the term "component" to discriminate between different types of naming. The same term will be used in this article.

[2] Catania (1998) used the term "feature" to discriminate between different types of naming.

emanated from the concept posited by Greer and Ross (2008) used the term "full naming" to describe the dependent variable in their experimental studies (e.g., Gilic & Greer, 2011; Greer et al., 2005, 2007, 2011; Hawkins et al., 2007, 2009; Pérez-González et al., 2011, 2014; Speckman-Collins et al., 2007). Table 1 illustrates two predominant research tracks and links them to different theorists.

Establishment of Research Tracks Based on the Conceptual Literature

Two applied research tracks emerged from the published conceptual literature on common bidirectional naming (Miguel, 2016). One research track is related to the bidirectional relationship that occurs when listener behavior is taught to an individual and speaker behavior emerges for that same individual, and/or vice versa (e.g., Catania, 1998; Horne & Lowe, 1996). This may be categorized as bidirectional naming. A second research track is related to the emergence of new listener and speaker behavior following an incidental language experience without direct teaching. This can be categorized as incidental bidirectional naming (e.g., Catania, 1998; Greer & Ross, 2008; Horne & Lowe, 1996).

Proposed Classification of Experimental Research Tracks

Closer inspection of these two previously identified research tracks suggests further dissection of common bidirectional naming. Separate and unique subtypes of naming may be classified into categories specific to the types of emergent verbal operants isolated in each study. This analysis has provided a case for the identification of possibly six subtypes of common bidirectional naming (Miguel, 2016). The studies selected in our review of the relevant literature on naming were restricted to only peer-reviewed published research. Dissertations were not considered.

Bidirectional Naming

Bidirectional naming occurs when listener behavior is taught to an individual and speaker behavior emerges for that same individual, and/or vice versa (e.g., Catania, 1998; Horne & Lowe, 1996). This relationship describes one aspect of naming

Table 1 The different subtypes of naming and corresponding theorists

Subtypes	Description	Theorists
Component 1	Emergence of untaught speaker/listener behavior	Horne and Lowe (1996)
Feature 1		Catania (1998)
Component 2	Acquiring new names without direct teaching	Horne and Lowe (1996)
Feature 2		Catania (1998)
Full naming		Greer and Ross (2008)

behaviors and may be broken down into three subtypes of bidirectional naming behavior.

Subtype 1: Teaching Speaker Behavior and Testing for Corresponding Untaught Listener Behavior (a Unidirectional Relationship)

Lowe et al. (2002, 2005) demonstrated the emergence of untaught listener behavior following the teaching of corresponding speaker behavior using contrived stimuli. Neurotypical children, aged 1 year to 4 years 3 months, were presented with a contrived symbol and taught to tact the symbol as "vek" or "zog." Children who achieved criterion on tact training (speaker behavior) were tested for corresponding listener behavior. All participants achieving criterion on tact training passed this subsequent listener test.

In contrast to the findings by Lowe et al. (2002, 2005), Fiorile and Greer (2007) taught children diagnosed with autism to tact contrived stimuli, but their participants did not demonstrate corresponding emergent listener behavior when initially tested. Emergent listener behavior was induced for these participants following a multiple-exemplar instruction procedure.

Within this subtype of naming behavior, if the untaught listener behavior emerges, the term *listener unidirectional naming* is specific to what has occurred.

Subtype 2: Teaching Listener Behavior and Testing for Corresponding Untaught Speaker Behavior (a Unidirectional Relationship)

Horne et al. (2004) provided listener training to nine neurotypical children aged 1 year 4 months to 4 years. Seven of the nine children failed a subsequent test of corresponding untaught speaker behavior (tact test). These mixed results indicated that this subtype of naming occurs for some individuals, but not all. In order to predict the emergence of specific verbal operants more reliably, researchers may need to have more data on the participants' repertoires prior to the onset of the study.

To expand on these apparent idiosyncratic findings, Horne et al. (2006) investigated whether speaker behavior emerged if listener behavior was taught to 14 neurotypical children aged 1 to 4 years. The results of this study showed that listener training did establish untaught speaker behavior in 10 of the children. Horne et al. (2006) showed that most (but not all) participants acquired untaught speaker behavior. In these studies, if the untaught speaker behavior emerged, the term *speaker unidirectional naming* explicitly describes the type of emergent behavior.

Although the speaker/listener, listener/speaker relation is referred to as *bidirectional* naming, the studies by Lowe et al. (2002, 2005), Fiorile and Greer (2007), and Horne et al. (2004, 2006) reported on outcomes of *unidirectional* procedures (testing one of the untaught behaviors, listener or speaker). Arguably, testing for a bidirectional naming relationship should include both direct teaching of listener behavior followed by a subsequent test for corresponding emergent speaker behavior and direct teaching of speaker behavior followed by a subsequent test for corresponding emergent listener behavior. Cases in which both of these subtypes of naming emerged possibly demonstrate that listener and speaker behavior may be joined.

Subtype 3: Testing for a Bidirectional Relationship Between Listener and Speaker Behavior

Pérez-González et al. (2011, 2014) conducted a true test for a bidirectional relationship. They tested whether taught listener behavior resulted in untaught speaker behavior without further training and vice versa. Both studies involved neurotypical children. Pérez-González et al. (2011) showed that speaker training led to untaught listener behavior emerging, but untaught speaker behavior did not emerge following listener training. Similarly, Pérez-González et al. (2014) tested for a bidirectional relationship but yielded mixed results. Some participants demonstrated a unidirectional relationship (untaught listener behavior emerged following speaker training), and some participants demonstrated a bidirectional relationship (both untaught listener behavior and untaught speaker behavior emerged).

The term *joint bidirectional naming* more specifically describes the subtype of naming behavior occurring when an individual meets the requirements for both listener unidirectional naming and speaker unidirectional naming (e.g., Pérez-González et al., 2011, 2014).

Incidental Bidirectional Naming

Three additional subtypes of naming are linked to incidental bidirectional naming, which refers to acquiring new names of stimuli without direct teaching (e.g., Gilic & Greer, 2011; Greer et al., 2005, 2007, 2011; Hawkins et al., 2007, 2009; Pérez-González et al., 2011, 2014; Speckman-Collins et al., 2007). These are identified conceptually by Greer and Ross (2008) as the "listener component of naming" (p. 93), the "speaker component of naming" (p. 112), and "full naming" (p. 149). In fact, Greer and Ross (2008) were the first to categorize naming into these different subtypes. However, the subtypes proposed by Greer and Ross (2008) are not specific enough to discern the subtypes of naming behaviors that have occurred (bidirectional naming or incidental naming). The proposed three components of incidental naming each focus on acquiring untaught listener and/or untaught speaker behavior without any corresponding direct teaching of speaker or listener behavior. Instead, individuals are exposed to novel names of items and tested if they subsequently used those novel names as a listener (e.g., pointing to the item) or as a speaker (e.g., tacting the item). Individuals who use the names as a listener but not as a speaker are described by Greer and Ross (2008) as meeting the criterion for the "listener component of naming." Because the use of consistent terminology is essential when conducting scientifically validated research, it is likely important to align these terms with the terms introduced in the section on bidirectional naming.

Subtype 4: The Emergence of Untaught Listener Behavior Following an Incidental Language Experience

The term *listener incidental unidirectional naming* appears to be a good fit to describe the naming behavior that occurs when individuals point to objects following exposure to hearing the names of those items (no direct teaching) but do not accurately tact those same items.

Similar to the research on bidirectional naming, there are differences in the outcomes within the empirical research on incidental bidirectional naming. For example, when applying the proposed classification framework, the participants in the study by Speckman-Collins et al. (2007) did not initially demonstrate listener incidental unidirectional naming (the emergence of untaught listener behavior following an incidental language experience). However, an auditory matching procedure was implemented, and subsequently, listener incidental unidirectional naming was induced.

Subtype 5: The Emergence of Untaught Speaker Behavior Following an Incidental Language Experience

The term *speaker incidental unidirectional naming* should be considered when describing individuals who demonstrate the emergence of untaught speaker behavior following an incidental language experience. In other words, after exposure to hearing the names of items, but without direct teaching, the individual only tacts those items but does not accurately point to the corresponding items.

If an individual is tested for incidental bidirectional naming and he or she meets the criterion for listener incidental unidirectional naming, but not speaker incidental unidirectional naming, then only speaker incidental unidirectional naming needs to be induced. Greer et al. (2005, 2011) and Hawkins et al. (2007) used an intervention, multiple-exemplar instruction, to induce speaker incidental unidirectional naming. As per the proposed classification framework, their participants demonstrated listener incidental unidirectional naming prior to the implementation of multiple-exemplar instruction. Following the multiple-exemplar instruction intervention, their participants demonstrated speaker incidental unidirectional naming, therefore meeting the criteria for another subtype of naming, joint incidental bidirectional naming.

Subtype 6: The Emergence of Untaught Listener and Speaker Behavior Following an Incidental Language Experience

The term *joint incidental bidirectional naming* appears to accurately describe the subtype of naming that occurs when individuals achieved the criteria for both listener incidental unidirectional naming and speaker incidental unidirectional naming. These terms provide more specification than Greer and Ross (2008), who described individuals with "full naming" as those who achieved the criteria for both the listener component and the speaker component of naming.

Five studies (Gilic & Greer, 2011; Greer et al., 2007; Hawkins et al., 2009; Pérez-González et al., 2011, 2014) tested for joint incidental bidirectional naming. In three of these studies (Gilic & Greer, 2011; Greer et al., 2007; Hawkins et al., 2009), participants did not demonstrate listener incidental unidirectional naming or speaker incidental unidirectional naming when they were initially tested. Following a multiple-exemplar instruction procedure, most of the participants subsequently demonstrated joint incidental bidirectional naming.

In summary, congruent with the research track on bidirectional naming, the research track on incidental bidirectional naming also appears to include three

subtypes: (a) listener incidental unidirectional naming, or individuals who demonstrate the emergence of untaught listener behavior following exposure to the names of novel items (e.g., Speckman-Collins et al., 2007); (b) speaker incidental unidirectional naming, or individuals who demonstrate the emergence of untaught speaker behavior following exposure to the names of novel items (e.g., Greer et al., 2005, 2011; Hawkins et al., 2007); and (c) joint incidental bidirectional naming, or individuals who demonstrate the emergence of both untaught listener behavior and untaught speaker behavior following exposure to the names of novel items (e.g., Gilic & Greer, 2011; Greer et al., 2007; Hawkins et al., 2009; Pérez-González et al., 2011, 2014).

Alternative Terminology

It is of interest that Pérez-González et al. (2014) distinguished between bidirectional naming and incidental bidirectional naming but used the names of the procedures to test for naming to describe the type of naming. The authors labeled bidirectional naming as "tact-selection" naming. Pérez-González et al. (2014) reported a tact-selection procedure for testing for tact-selection naming, which involved directly teaching listener behavior and testing for untaught speaker behavior and vice versa with the same participants. The procedure used in Pérez-González et al. (2014) is identical to the test for joint bidirectional naming, measuring the emergence of both untaught listener behavior and untaught speaker behavior.

Pérez-González et al. (2014) also used the term "full naming" in their work, citing Greer and Ross (2008), but renamed it "pair-test" naming to distinguish it from tact-selection naming, described previously. Using the proposed classification framework, pair-test naming is equivalent to joint incidental bidirectional naming.

Proposed Classification Framework

In summary, some studies have taught speaker behavior and tested for untaught listener behavior (Subtype 1, proposed as listener unidirectional naming), others have taught listener behavior and tested for untaught speaker behavior (Subtype 2, proposed as speaker unidirectional naming), and some have tested for both subtypes (Subtype 3, proposed as joint bidirectional naming). There is also evidence that these patterns of emergent behavior may happen without direct teaching of participants in either speaker or listener behavior but through mere exposure to an object and a name. This occurrence may be referred to as incidental. Overall, this gives rise to six categories: Subtypes 1, 2, and 3 (bidirectional naming) and Subtypes 4, 5, and 6 (incidental bidirectional naming). See Figure 1 for a schematic representation of the proposed classification of common bidirectional naming.

Figure 2 illustrates the same schematic representation for common bidirectional naming but also includes terminology used by other researchers, specifically Greer and Ross (2008) and Pérez-González et al. (2014), so that useful comparisons and analyses can be made between the new suggested taxonomy and the current terminology.

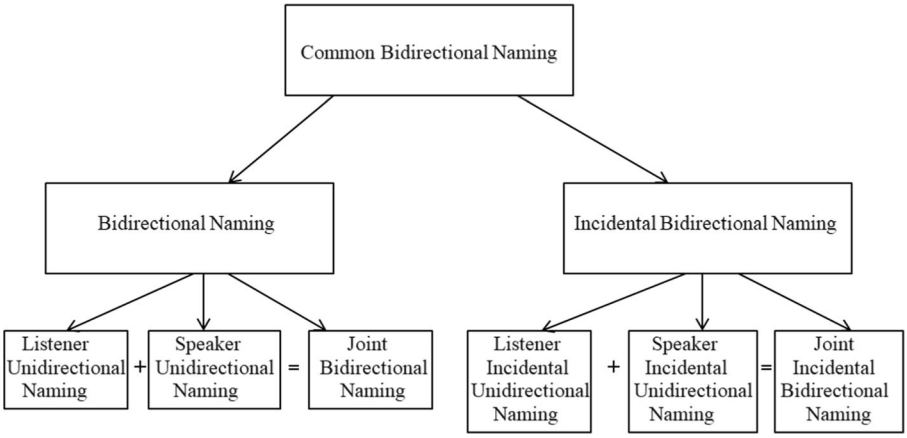

Fig. 1 A schematic representation of the proposed classification of common bidirectional naming

Although the existing body of research on naming has implications for understanding the emergence of untaught verbal behavior, it is for the benefit of future research to conceptually categorize and organize the prerequisite subtypes making up the composite behavior known as naming. The foregoing consideration of research in this area suggests a classification framework to include six subtypes of naming. These are presented in Table 2.

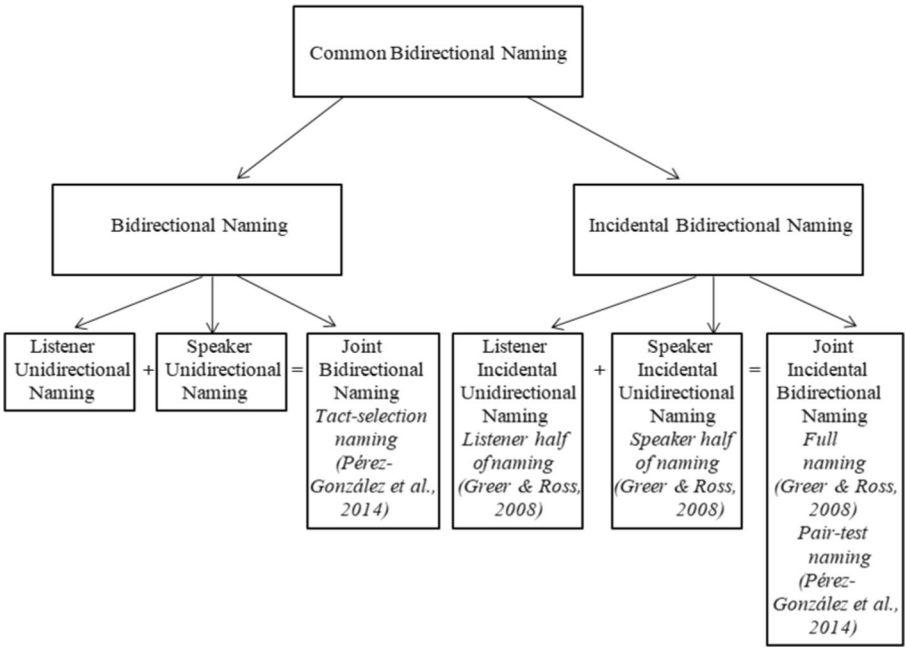

Fig. 2 A schematic representation of the proposed classification of common bidirectional naming, including terminology currently in use

Table 2 Six suggested subtypes of naming with corresponding descriptions, examples, and relevant researchers

Subtype of Naming	Description	Example	Researchers
Listener unidirectional naming	Speaker behavior is taught and corresponding untaught listener behavior emerges.	Using contrived stimuli, the tact "zog" is taught (speaker behavior) and the selection of the symbol from a choice of symbols emerges (listener behavior).	Fiorile and Greer (2007) Lowe et al. (2002, 2005)
Speaker unidirectional naming	Listener behavior is taught and corresponding untaught speaker behavior emerges.	Using contrived stimuli, the selection of a "zog" from a choice of symbols is taught (listener behavior) and the tact "zog" emerges (speaker behavior).	Horne et al. (2006)
Joint bidirectional naming	Both listener unidirectional naming and speaker unidirectional naming; speaker behavior is taught and corresponding untaught listener behavior emerges, and listener behavior is taught and corresponding untaught speaker behavior emerges.	Using contrived stimuli, the tact "zog" is taught (speaker behavior) and the selection of the symbol from a choice of symbols emerges (listener behavior), *and* using contrived stimuli, the selection of a "vek" from a choice of symbols is taught (listener behavior) and the tact "vek" emerges (speaker behavior).	Pérez-González et al. (2011, 2014)
Listener incidental unidirectional naming	Following an incidental experience providing the name of a novel item, but no direct teaching or direct reinforcement, the novel name can be selected from a choice of items without any further teaching; the novel name emerges as listener behavior.	Using contrived stimuli, a match-to-sample procedure (e.g., "match zog") is presented and listener behavior emerges without further teaching (e.g., a "zog" is selected from a choice of symbols, having only heard the name "zog" in the match-to-sample procedure).	Speckman-Collins et al. (2007)
Speaker incidental unidirectional naming	Following an incidental experience providing the name of a novel item, but no direct teaching or direct reinforcement, the tact for the novel name is produced without any further teaching; the novel name emerges as speaker behavior.	Using contrived stimuli, a match-to-sample procedure (e.g., "match zog") is presented and speaker behavior emerges without further instruction (e.g., the tact "zog" emerges, having only heard the name "zog" in the match-to-sample procedure).	Greer et al. (2005, 2011) Hawkins et al. (2007)
Joint incidental bidirectional naming	Both listener incidental unidirectional naming and speaker incidental unidirectional naming; following an incidental experience providing the name of a novel item, but no direct teaching or direct reinforcement, the novel name can be selected from a choice of items and the tact for the novel name is produced without any further teaching; the novel name emerges as listener behavior and speaker behavior.	Using contrived stimuli, a match-to-sample procedure (e.g., "match zog") is presented and listener and speaker behavior emerges without further teaching (e.g., a "zog" is selected from a choice of symbols and the tact "zog" emerges, having only heard the name "zog" in the match-to-sample procedure).	Gilic and Greer (2011) Greer et al. (2007) Hawkins et al. (2009) Pérez-González et al. (2011, 2014)

Research Previous to Horne and Lowe (1996) on the Emergence of Untaught Verbal Behavior

There are apparent overlapping elements between different types of naming within the body of research on the emergence of untaught verbal behavior published prior to the coining of the term *naming* (Horne & Lowe, 1996)—for example, Cuvo and Riva (1980), Eikeseth and Smith (1992), Guess (1969), Guess and Baer (1973), Keller and Bucher (1979), and Lee (1981). Revisiting these studies against the backdrop of a new classification framework is important in order to effectively analyze the broader corpus of research on emergent untaught verbal behavior.

Research Previous to Horne and Lowe (1996) Reclassified as Subtype 1: Listener Unidirectional Naming

Eikeseth and Smith (1992) taught children diagnosed with autism to tact (speaker behavior) a contrived symbol. Subsequently, their listener behavior was tested to determine whether it emerged without additional teaching. Results showed that corresponding listener behavior did not automatically emerge. When applying the proposed classification framework to this study, the authors actually tested for listener unidirectional naming. In contrast to the studies by Lowe et al. (2002, 2005), but similar to Fiorile and Greer (2007), listener unidirectional naming was not present for these participants.

Research Previous to Horne and Lowe (1996) Reclassified as Subtype 2: Speaker Unidirectional Naming

Guess (1969) carried out a study to determine whether untaught speaker behavior emerged if listener behavior was taught. Guess (1969) taught individuals diagnosed with a learning disability to select different plural forms of words (listener behavior), and untaught speaker behavior did not subsequently emerge. Thus, speaker unidirectional naming was not shown for these participants.

Research Previous to Horne and Lowe (1996) Reclassified as Subtype 3: Joint Bidirectional Naming

Similar to the studies by Pérez-González et al. (2011, 2014), Cuvo and Riva (1980) conducted a true test for a bidirectional relationship by testing for both untaught listener behavior and untaught speaker behavior. They compared children who were neurotypical to children diagnosed with learning disabilities and found that all participants demonstrated the emergence of untaught listener behavior after corresponding speaker behavior was taught. In addition, the participants demonstrated a reciprocal effect. Based on the proposed classification framework, joint bidirectional naming was therefore shown.

The suggested classification framework may also be applied to three additional studies published prior to 1996 (Guess & Baer, 1973; Keller & Bucher, 1979; Lee, 1981). Based on the classification framework, joint bidirectional naming was tested for in these studies and was not demonstrated in the study by Guess and Baer (1973).

Listener unidirectional naming was shown, but speaker unidirectional naming was not shown, in the studies by Keller and Bucher (1979) and by Lee (1981).

Research Previous to Horne and Lowe (1996) Reclassified as Subtypes 4, 5, and 6: Incidental Bidirectional Naming

In a review of research prior to 1996, there were no studies conducted that met the criteria for incidental bidirectional naming.

Additional Variations in Dependent Measures, Outcomes, and Terminology

There exists a marked disparity in the research findings across all of the studies discussed thus far (pre- and post-1996). For example, for some participants, untaught verbal behavior emerged (Cuvo & Riva, 1980; Keller & Bucher, 1979; Lee, 1981; Lowe et al., 2002, 2005), whereas other studies failed to show such emergent behavior (Eikeseth & Smith, 1992; Guess, 1969; Guess & Baer, 1973). Some studies produced mixed results (Horne et al., 2004, 2006).

Several researchers used the term *naming* to describe emergent verbal behavior in their studies (e.g., Fiorile & Greer, 2007; Horne et al., 2004, 2006; Lowe et al., 2002, 2005), whereas others used a variety of terminology (Cuvo & Riva, 1980; Eikeseth & Smith, 1992; Guess, 1969; Guess & Baer, 1973; Keller & Bucher, 1979; Lee, 1981). It appears the research published prior to Horne and Lowe's (1996) landmark publication used terminology such as "generalisation and transfer between comprehension and production" (Cuvo & Riva, 1980, p. 315) or "transfer between receptive and productive language" (Keller & Bucher, 1979, p. 311), whereas research conducted since the publication of Horne and Lowe (1996) predominantly used the term *naming* (Fiorile & Greer, 2007; Horne et al., 2004, 2006; Lowe et al., 2002, 2005).

Three recent studies (post-1996) do require important consideration for a more robust discussion on naming behavior. Sprinkle and Miguel (2012); Miguel and Kobari-Wright (2013); and Delfs, Conine, Frampton, Shillingsburg, and Robinson (2014) cited "naming" in their literature review and referenced Horne and Lowe (1996) but used the terminology "the emergence of listener/speaker skills" when describing the dependent variable. Such incongruence may inadvertently result in these studies being excluded from the naming literature even though the description of these variables fits within the proposed classification framework. Based on the proposed classification framework, Miguel and Kobari-Wright (2013) tested for listener unidirectional naming and their participants achieved the criterion for this subtype of common bidirectional naming. When applying the proposed classification framework to the studies by Sprinkle and Miguel (2012) and Delfs et al. (2014), both tested for joint bidirectional naming. Participants in both studies achieved the criterion for listener unidirectional naming but not for speaker unidirectional naming.

In addition, Tu (2006) cited Horne and Lowe (1996) in the literature review but used the terminology "manded selection responses" and "object-name" versus "name-object" relations. Similar to Eikeseth and Smith (1992), Tu (2006) also tested for listener unidirectional naming, and this subtype of naming was not shown.

Finally, Rosales, Rehfeldt, and Lovett (2011) used the term "derived tact relations" to describe naming behavior. When applying the proposed classification framework to this study, speaker unidirectional naming was tested and it was induced following a multiple-exemplar training procedure.

There is additional research from the derived relational responding literature not included in this section (e.g., Carp & Petursdottir, 2015; Devine, Carp, Hiett, & Petursdottir, 2016; May, Hawkins, & Dymond, 2013; Santos, Ma, & Miguel, 2015). In these studies, intraverbal bidirectional naming (Miguel, 2016) was tested, rather than common bidirectional naming. Thus, a review of these studies has not been included.

The Impact of Identifying the Subtypes of Naming on Skill Acquisition and Curriculum Design

It is important to identify the specific subtype(s) of naming an individual demonstrates because this naming behavior may change how the individual now comes to acquire new skills. For example, if an individual shows evidence of listener unidirectional naming, then listener behavior will likely emerge when instructional antecedents are presented in speaker format (e.g., tacts). Conversely, if an individual demonstrates speaker unidirectional naming, then speaker behavior will likely emerge when instructional antecedents are presented in listener format (e.g., "point to" programs). Thus, teaching by delivering one type of antecedent presentation (listener or speaker format) may result in the acquisition of two forms of behavior (listener and speaker) producing more learning than what was directly taught.

Furthermore, if an individual shows evidence of listener incidental unidirectional naming, then the individual only needs to be exposed to the names of items in the presence of the stimuli for listener behavior to emerge. From this incidental language experience, the individual demonstrating only listener incidental unidirectional naming may acquire the names of these new items as a listener (i.e., point to them) but may likely still require direct teaching to acquire them as a speaker (i.e., a tacts program is necessary). Conversely, if an individual demonstrates speaker incidental unidirectional naming, then the individual may only need to be exposed to the names of items for speaker behavior to emerge. From an incidental language experience, the individual demonstrating only speaker incidental unidirectional naming may acquire the names of new items as a speaker (i.e., tact them) but may likely still require direct teaching to acquire them as a listener. To clarify, if the subtype of naming is accurately identified, then curricula and programming are designed more effectively and efficiently for the learner.

Reclassifying the Research on Common Bidirectional Naming

Our systematic analysis of the published research has provided a case for the isolation of possibly six distinct subtypes of common bidirectional naming (listener unidirectional naming, speaker unidirectional naming, joint bidirectional naming, listener incidental unidirectional naming, speaker incidental unidirectional naming, and joint

incidental bidirectional naming) within two defined research tracks on common bidirectional naming (bidirectional naming and incidental bidirectional naming).

Because the subtypes of naming were not classified in this fashion prior to most of the naming research being conducted, it is important to revisit the variables researchers measured in each of the experimental papers described thus far. This research is summarized in Table 3 (listed in the same order as the suggested six subtypes in Table 2).

Organizing the subtypes of naming in this structure and reanalyzing the published research on naming, based on this organization of subtypes, revealed that more research had been conducted on some subtypes of naming compared to others. More specifically, there appeared to be little research on speaker unidirectional naming and listener incidental unidirectional naming. Instead, most of the research on naming has focused on listener unidirectional naming and joint incidental bidirectional naming. In terms of inducing subtypes of naming, there is evidence that listener unidirectional naming, speaker unidirectional naming, listener incidental bidirectional naming, speaker incidental bidirectional naming, and joint incidental bidirectional naming can be induced following different procedures, such as multiple-exemplar training (e.g., Rosales et al., 2011), multiple-exemplar instruction (e.g., Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer et al., 2005, 2007, 2011), or auditory matching (e.g., Speckman-Collins et al., 2007). There is no research demonstrating that joint bidirectional naming can be induced; therefore, future research may need to focus on inducing this newly classified subtype of naming.

In addition, the lack of classification in the literature has led to ambiguities in citing the literature. For example, the study by Fiorile and Greer (2007) is often cited as evidence for multiple-exemplar instruction inducing full naming (joint incidental bidirectional naming); however, the subtype of naming in this study was listener unidirectional naming.

Conclusions and Recommendations for Future Research

A review of the literature on naming, specifically common bidirectional naming (Miguel, 2016), yielded some discrepancies related to differences in how researchers in the field defined naming. These differences provided some evidence that there are potentially several subtypes of common bidirectional naming. Identifying several different subtypes of emergent responding under the umbrella term of *naming* without distinguishing the differences between these subtypes may serve as a point of confusion for consumers of behavior-analytic literature and researchers in behavior analysis. Such confusion may also be a barrier to a fuller understanding of common bidirectional naming. This is a point for conceptual consideration in the basic and applied literature that may be addressed by reclassifying common bidirectional naming according to the suggested subtypes.

Alternatively, referring to all of these different subtypes under the umbrella term *naming* may be acceptable; however, a hallmark of any science is the precision of language. Therefore, clear definitions of behaviors should allow for a more accurate analysis of current research and serve as an impetus for future experimental research.

Table 3 A summary of all the research on common bidirectional naming with a redefined subtype of naming according to the suggested six subtypes

Author(s)	Subtype of Naming Tested
Guess and Baer (1973)	Joint bidirectional naming was tested and not shown (neither listener unidirectional naming nor speaker unidirectional naming).
Eikeseth and Smith (1992)	Listener unidirectional naming was tested and not shown.
Tu (2006)	Listener unidirectional naming was tested and not shown.
Lowe et al. (2002)	Listener unidirectional naming was tested and shown.
Lowe et al. (2005)	Listener unidirectional naming was tested and shown.
Fiorile and Greer (2007)	Listener unidirectional naming was tested and induced.
Miguel and Kobari-Wright (2013)	Listener unidirectional naming was tested and shown.
Guess (1969)	Speaker unidirectional naming was tested and not shown.
Horne et al. (2004)	Speaker unidirectional naming was tested, and mixed results were produced.
Horne et al. (2006)	Speaker unidirectional naming was tested, and mixed results were produced.
Rosales et al. (2011)	Speaker unidirectional naming was tested and induced.
Keller and Bucher (1979)	Joint bidirectional naming was tested. Listener unidirectional naming was shown. Speaker unidirectional naming was not shown.
Lee (1981)	Joint bidirectional naming was tested. Listener unidirectional naming was shown. Speaker unidirectional naming was not shown.
Sprinkle and Miguel (2012)	Joint bidirectional naming was tested. Listener unidirectional naming was shown. Speaker unidirectional naming was not shown.
Delfs et al. (2014)	Joint bidirectional naming was tested. Listener unidirectional naming was shown. Speaker unidirectional naming was not shown.
Cuvo and Riva (1980)	Joint bidirectional naming was tested and shown.
Speckman-Collins et al. (2007)	Listener incidental unidirectional naming was tested and not shown, but was induced.
Greer et al. (2011)	Joint incidental bidirectional naming was tested. Listener incidental unidirectional naming was shown and speaker incidental unidirectional naming was not shown. Speaker incidental unidirectional naming was induced (and therefore joint incidental bidirectional naming was shown).
Greer et al. (2005)	Joint incidental bidirectional naming was tested. Listener incidental unidirectional naming was shown and speaker incidental unidirectional naming was not shown. Speaker incidental unidirectional naming was induced (and therefore joint incidental bidirectional naming was shown).
Hawkins et al. (2007)	Joint incidental bidirectional naming was tested. Listener incidental unidirectional naming was shown and speaker incidental unidirectional naming was not shown. Speaker incidental unidirectional naming was induced (and therefore joint incidental bidirectional naming was shown).
Greer et al. (2007)	Joint incidental bidirectional naming was tested and not shown, but was induced.

Table 3 (continued)

Author(s)	Subtype of Naming Tested
Hawkins et al. (2009)	Joint incidental bidirectional naming was tested and not shown, but was induced.
Gilic and Greer (2011)	Joint incidental bidirectional naming was tested and not shown, but was induced.
Pérez-González et al. (2011)	Joint bidirectional naming was tested. Listener unidirectional naming was shown. Speaker unidirectional naming was not shown. Joint incidental bidirectional naming was tested and shown for most participants.
Pérez-González et al. (2014)	Joint bidirectional naming was tested. Listener unidirectional naming and speaker unidirectional naming was shown for some participants. Joint incidental bidirectional naming was tested and shown for some participants.

This proposed classification framework allows researchers to test for the presence or absence of the isolated subtypes of naming. The framework supports the empirical testing of prerequisites. For example, joint bidirectional naming may be a prerequisite to joint incidental bidirectional naming, or listener unidirectional naming may be a prerequisite to speaker unidirectional naming. Research has already shown that there are mixed results within and across studies. Collecting all of these subtypes into one category of naming may mask essential elements that need to be identified for experimental replications and recommendations on how to induce naming. It may be possible that a procedure shown to induce one subtype of naming may not successfully induce other subtypes. This consideration is essential when conducting research across a variety of individuals with varying instructional histories and behavioral cusps. There may be multiple ways to induce naming or multiple ways to induce different subtypes of naming.

Future researchers may consider specifying the subtype of naming they are investigating according to the proposed classification framework. In addition, researchers who find this body of work valuable could engage in research testing whether procedures induce one or more subtypes of naming. These research endeavors may provide fruitful contributions to the important and widening body of research on naming. We strongly believe that the proposed classification framework for common bidirectional naming was made possible by the rich contributions to the field in the area of naming (e.g., Greer et al., 2007, 2011; Pérez-González et al., 2011; Rosales et al., 2011). In many ways, their research has allowed for the uncovering of variables that may have been unknown up until this point. A well-designed classification framework of complex and sophisticated language acquisition should aid researchers who seek to replicate research and explore unknown variables related to naming.

Compliance with Ethical Standards

Conflict of Interest Emma Hawkins declares that she has no conflict of interest. Grant Gautreaux declares that he has no conflict of interest. Mecca Chiesa declares that she has no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

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