
The Development of Sexual Arousal Patterns in Humans

Implications Arising From the Derived Transformation of Functions

Bryan Roche

National University of Ireland, Maynooth

The behavioral approach has offered much to the field of sex research by way of demonstrating the respondent and operant flexibility of human sexual arousal. Nevertheless, social and cognitive theories of sexual arousal development, such as Bems' (1996) Exotic Becomes Erotic theory, have won widespread favor due to several specific shortcomings in behavioral accounts. The present paper briefly reviews these shortcomings and offers a solution by pointing to recent developments in the analysis of derived stimulus relations and the derived transformation of functions. In particular, it is argued that Relational Frame Theory, as one account of derived relational activity, provides opportunities for the significant extension of the behavioral sex research agenda. Moreover, the Relational Frame approach addresses the widespread interest in the role of verbal and social interaction in the development of sexual arousal, and the natural constraints on learning imposed by biology.

Over the past century, sex researchers from a range of theoretical perspectives have examined an impressive range of human sexual behavior under laboratory conditions. The topics of study might be broadly summarized under the following headings: sexual deviance, sexual identity, sexual attraction, sexual orientation, mating, and sexual arousal patterns. To the behavior analyst, patterns of sexual arousal are perhaps the central component of sexual behavior because such patterns determine the types of objects towards which this behavior is directed (Alford, Plaud, & McNair, 1995). It is likely for this reason that most behavioral sex research to date has concerned the development of patterns of sexual arousal to arbitrary and biologically significant stimuli.

Behavioral accounts of the emergence of sexual arousal patterns are essentially developmental in nature. For instance, a behavioral account of sexual orientation attempts to identify the history of stimulus associations, reinforcement, and social and nonsocial interactions necessary for a given sexual orientation to emerge across time. While no longitudinal behavioral/developmental analysis of human sexual arousal patterns has yet been conducted, important theoretical advances have arisen from laboratory analyses of conditioned sexual arousal (see Alford et al., 1995).

To date, a range of behavioral studies have examined habituation to sexual stimuli (e.g., Koukounas & Over, 1993; O'Donohue & Geer, 1985; O'Donohue & Plaud, 1991), the respondent conditioning of sexual arousal to arbi-

trary stimuli (e.g., Plaud & Martini, 1999; Rachman, 1966), and the operant conditioning of sexual arousal (e.g., Quinn, Harbison, & McAllister, 1970; Schaefer & Colgan, 1977). A much larger number of studies have examined the treatment of sexual disorders in the clinical setting using such behavioral techniques such as respondent conditioning (e.g., Herman, Barlow, & Agras, 1974; see also Quinsey & Marshall, 1983), stimulus fading (e.g., Barlow & Agras, 1973), covert sensitization (e.g., Barlow, 1993; Barlow, Agras, Leitenberg, & Callahan, 1972), orgasmic reconditioning (e.g., Conrad & Winzce, 1976), and aversive conditioning (e.g., Bancroft, 1974; McConaghy, 1970).

Of course, demonstrating the use of learning principles in the laboratory conditioning of sexual arousal and the treatment of dysfunctional sexual arousal patterns does not serve as conclusive evidence that sexual arousal patterns actually emerge through respondent or operant processes in the world outside the laboratory. Nevertheless, the relative success of behavioral procedures in the treatment of a wide range of sexual paraphilias serves as strong support for a behavioral account of the development of sexual arousal patterns in humans.

Despite real advances in the experimental analysis of sexual arousal, laboratory analogues of the development of sexual arousal patterns have persistently suffered from a series of specific shortcomings. Firstly, laboratory conditioned arousal is relatively weak and quick to extinguish, showing none of the robustness of paraphilias observed in the clinical setting. For this reason, even Rachman, the pioneer of the "laboratory induced fetish," abandoned hope of developing a full behavioral model of sexual fetishism. Secondly, the operant conditioning of sexual arousal is not an unambiguous effect. Only a limited number of studies have shown the effect and many of these have considerable methodological weaknesses (see O'Donohue & Plaud, 1991). Thirdly, it is often difficult to relate paraphilic arousal to previous learning experiences. Even the eponymous San Francisco study (Bell, Weinberg, & Hammersmith, 1981) failed to find a link between learning experiences and the development of sexual preference across a sample of 1000 homosexual men and women. Consequently, many sex researchers have lost faith in a learning account of sexual arousal patterns (Bem, 1996).

Because of these shortcomings in the behavioral approach to sexual arousal, cognitive and social theories of sexual arousal development have begun to win favor in the sex research literature. Perhaps the most influential of these theories is Daryl Bem's (1996, 2000) *Exotic Becomes Erotic* (EBE) theory. According to EBE theory, genetic, hormonal, and neuroanatomical variables do not code for sexual arousal patterns to specific stimuli (e.g., the opposite sex), but for behavioral temperaments, such as a preference for rough-and-tumble play. Children of a given temperament discriminate themselves as similar to or different from other children of the same or opposite sex. As they develop, children respond to peers of a different temperament as unfamiliar and exotic. In some cases, the exotic others will be of the same sex (as for a child with a sex-atypical temperament), and in other cases, exotic others will be members of the opposite sex (as for a child with sex-typical temperament). Exotic peers serve as novel stimuli that produce non-specific autonomic arousal that is then transformed into erotic arousal over time.

At this point, the behavioral researcher will be in need of several technical definitions of hypothetical process and variables, most notably *transformation*. The process of transformation would appear to be the critical stage in EBE theory, and yet it would appear to be unsupported empirically. Bem draws loosely on a few well established psychological effects (i.e., opponent processes, imprinting, extrinsic arousal effect) to speculate on how the transformation may occur, but concedes that there is no direct evidence for this process. Indeed, Bem suggests that empirical research is needed to identify precisely how an individual viewed as exotic could acquire sexually arousing functions for another individual. As it happens, behavior analysts are already busy developing analyses of how the psychological functions of stimuli are transformed by their participation in verbal relations, and the current author's research in particular has examined this in relation to the transformation of neutral stimuli into sexually arousing stimuli. While several key processes may be involved in the transformation of exotic stimuli into erotic stimuli, recent developments in the experimental analysis of sexual arousal may help fill some of the empirical knowledge gaps in EBE theory, as well as significantly supplement the existing behavioral sex research literature.

Derived Stimulus Relations and the Transformation of Sexual Arousal Functions

Studying derived stimulus relations often involves explicitly training a number of conditional discriminations among arbitrary stimuli such as: A → B and B → C, and then testing for untaught or derived relations, such as symmetry between B and A, C and B, and transitivity between A and C (e.g., Sidman, 1994). Researchers in this area also often investigate what has been called the derived transformation of function, in which a specific behavioral function, such as sexual arousal, is explicitly established for the C stimulus, after which it emerges for the A stimulus (e.g., Roche & Barnes, 1997). This effect is important because it allows the

behavioral researcher to explain emotional responses for which there would not appear to be a sufficient history of direct reinforcement or stimulus association. Sexual responses to apparently novel stimuli, for instance, might be traced historically, not to respondent processes or explicit reinforcement for sexual responding, but to the participation of those stimuli in derived relations that themselves contain respondent sexual stimuli or discriminative stimuli for the availability of sexual reinforcement. Several authors have used the transformation of stimulus function effect as a crucial component of a modern behavioral approach to phobia and fear conditioning (e.g., Dougher et al. 1994), sexual arousal patterns to novel stimuli (e.g., Roche & Barnes, 1997; Roche, Barnes-Holmes, Smeets, Barnes-Holmes, & McGeady, 2000), and emotional functioning in general (e.g., Friman, Hayes, & Wilson, 1998).

Relational Frame Theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001) explains the emergence of derived relations and the derived transformation of function in operant terms. More specifically, RFT takes the position that the ability to derive relations must itself be learned across a large number of relational exemplars. Training across multiple exemplars of derived relations occurs in a variety of social contexts such as parent-child interactions and in educational games. For instance, many children are taught explicitly that the sound of the word "cup" stands for or goes with actual cups. On other occasions, children are also taught to orient toward cups on the production of the sound "cup" by a teacher or parent. In effect, the child is taught the "cup" → *actual cup* relation in two directions. This explicit symmetry training may then occur for hundreds of other sounds and words across time until the effects of training are sufficiently generalized that they can apply to any range of events (i.e., name-object symmetry will emerge between any two stimuli following training in one direction only). Thus, according to RFT, derived relational responding shares all of the important defining features of any operant. Specifically, relational frames develop over time, they are flexible and can be shaped, they can be brought under stimulus control, and they are controlled by their consequences (see Hayes, Barnes-Holmes, & Roche, 2001).

Relational Frame Theory also takes an explicit interest in relations other than equivalence, such as opposite, more than, less than, different, and so on. Each of these relations can be characterized by different patterns of the transformation of function. The characteristic nature of these various patterns is illustrated by a study conducted by Roche et al. (2000). In that study, the contextual functions of SAME and OPPOSITE were established for two arbitrary stimuli using pretraining devised by Steele and Hayes (1991), and these cues were then used to establish a simple relational network in which B1 and C1 were related to A1 through *Sameness*, and B2 and C2 were related to A1 through *Opposite*. Stimulus B1 was then paired directly with sexually arousing material, and during subsequent probe trials, sexually arousing functions emerged for C1 in the presence of the SAME cue, but not

in the presence of the OPPOSITE cue. The converse pattern emerged for the C2 stimulus: C2 produced arousal in the presence of the OPPOSITE cue, but not in the presence of the SAME cue. These and related findings extend the transformation of function effect and would appear to demonstrate that highly complex patterns of sexual arousal can now be studied from a behavior-analytic perspective.

A Relational Frame analysis of sexual arousal takes a special interest in the verbal relations that govern sexual behavior. For instance, the verbal statement "weird sexual activity can be really enjoyable" frames the terms "weird" and "enjoyable" in a relation of coordination (or equivalence) such that the functions of the former term are transformed by the functions of the latter. In effect, for the listener, the term "weird" acquires some of the appetitive functions of the term "enjoyable." It is a simple extrapolation from several laboratory demonstrations of the derived transformation of sexual arousal functions that verbal interaction with the wider culture is at least one process by which the functions of sexual stimuli are established, transformed, and maintained.

For the purposes of illustrating a simple RFT analysis of a relatively unusual sexual arousal pattern, the foregoing example can be built out a little further. Let us consider the development of transvestism in a hypothetical scenario. Suppose that a sexually developing young boy hears from friends and peers that some people find "weird" behaviors sexually arousing. The young boy may well not understand the statement and have no reference for the term "weird" in this context. Some time later, however, he may also hear that it is considered "weird" for boys to dress in girls' clothes. Given the foregoing verbal relations, the boy may now respond to a derived relation of coordination between sexual arousal and "dress in girls' clothes" (and equivalent terms). Once this relation is derived, the functions of sexual arousal will transform the functions of cross-dressing for this boy over time such that "cross-dressing" will elicit some of the functions of sexual arousal itself.

Of course, not all boys who are exposed to the foregoing verbal relations will respond to cross-dressing as sexually arousing. Many other competing verbal relations established by the verbal community will lead to incompatible transformations of function (e.g., "boys should not wear girls' clothes"). Thus, it remains an empirical question as to how myriad verbal relations together support the dominance of a particular sexual function for a particular stimulus, event, or activity in a given context. Surely, each case of the development of transvestic arousal will be unique with respect to the relevant social and nonsocial interactions necessary and sufficient to generate that specific arousal pattern. Nevertheless, RFT provides a conceptual framework for understanding how sexual arousal responses might be transformed in accordance with networks of verbal relations established by the verbal community.

A relational frame approach to human sexual behavior also accommodates the study of covert sexual stimuli and the covert transformation of arousal functions resulting from private sexual fantasies. Put simply, RFT does not distinguish, at the level of process, between the transformation of

easily observable respondent, discriminative, and reinforcement functions and the transformation of private perceptual functions. So, for instance, a person may experience private perceptual functions of sexual contact by simply reading about sexual interaction, or by making private statements concerning sexual activity. In technical terms, this is possible because of the transformation of printed words or privately stated terms by the functions of the symmetrically related perceptual functions of sexual contact. Indeed, there is no reason why private statements could not form the basis of further derived verbal relations and thus further transformations of sexual arousal functions. In this way, sexual arousal established through observable respondent or operant processes can, at least in principle, be developed and transformed beyond recognition through private verbal behavior (i.e., sexual fantasy). An RFT approach is suited to the analysis of this process in that it uses functional-analytic terms and concepts in the analysis of private sexual fantasy. This ultimately leads to overt sexual arousal patterns which might otherwise appear inexplicable in terms of a traditional learning account (see Roche & Barnes, 1998).

Natural Constraints on Learning

It would be surprising if there were not some natural constraints placed on the development of sexual arousal patterns by the formal features of stimuli. Surely, many directly conditioned and derived sexual stimulus relations in the world outside the laboratory have some nonarbitrary properties. For instance, sex researchers have long noted that natural selection has favored associations between specific types of stimuli and specific types of responses (see Garcia & Koelling, 1966; Seligman, 1970). In one study (Gosselin & Wilson, 1984), a surprising consistency across stimulus types that form fetish objects for males was found. These objects are typically pink, black, smooth, silky, and shiny. The obvious formal features that all of these objects have in common are those they share with the female genitalia, particularly the vulva. The relative narrowness of the range of fetish objects that are commonly present in the clinical setting and their likeness to what is presumed to be a biologically significant sexual stimulus (i.e., female genitalia) may suggest a biological preparedness for conditioning to such stimuli (McConaghy, 1987).

The relational frame approach to human sexual arousal fully acknowledges that formal similarities between various stimuli will make a wide variety of derived relations more likely to emerge. Thus, although a derived relation between a pink shiny object and the female vulva may in principle emerge from entirely arbitrary relational networks, the physical relationship between them may participate in the very generation of those relational networks. For instance, the fetishist will likely be able to make such statements as "all pink things turn me on," thereby demonstrating the derivation of an overarching verbal relation that now obtains across all pink objects. Such derived verbal relations will thereby lead to the fur-

ther transformation of functions across participating stimulus events and the strengthening of the sexual functions that adhere for pink objects. By recognizing the subtle interaction between verbal and nonverbal learning processes, therefore, RFT provides a technical account of the emergence of highly complex and unusual sexual arousal patterns that encompasses our knowledge of evolutionary variables, histories of direct stimulus association, instrumental learning, and the role of derived stimulus relations and verbal contingencies.

Conclusion

In this paper I have focused exclusively on the role of the derived transformation of function in explicating a newly emerging behavioral account of sexual arousal development. However, several important conceptual and empirical questions remain regarding the development of sexual arousal patterns, especially regarding other processes, such as rule governance and the role of setting variables. Ongoing research in the author's laboratory, for instance, has focused on the relationship between biological reinforcement and derived relational responding. Despite several outstanding empirical questions, however, the account presented here essentially represents the beginnings of an analysis of the interaction between social/verbal behavior and the sexual functions of stimuli. To this extent, it provides a scientific basis for the investigation of the increasingly popular idea that modes of discourse aid in the construction and constraint of sexual behavior (e.g., Grosz, 1994). By focusing on the role of verbal contingencies in the production and maintenance of sexual arousal patterns, and by recognizing the role of natural constraints on learning, this approach to the development of human sexual arousal takes some steps forward in the advance of behavioral sex research, and also builds empirical and conceptual bridges to mainstream sex research within our discipline.

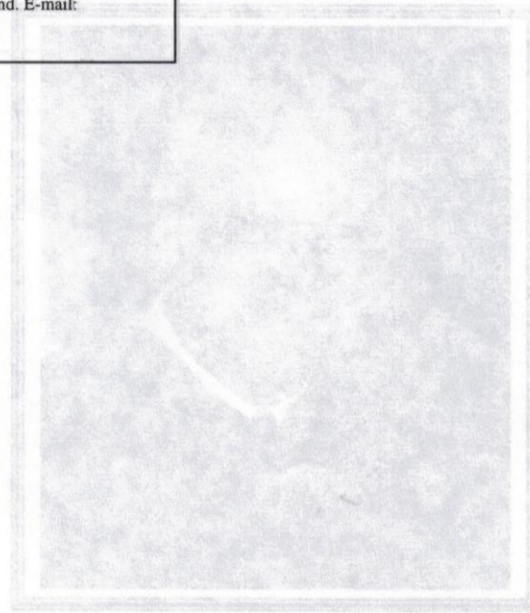
REFERENCES

- Alford, G. S., Plaud, J. J., & McNair, T. V. (1995). Sexual behavior and orientation: Learning and conditioning principles. In L. Diamant and R. D. McAnulty (Eds.), *The Psychology of sexual orientation, behavior, and identity: A handbook* (pp. 121-135). Westport, CT: Greenwood Press.
- Bancroft, J. (1974). *Deviant sexual behavior, modification and assessment*. Oxford: Clarendon Press.
- Barlow, D. H. (1993). Covert sensitization for paraphilia. In J. R. Cautela & A. J. Kearney (Eds.), *Covert conditioning casebook* (pp. 187-198). Pacific Grove, California: Brooks/Cole.
- Barlow, D. H. & Agras, W. S. (1973). Fading to increase heterosexual responsiveness in homosexuals. *Journal of Applied Behavior Analysis*, 6, 355-395.
- Barlow, D. H., Agras, W. S., Leitenberg, H., & Callahan, E. F. (1972). The contribution of therapeutic instructions to covert sensitization. *Behavior Research and Therapy*, 10, 411-415.
- Bell, A. P., Weinberg, M. S., & Hammersmith, S. K. (1981). *Sexual preference: Its development in men and women*. Bloomington: Indian University Press.
- Bem, D. J. (1996). Exotic becomes erotic: A developmental theory of sexual orientation. *Psychological Review*, 103, 320-335.
- Bem, D. J. (2000). Exotic becomes erotic: Interpreting the biological correlates of sexual orientation. *Archives of Sexual Behavior*, 29, 531-548.
- Conrad, S. R., & Winzce, J. P. (1976). Orgasmic reconditioning: A controlled study of its effects upon the sexual arousal and behavior of adult male homosexuals. *Behavior Therapy*, 7, 155-166.
- Dougher, M. J., Auguston, E. M., Markham, M. R., Greenway, D. E., & Wulfert, E. (1994). The transfer of respondent eliciting and extinction functions through stimulus equivalence classes. *Journal of the Experimental Analysis of Behavior*, 62, 331-351.
- Friman, P. C., Hayes, S. C., & Wilson, K. G. (1998). Why behavior analysts should study emotion: The example of anxiety. *Journal of Applied Behavior Analysis*, 31, 137-156.
- Garcia, J., & Koelling, R. (1966). Relation of cue to consequence in avoidance learning. *Psychonomic Science*, 4, 123-124.
- Gosselin, C., & Wilson, G. (1984). Fetishism, sadomasochism and related behaviors. In K. Howells (Ed.), *The psychology of sexual diversity* (pp. 89-110). Basil Blackwell.
- Grosz, E. (1994). Refiguring lesbian desire. In L. Doan (Ed.), *The lesbian postmodern* (pp. 67-84). New York: Columbia University Press.
- Hayes, S. C., Barnes-Holmes, D., & Roche, B. (Eds.), (2001). *Relational frame theory: A post-Skinnerian account of human language and cognition*. New York: Plenum Press.
- Herman, S. H., Barlow, D. H., & Agras, W. S. (1974). An experimental analysis of classical conditioning as a method of increasing heterosexual arousal in homosexuals. *Behavior Therapy*, 5, 33-47.
- Koukounas, E., & Over, R. (1993). Habituation and dishabituation of male sexual arousal. *Behavior Research and Therapy*, 31, 575-585.
- McConaghy, N. (1970). Penile response conditioning and its relationship to aversion therapy in homosexuals. *Behavior Therapy*, 1, 213-221.
- McConaghy, N. (1987). A learning approach. In J. H. Geer & W. T. O'Donohue (Eds.), *Theories of human sexuality* (pp. 282-333). New York: Plenum Press.
- O'Donohue, W. T., & Geer, J. H. (1985). The habituation of sexual arousal. *Archives of Sexual Behavior*, 14, 233-246.
- O'Donohue, W., & Plaud, J. J. (1991). The long-term habituation of human sexual arousal. *Journal of Behavior Therapy and Experimental Psychiatry*, 22, 87-96.
- Plaud, J. J., & Martini, J. R. (1999). The respondent conditioning of male sexual arousal. *Behavior Modification*, 23, 254-268.
- Quinn, J. T., Harbison, J., & McAllister, H. (1970). An attempt to shape penile responses. *Behavior Research and Therapy*, 8, 27-28.
- Quinsey, V. L., & Marshall, W. L. (1983). Procedures for reducing inappropriate sexual arousal: An evaluation review. In J. G. Geer & I. R. Stuart (Eds.), *The sexual aggressor: Current perspectives on treatment* (pp. 267-289). New York: Van Nostrand Reinhold.
- Rachman, S. (1966). Sexual fetishism: An experimental analogue. *The Psychological Record*, 16, 293-296.
- Roche, B., & Barnes, D. (1997). A transformation of respondent-conditioned stimulus function in accordance with arbitrarily applicable relations. *Journal of the Experimental Analysis of Behavior*, 67, 275-301.
- Roche, B., Barnes-Holmes, D., Smeets, P. M., Barnes-Holmes, Y., & McGeady, S. (2000). Contextual control over the derived trans-

- formation of discriminative and sexual arousal functions. *The Psychological Record*, 50, 267-291.
- Roche, B., & Barnes, D. (1998). The experimental analysis of human sexual arousal: Some recent developments. *The Behavior Analyst*, 21, 37-52.
- Schaefer, H. H., & Colgan, A. H. (1977). The effect of pornography on penile tumescence as a functional of reinforcement and novelty. *Behavior Therapy*, 8, 938-946.
- Seligman, M. E. P. (1970). On the generality of the laws of learning. *Psychological Review*, 77, 406-418.
- Sidman, M. (1994). *Stimulus Equivalence: A Research Story*. Boston: Authors Cooperative.
- Steele, D. L., & Hayes, S. C. (1991). Stimulus equivalence and arbitrarily applicable relational responding. *Journal of the Experimental Analysis of Behavior*, 56, 519-555.

Author's note

The author would like to thank an anonymous reviewer for very helpful comments on the first draft of this paper. Correspondence should be addressed to: Bryan Roche, Department of Psychology, National University of Ireland, Maynooth, Co. Kildere, Ireland. E-mail: Bryan.Y.Roche@may.ie



Donald M. Baer -- Roy A. Robbins distinguished Professor of Human Development and Family Life and of Psychology at the University of Kansas -- died unexpectedly of natural causes at his home in Lawrence, KS on April 28, 2002. He is survived by his wife, Elaine M. Baer, Professor of Social Services Administration at the University of Chicago, three daughters from an earlier marriage to Jim Marshall -- Ruth, Michael, and Deborah -- and his mother, Robert. Don was born in St. Louis, MO, on October 25, 1931, grew up in Chicago, and attended the University of Chicago in 1950. He received a B.A. with honors from Chicago in 1952, earned a doctorate in experimental psychology under the supervision of Jacob

Department of Psychology, National University of Ireland, Maynooth, Co. Kildere, Ireland. E-mail: Bryan.Y.Roche@may.ie

Dr. Baer was not only the acknowledged intellectual leader in the Department but also an outstanding scholar. He was the Director of the Department of Child Research, now the Schiefelbusch Life-Span Institute, where he secured significant federal funding for his research. He published over two hundred and fifty books, journal articles, chapters, book reviews, and commentaries, and made numerous presentations, many of them national and enduring contributions to the behavior analysis of development. Among the conceptual topics he addressed were developmental theory (e.g., Baer, 1970), developmental psychology as a discipline (e.g., Baer & Wright, 1974), the delay of analysis of development (e.g., Baer & Baer, 1981, 1982, 1978; see also Baer & Baer, 1997; Madsley & Baer, 1997), interrelations between developmental psychology and behavior analysis (e.g., Baer, 1981; Baer, 1982; Baer, 1983; Baer & Baer, 1983; Baer, 1985; Baer, 1986; Baer & Baer, 1987; Baer, 1988; Baer & Baer, 1989; Baer, 1990; Baer & Baer, 1991; Baer, 1992; Baer & Baer, 1993; Baer, 1994; Baer & Baer, 1995; Baer, 1996; Baer & Baer, 1997; Baer, 1998; Baer & Baer, 1999; Baer, 2000; Baer & Baer, 2001; Baer, 2002; Baer & Baer, 2003; Baer, 2004; Baer & Baer, 2005; Baer, 2006; Baer & Baer, 2007; Baer, 2008; Baer & Baer, 2009; Baer, 2010; Baer & Baer, 2011; Baer, 2012; Baer & Baer, 2013; Baer, 2014; Baer & Baer, 2015; Baer, 2016; Baer & Baer, 2017; Baer, 2018; Baer & Baer, 2019; Baer, 2020; Baer & Baer, 2021; Baer, 2022; Baer & Baer, 2023; Baer, 2024; Baer & Baer, 2025).