

SPREAD THE WORD! DISSEMINATING
THE SCIENCE

Operants

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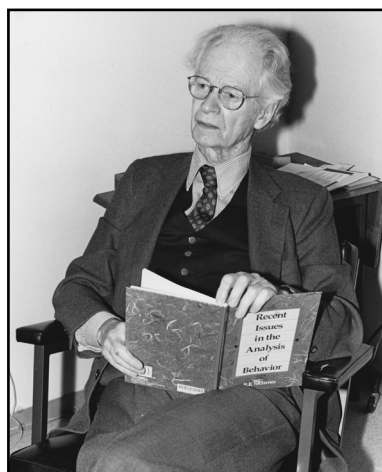
Are Artificial
Intelligence,
Virtual Reality,
and ROBOTS
the 21st century
TEACHING
MACHINES?

REPLICATING SKINNER'S VERBAL SUMMATOR RESEARCH



Julie S. Vargas, PhD
President
B. F. Skinner Foundation

IF B. F. SKINNER WERE ALIVE TODAY, HE WOULD BE PLEASED BY THE SPREAD OF THE SCIENCE HE BEGAN. THAT SCIENCE SHOWS HOW BEHAVIOR IS BUILT MORE EFFECTIVELY WITH REINFORCEMENT THAN WITH AVERSIVE TECHNIQUES. IT SHOWS HOW TO MAKE IMPROVEMENTS POSSIBLE EVEN WHERE NO PROGRESS EXISTED BEFORE. MANY OF YOU HAVE APPLIED PRINCIPLES DRAWN FROM SKINNER'S BOOK [VERBAL BEHAVIOR](#) TO TEACH INDIVIDUALS TO COMMUNICATE FOR THE VERY FIRST TIME. *VERBAL BEHAVIOR* MUST BE USEFUL. IT SELLS MORE TODAY THAN IN 1957 WHEN IT WAS FIRST PUBLISHED.



B. F. Skinner (1989)

SKINNER WOULD BE IMPRESSED, TOO, WITH THE WORLDWIDE DISTRIBUTION AND SUPPORT OF *OPERANTS*. ON HIS BEHALF, THE FOUNDATION THANKS ALL FINANCIAL CONTRIBUTORS, AND THOSE WHO PROVIDE ARTICLES, WHO CONDUCT INTERVIEWS, WHO EDIT FEATURES OR TRANSLATE THEM. WITHOUT YOU, *OPERANTS* WOULD NOT EXIST.

Chinese Simplified Translated by Coco Liu

如果B. F. Skinner博士今天仍在世，他会因他开始的科学传播而感到高兴。这项科学展示了如何通过强化比使用惩罚/负面的技术更有效地建立行为。它显示了即使以前没有进展，我们还是可以继续的进步。你们中的许多人已经应用了斯金纳的书“言语行为”中提出的原则来教导他人学习第一次交流/沟通，言语行为必须有用。它的销售量比1957年首次出版时要多。

Skinner也会非常高兴看到，Opera在全球的分销和支持。基金会代表他，感谢所有财务贡献者，以及那些提供文章，进行访谈，编辑功能或翻译功能的人。没有你，Opera将不存在。

Chinese Traditional Translated by Coco Liu

如果B.F.Skinner博士今天仍在世，他會因他開始的科學傳播而感到高興。這項科學展示，如何通過強化比使用懲罰/負面的技術更有效地建立行為。它顯示了即使以前沒有進展，我們還是可以繼續的進步。你們中的許多人已經應用了斯金納的書“言語行為”中提出的原則來教導他人學習第一次交流/溝通，言語行為必須有用。它的銷售量比1957年首次出版時要多。

Skinner也會非常高興看到，Opera在全球的分銷和支持。基金會代表他，感謝所有財務貢獻者，以及那些提供文章，進行訪談，編輯功能或翻譯功能的人。沒有你，Opera將不存在。

Dutch Trstranslated by Frans van Haaren

Als B.F. Skinner vandaag nog leefde, zou hij zeer tevreden zijn over de verspreiding van de wetenschap die hij begon. Die wetenschap laat zien hoe gedrag effectiever tot stand komt door middel van positieve bekrachtiging dan via aversieve middelen. De wetenschap laat zien hoe verbeteringen tot stand kunnen komen, zelfs daar waar eerder geen vooruitgang geboekt werd. Velen onder jullie hebben gebruik gemaakt van principes uit Skinner's boek Verbal Behavior om individuen voor de allereerste keer te leren communiceren met anderen. Verbal Behavior moet wel heel nuttig zijn. Er worden nu meer exemplaren van verkocht dan in 1957 toen het voor het eerst gepubliceerd werd.

Skinner zou ook zeer onder de indruk zijn van de globale distributie en ondersteuning van Operants. Namens hem bedankt de Foundation allen die geldelijke steun verlenen, en diegenen die artikelen aanreiken, die interviews afnemen en die artikelen bewerken of vertalen. Zonder jullie zou Operants niet bestaan.

French Translated by Marie-Céline Clemenceau

Si B. F. Skinner était en vie aujourd'hui, il serait ravi de la diffusion de la science qu'il a commencée. Cette science montre comment le comportement se construit plus efficacement avec le renforcement qu'avec les techniques aversives. Il montre comment rendre des améliorations possibles même là où aucun progrès n'existait auparavant. Beaucoup d'entre vous ont appliqué les principes tirés du livre de Skinner Verbal Behavior pour apprendre aux individus à communiquer pour la première fois. Le comportement verbal doit être utile. Il se vend plus aujourd'hui qu'en 1957, année de sa publication.

Skinner serait également impressionné par la distribution et le soutien à Operants dans le monde entier. En son nom, la Fondation remercie tous les contributeurs financiers, ainsi que ceux qui fournissent des articles, qui mènent des entretiens, qui modifient des éléments ou les traduisent. Sans vous, Operants n'existeraient pas.

Greek Translated by Katerina Dounavi

Εάν ο B. F. Skinner ζούσε σήμερα, θα χαιρόταν με την εξάπλωση της επιστήμης που ο ίδιος ξεκίνησε. Αυτή η επιστήμη δείχνει πώς η συμπεριφορά χτίζεται πιο αποτελεσματικά με ενίσχυση παρά με τεχνικές αποστροφής. Δείχνει πώς η βελτίωση είναι εφικτή ακόμα κι όταν δεν υπήρξε προηγούμενη πρόοδος. Πολλοί από εσάς έχετε εφαρμόσει αρχές που πηγάζουν από το βιβλίο του Skinner Verbal Behavior για να διδάξετε τους ανθρώπους να επικοινωνούν για πρώτη φορά. Το βιβλίο Verbal Behavior πρέπει να είναι χρήσιμο. Πουλάει περισσότερο σήμερα από ό,τι το 1957 που δημοσιεύθηκε για πρώτη φορά.

Ο Skinner θα εντυπωσιαζόταν επίσης με την παγκόσμια διανομή και υποστήριξη των Operants. Εκ μέρους του, το Ίδρυμα ευχαριστεί όλους τους οικονομικούς συνεργάτες και αυτούς που παρέχουν άρθρα, που διεξάγουν συνεντεύξεις, που επεξεργάζονται κομμάτια ή τα μεταφράζουν. Χωρίς εσάς, το Operants δε θα υπήρχε.

Hebrew Translated by Shiri Ayzazo

אם ב. פ. סקינר היה חי היום, הוא היה שבע רצון מהתפשטות המדע אותו הוא החל. מדע זה מראה כיצד התנהגות נבנית בעילות רבה יותר עם חיזוק מאשר עם טכניקות אוורסיביות. הוא מראה כיצד שיפור הופך לאפשרי גם במקומות בהם לא הייתה שום התקדמות קודם לכן. רבים מכם יישמתם עקרונות שלקוחים מתוך ספרו של סקינר התנהגות מילולית לשם לימוד יחידים לתקשר בפעם הראשונה שלהם. כנראה שהתנהגות מילולית שימושי. הוא נמכר היום יותר מאשר ב 1957 כאשר יצא לאור לראשונה.

סקינר כנראה היה גם מתרשם מההפצה והתמיכה הכלל-עולמית באופרנטס. בשמו, העמותה מבקשת להודות לכל התורמים הכספיים ולאלו אשר כתבו כתבות, קיימו ראיונות, ערכו גיליונות נושא ותרגמו אותם. בלעדיכם, אופרנטס לא היה מתקיים.

Icelandic Translated by Kristján Guðmundsson

Ef B. F. Skinner væri á lífi í dag, þá myndi hann vera ánægður með útvíkkun þeirra vísinda sem hann bjó til. Þau vísindi sýna hvernig hegðun verður áhrifaríkari með styrkingum heldur en með neikvæðum aðferðum. Þau sýna hvernig meira að segja hægt er að bæta, þar sem engin framför áttu sér stað til að byrja með. Mörg ykkar hafa hagnýtt lögmál sem fá má úr bók Skinners: Verbal Behavior til að kenna einstaklingum að tjá sig í fyrsta skiptið. Verbal Behavior hlýtur því að vera gagnleg. Hún selst meira í dag heldur en 1957 þegar hún var fyrst gefin út.

Skinner væri líka ánægður með heimsútbreiðsluna í dag á: Operants. Fyrir hans hönd þakkar The Skinner Foundation öllum styrktaraðilum, og þeim sem senda inn greinar, taka viðtöl, ritstýra eða þýða þær. Án ykkar þá væri: Operants ekki til.

Japanese Translated by Naoki Yamagishi

B. F. Skinnerがもし今生きていたならば、彼が始めた行動の科学が普及しているのを喜ぶでしょう。その科学は、嫌悪的な技法よりも強化によって行動がより効果的に形成されることを示しています。かつてはまったく前進しなかった行動でさえ、改善させることが可能であることを示しています。あなたの方の多くはSkinnerの書籍Verbal Behaviorからくみとった原理を応用し、生まれて初めての人にコミュニケーションを教えています。書籍Verbal Behaviorは役に立つに違いありません。この書籍は1957年に最初に出版されたときよりも、今日より多く売られています。

Skinnerは広報誌Operantsが世界中に広まり、世界中から支援されていることにも感動しているでしょう。彼に代わって、資金的な援助していただいた方々、記事を寄せていただいた方々、インタビューしていただいた方々、記事を編集・翻訳していただいた方々すべてに感謝いたします。あなた方なしに広報誌Operantsが存在することはできません。

Korean Translated by Theresa Yunhee Shin

만약 B.F. Skinner가 오늘날 살아있었다면, 그가 시작한 과학의 확산을 보고 기뻐했을지도 모릅니다. 과학은 혐오적인 방법보다 강화가 더 효과적으로 행동을 형성한다는 것을 보여줍니다.

이전에 진보하지 않았던 곳에서조차도 개선이 가능하다는 것을 보여줍니다.

많은 사람들은 처음으로 Skinner의 저서 'Verbal Behavior'를 통해 사람들에게 의사소통을 어떻게 가르쳐야 하는지에 대한 원칙 안을 적용해왔습니다.

'Verbal Behavior'이 유용하다는 것은 틀림없습니다. 그의 저서가 처음으로 발행되었던 때인 1957년보다 오늘날 더 많이 팔립니다. Skinner도 역시 Operants가 세계적으로 배포되고 지원되는 것에 대해 감동받을지도 모릅니다. 그를 대신하여, 재단에서는 모든 재정적 기부자들, 기사를 제공해주신분들, 인터뷰를 실행한 분들, 그리고 편집, 번역을 해주신분들 모두에게 감사를 전합니다. 이분들이 없이는, Operants는 존재하지 않았을지도 모릅니다.

Norwegian Translated by Karoline Giæver Helgesen

Hvis B. F. Skinner levde i dag, ville han være fornøyd med spredningen av vitenskapen han påbegynte. Den vitenskapen viser hvordan atferd bygges mer effektivt med forsterkning enn med aversive teknikker. Den viser hvordan forbedringer kan muliggjøres, selv der man tidligere ikke har gjort noen fremgang. Mange av dere har anvendt prinsipper hentet fra Skinners bok Verbal Behavior for å lære individer å kommunisere for aller første gang. Verbal Behavior må være nyttig. Den selger mer i dag enn i 1957 da den først ble utgitt.

Skinner ville også være imponert over den verdensomspennende distribusjonen av, og innsatsen bak Operants. På hans vegne takker stiftelsen alle økonomiske bidragsytere, og de som leverer artikler, gjennomfører intervjuer, redigerer saker eller oversetter dem. Uten dere ville Operants ikke eksistere.

Portuguese Translated by Bruna Colombo dos Santos

Se B. F. Skinner estivesse vivo hoje, ele estaria satisfeito com a expansão da ciência que ele começou. Essa ciência mostra como o comportamento é construído mais efetivamente com reforçamento do que com técnicas aversivas. Ela mostra como tornar melhorias algo possível, mesmo quando nenhum progresso existia antes. Muitos de vocês tem aplicado princípios derivados do livro Comportamento Verbal, escrito por Skinner, para ensinar indivíduos a se comunicar pela primeira vez. Comportamento Verbal precisa ser útil. Ele vende mais hoje do que em 1957 quando ele foi publicado pela primeira vez.

Skinner estaria impressionado, também, com a distribuição mundo afora e com o apoio recebido pela revista Operants. Em seu nome, a Fundação agradece a todos os contribuintes financeiros e aqueles que escrevem artigos, conduzem entrevistas, editam peças ou as traduzem. Sem vocês, a revista Operants não existiria.

Russian Translated by Konstantin Evdokimov

Если бы Б. Ф. Скиннер был жив сегодня, он был бы рад масштабам распространения науки, у истоков которой он стоял. Эта наука доказала, что поведение выстраивается более эффективно с помощью подкрепления, нежели чем с помощью наказания. Наука показывает, как сделать возможными улучшения даже там, где раньше не было никакого прогресса. Многие из вас применяют принципы, взятые из книги Скиннера «Вербальное поведение», чтобы научить общаться людей, лишенных ранее этой возможности. Польза от «Вербального поведения» неоспорима. Сегодня эта книга продается больше, чем в 1957 году, когда была впервые опубликована.

Скиннер также был бы под впечатлением от всемирного распространения и поддержки журнала «Операнты». От его имени Фонд благодарит всех финансовых спонсоров и тех, кто предоставляет статьи, проводит интервью, редактирует и переводит материалы. Без вас нашего журнала не существовало бы.

Spanish Translated by Kenneth Madrigal and Gonzalo Fernández

Si B.F. Skinner siguiera vivo, seguramente estaría agradecido por la difusión de la ciencia que él inició. Con ella se mostró cómo es posible establecer comportamientos más efectivamente mediante el reforzamiento que con técnicas aversivas. Demostrando así que es posible realizar mejoras a pesar de no contar con un avance. Muchos de ustedes han aplicado los principios planteados en el libro de Conducta Verbal para enseñar a personas a comunicarse por primera vez, lo cual deja ver que ha sido de ayuda. A la fecha, el libro se vende más que cuando se publicó por primera vez en 1957.

De igual manera, Skinner estaría impresionado con la distribución mundial y el apoyo que Operants ha recibido. A nombre de él, la Fundación agradece a todos los que han apoyado financieramente, a quienes proporcionan artículos para la revista, quienes conducen entrevistas, así como a quienes editan y ayudan con la traducción. Sin ustedes Operants no existiría.

Swedish Translated by Dag Strömberg

Om B. F. Skinner levde idag skulle han vara nöjd med spridningen av den vetenskap han påbörjade. Den vetenskapen visar hur beteende byggs effektivare med förstärkning än med aversiva tekniker. Den visar hur förbättringar kan möjliggöras även där ingen utveckling tidigare fanns. Många av er har tillämpat principer från Skinners bok Verbal Behavior för att lära individer kommunicera för allra första gången. Verbal Behavior måste vara användbar. Den säljer mer idag än 1957 när den först publicerades.

Skinner skulle också vara imponerad av den världsomfattande distributionen av och stödet för Operants. Å hans vägnar tackar the Foundation alla ekonomiska bidragsgivare och de som lämnar artiklar, genomför intervjuer, redigerar inslag eller översätter dem. Utan er skulle Operants inte existera.

Thai Translated by Sirima Na Nakorn

ถ้า ดร. บี เอฟ สกินเนอร์ยังมีชีวิตอยู่ ท่านจะปีติยินดีกับการแพร่หลายของวิทยาศาสตร์ที่ท่านเป็นผู้เริ่มคิดค้น วิทยาศาสตร์ของท่านแสดงให้เห็นว่าพฤติกรรมที่สร้างขึ้นโดยใช้การให้รางวัลนั้นดีกว่าพฤติกรรมที่สร้างขึ้นโดยการทำโทษ การเปลี่ยนแปลงพฤติกรรมให้ดีขึ้นนั้น เป็นไปได้ ทั้งที่ก่อนหน้านี้ไม่สามารถทำได้ นักฝึกหลายท่านได้นำหลักการจากหนังสือ Verbal Behavior ของ ดร. สกินเนอร์ ไปประยุกต์ใช้สอนให้เด็กที่สื่อสารไม่ได้เลย สามารถสื่อสารได้เป็นครั้งแรกในชีวิตรองของเขา หนังสือ Verbal Behavior เล่มนี้ไม่มีประโยชน์มาก และปัจจุบันมียอดขายมากกว่าในปี 1957 ที่พิมพ์ออกจำหน่ายเป็นครั้งแรก อีกอย่างที ดร. สกินเนอร์ ต้องภูมิใจ ก็คือ นิตยสาร Operants มีสมาชิกและได้รับการสนับสนุนไปทั่วโลก ในนามของ ดร. สกินเนอร์ มูลนิธิฯ ขอขอบคุณผู้สนับสนุนนิตยสาร Operants ในด้านการเงิน จิตอาสาในด้านการค้นหาบทความ ทำการสัมภาษณ์ ทบทวนการเขียนและแปลบทความ

Turkish Translated by Yeşim Güleç-Aslan

Eğer B. F. Skinner bugün hayatta olsaydı, kendisinin başlattığı bilimin yayılmasından memnun olurdu. Bu bilim, davranışın oluşumunda kaçınma tekniklerindense pekiştirmenin nasıl daha etkili olduğunu göstermektedir. Bu, daha önce ilerleme kaydedilmemiş olsa bile iyileşmenin, gelişmenin nasıl sağlanabileceğini gösterir. Birçoğunuz, bireylere ilk kez iletişim kurmayı öğretmek için Skinner'ın Sözel Davranış kitabındaki ilkeleri uyguladınız. Sözel Davranış yararlı olmalı. Bugün ilk yayınlandığı 1957'den daha fazla satıyor.

Skinner, dünya çapındaki Operants'ların yayılması ve desteklenmesiyle da etkili olacaktı.. Onun adına, Vakıf tüm finansal destek sunanlara, makaleler sağlayanlara, görüşmeleri yürütenlere, bunları düzenleyen veya tercüme edenlere teşekkür eder. Sensiz Operants olmazdı.

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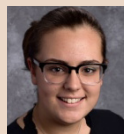
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We would like to thank those who contributed to this issue. Operants preserves the intellectual tradition of Skinner’s writings — articles of interest to the field, but also written without heavy use of citations and references. In most articles intellectual credit to others is given, not by citing and referencing specific studies or articles/books, but rather through discussing the “big idea” or “concept”, and naming the person/affiliation. In this way, the intellectual credit is provided while still writing for a wider audience. Especially today, we would like to continue to advance the relationship between basic and applied science — and its theory — and make that available to the public.

Operants is produced by the B. F. Skinner Foundation. The opinions reflected in this Operants do not necessarily represent the views of the Foundation. We reserve the right to edit all submissions for factual and scientific accuracy, however, as a rule, we preserve the author’s grammar and punctuation.

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AS A CHILD, SKINNER STRUGGLED TO REMEMBER TO HANG UP HIS pajamas in his closet each morning, despite his mother's daily reminders that he'd failed to do so. Fortunately, even as a young boy, Skinner was inventive, and in his autobiography, *Particulars of My Life*, he described the following solution to his problem:

The clothes closet in my room was near the door, and in it I fastened a hook on the end of a string which passed over a nail and along the wall to a nail above the center of the door. A sign reading "Hang up your pajamas" hung at the other end. When the pajamas were in place, the sign was up out of the way, but when I took them off the hook at night, the sign dropped to the middle of the door where I would bump into it on my way out.



Skinner's ability to design apparatus to solve behavioral puzzles continued to be a critical repertoire to maximize the effects of his behavior throughout both his personal life and his professional career. Examples of the latter include his inventions of the operant chamber, the cumulative recorder, the "air crib" (or "Heir Conditioner" as it was sometimes called), teaching machines, and the verbal summator. This second quarterly issue of *Operants* features articles in which current behavior analysts have similarly incorporated the latest technological advances into their respective areas of work.

Kazemi and Ptah present their innovative use of technology to train individuals within various complex areas of behavior analysis, including the programming of artificially "intelligent" robots for effectively training graduate students in the design and implementation of functional analyses of problem behaviors, such as self-injury.

Gauert has dusted off Skinner's 1934 empirical research on latent behavior with his verbal summator device, also referred to as a "verbal inkblot." Gauert has expanded upon the technological limitations of Skinner's time to reveal some interesting advances of an important, yet seldom discussed, behavioral phenomenon in our field.

Matt Cicoria has taken advantage of the growing popularity in podcast technology to provide an easily accessible medium for the dissemination of our science. *Operants* interviewed Cicoria to learn about his background and the development of the *Behavioral Observations* podcast. The essay by Leif, Parker, and Celiberti detail the importance of disseminating our science, and describe their own efforts to do so through The Association for Science in Autism Treatment (ASAT).

Finally, Henry Schlinger provides a conceptual paper on the dangers of dualism and the necessity of parsimony in our current analyses of behavior, an essay that every student and professional in behavior analysis would benefit from reading. Schlinger also provides for us some selections of Skinner's personal notes for our recent *Notebooks Corner*, which nicely supplement the contents of his essay.

David Roth, MA
Editor-in-Chief

“All’s Behaviour—And the Rest Is Naught”

Henry D. Schlinger, Jr.

California State University, Los Angeles



Henry D. (Hank) Schlinger Jr. received his PhD in psychology (applied behavior analysis) from Western Michigan University (WMU) under the supervision of Jack Michael. He then completed a two-year National Institutes of Health-funded post-doctoral fellowship in behavioral pharmacology also at WMU with Alan Poling. Dr. Schlinger was a full tenured professor of psychology at Western New England University in Springfield, MA, before moving to Los Angeles in 1998. He is now professor of psychology and former director of the M. S. Program in Applied Behavior Analysis in the Department of Psychology at California State University, Los Angeles. Dr. Schlinger has published more than 80 scholarly articles and commentaries in more than 30 different journals. He also has authored or co-authored three books, *Psychology: A Behavioral Overview* (1990), *A Behavior-Analytic View of Child Development* (1995) (translated into Japanese), and *Introduction to Scientific Psychology* (1998). He is past editor of *The Analysis of Verbal Behavior* and *The Behavior Analyst* and sits on the editorial boards of several other journals. He received the Distinguished Alumni Award from the Department of Psychology at Western Michigan University in 2012, and the Jack Michael Award for Outstanding Contributions in Verbal Behavior from the Verbal Behavior Special Interest Group of the Association for Behavior Analysis International in 2015.

Introductory Note

In 2016, I was invited to give one of the so-called “Last Lectures” at the 96th annual conference of the Western Psychological Association in Long Beach, California. The Last Lecture is given by academics late in their careers and is supposed to be the last lecture they give before retiring. While it pains me to think that I am late in my career, the facts support that conclusion. In any case, the title of my last lecture was “All’s behaviour—and the rest is naught.” In it, I made the case in front of a packed room of traditional psychologists that everything psychologists study and are interested in is just behavior and that undertaking an experimental analysis is the only way to understand it scientifically. What follows is a truncated version of that talk. (Note that this talk was presented to psychologists, so the arguments will be obvious to most readers of *Operants* and, in fact, you might find yourself saying many of the same things.)

My title comes from a poem written by the British literary critic and rhetorician I. A. Richards, titled “Verbal Behaviour.” The impetus of his poem was B. F. Skinner’s deterministic and behavioral account of language described in *Verbal Behavior*. In the poem, Richards claimed that, among other things, behaviorism would mean the death of the individual as the originator of his or her actions. Skinner replied to Richards with his own poem, which began “Yes, all’s behaviour—and the rest is naught.” (Skinner then gave a talk, subsequently published, titled “A Lecture ‘On Having’ a Poem,” in which he expanded on the notion that we are not responsible for our behavior by comparing a poet writing a poem to a mother having a baby.) Richards meant the phrase to be a criticism; that is, if everything is behavior what role is there for a thinking, feeling self? However, Skinner accepted the phrase as a proper characterization of the subject matter of a natural science of behavior, which is how I intended it in my talk. Almost 30 years after Skinner died, with a few exceptions, the chasm between nominal psychologists and behavior analysts is still as great as it has always been. How, then, can that schism be characterized?

Psychology Is Still Dualistic

Natural scientists, including behavior analysts, explain the phenomena they study by appealing to physical events. Psychologists, however, still appeal to unseen, nonphysical events and processes. Some try to justify this dualism by claiming that cognitive processes are really brain processes, or as some cognitive psychologists have said, “The mind is what the brain does.” Or they ask how the brain can generate the mind. Such statements or questions are muddled because, like Descartes, they are trying to solve the problem of interactive dualism, a problem that Descartes’ friend, and philosopher in her own right, Princess Elizabeth of Bohemia, pointed out was unsolvable because a nonphysical entity—the mind—cannot interact with a physical one—the body. The problem is that even if most cognitive psychologists are not dualists, they still use the language of dualism. Abandoning our everyday folk psychology vernacular about the mind and cognitive events, and focusing only on what really matters evolutionarily, physiologically, and psychologically—behavior—would go a long way toward solving these problems.

Why Appealing to Neuroscience Is Not Satisfactory

Perhaps faced with the realization of this implied dualism, many cognitive psychologists nowadays look to neuroscience to clarify their subject matter. In doing so, they implicitly accept what Tania Lombroso at UC Berkeley stated: “If we want to understand the mind, we should look to neuroscience and the brain for the real answers.” That’s a cop-out for more than one reason. First, it ignores behavior at the expense of mind and brain, which are, respectively, impossible and difficult to observe. Second, the brain is not a unitary organ; it is a collection

of billions of neurons, supporting cells, some blood and cerebral spinal fluid. Third, neurons do only one of two things: they fire or don't fire—the so-called “all-or-none-law.” So, the brain itself doesn't do anything. Some like to say that the brain *thinks, decides, plans, etc.*, but these are things that *people* do; and they are most parsimoniously described as behaviors.

Much of modern cognitive neuroscience looks for the neural correlates of a wide range of environment-behavior interactions. And often it is successful in identifying areas of the brain at least correlated with those interactions. But such research doesn't (and probably can't) answer two questions. The first is how the brain got to be that way in the first place. There is good brain-imaging evidence that, except for the primary sensory and motor regions, most of the cerebral cortex is programmed, that is, neuronal connections are established, as a result of interactions with the environment, beginning before birth, but mostly after birth. These environment-behavior interactions produce corresponding changes in behavior that we call learning, and the only two scientifically documented forms of learning are Pavlovian and operant learning.

A second question left unanswered by current cognitive neuroscience research is how we could change the behavior of individuals with disordered behavior, such as those with autism, schizophrenia, etc. In fact, the only documented methods of changing the behaviors of people diagnosed with behavior disorders is therapy based on Pavlovian and operant learning, the very environment-behavior interactions that program the brain in the first place. And, once again, there is good brain imaging evidence that these therapies actually change the structure and chemical nature of the brain in such patients. The central nervous system is only a proximate or immediate cause of behavior. But the ultimate, or original, causes of both behavior *and* the brain lie in our evolutionary history but, mostly, in our individual learning environments.

Parsimony in Description and Explanation

One of the biggest problems with cognitive psychology is that their descriptions and explanations are not parsimonious.

Parsimonious descriptions and explanations are ones that make the fewest assumptions. As a counterexample, consider the traditional view of mental imagery, which is described in terms of memory. According to Kosslyn and his colleagues, “Mental imagery occurs when perceptual information is accessed from memory, giving rise to the experience of ‘seeing with the mind's eye,’ ‘hearing with the mind's ear,’ and so on.” Finke, another cognitive psychologist, has stated that mental imagery is “the mental invention or recreation of an experience....” But what does it mean to say that “perceptual information is accessed from memory” or to talk about the “mental invention or recreation of an experience”? How can we possibly operationally define “mental imagery” or “mental invention”?

As I argued in a 2009 article on auditory imagining, a more parsimonious view is that imagining (as a verb—to *imagine* is to do something) is behavior. For example, I have argued that auditory imagining, that is, imagining “hearing” someone else talking or some piece of music, involves sub-audible speech or humming. Although these behaviors are not presently capable of being observed directly, they are potentially capable of being

observed, and there is neuroimaging evidence to support this behavioral interpretation over a mentalistic one, namely, that motor and language areas of the cortex are active when subjects are instructed to listen to or imagine “hearing” speech or music.

Not only do psychologists describe their subject matter in non-parsimonious—mentalistic—terms, they explain the behavior they do observe as being caused by the very cognitive processes they can never observe or measure. Such explanations are circular (Skinner called them explanatory fictions) in that the only evidence of the cognitive processes is the very behaviors they are trying to explain in the first place. When we are given circular explanations, we are being bamboozled into thinking that the behavior has been explained when it hasn't. Or as Skinner has written, such explanations function to “allay curiosity and to bring inquiry to an end.”

The Alternative to Cognitive Psychology

As the title of this essay suggests, the parsimonious alternative to studying cognitive events and processes is to study behavior in its own right, which means not as a reflection, index, or manifestation of underlying mental or cognitive events, such as ideas, thoughts, feelings, schemata, memories, etc. But we have to define what we mean by behavior. And, there are two views of what behavior refers to and how we can study it. One, called methodological behaviorism, is not a scientifically satisfactory position; and the other, called radical behaviorism, is.

Let me first address methodological behaviorism. There are two broad forms of methodological behaviorism. In one, mental events do not exist, and only observed behaviors count in a scientific analysis; that is, no private (i.e., unobserved) factors can explain public behavior even if the private events are physical. This version of methodological behaviorism is a caricature of Skinnerian, or radical, behaviorism, which states that behaviorists are only interested in behavior that can be observed.

The other version of methodological behaviorism asserts that mental events do exist and they can be inferred from observed behaviors and, thus, used indirectly in scientific explanations. Consider the common claim that verbal reports support the inference of causal mental phenomena. This is another way of saying that we talk to express ideas. The ideas are in the mind and presumably precede and, thus, cause the talking. This version of methodological behaviorism is basically the cognitive position. Let me explain.

As I pointed out earlier, all cognitive psychologists can ever directly observe and measure is behavior. But they're not interested in the behavior *per se*. What they're interested in are events and processes they think take place somewhere else (in the mind?), and which are reflected in behavior. To the extent that cognitive psychologists infer cognitive processes only from observed behavior, they are methodological behaviorists. Either way, their research program cannot discover the physical causes of behavior.

Consider memory as an example. The definition of memory in the introductory textbook that I use is “the retention of information.” The biggest problems with this definition are the operational definition of *information* and then how it can be retained. Another problem is that *memory* is a noun, and like all nouns, it must refer to a person, place, or thing. Obviously, *memory* refers to none of them.

Talking as if memory really exists commits the reification fallacy. Moreover, psychologists have never directly observed memories nor will they ever. So, what exactly are they studying? The answer is behavior (remember that *all's behavior—and the rest is naught*). Cognitive psychologists, like methodological behaviorists, only observe and measure behavior and some of the circumstances under which it occurs. Then they make up explanations that appeal to events taking place somewhere else. For example, for the past 60 years or so, psychologists have appealed to a metaphor about how they think memory works called the information-processing model. But it is only a metaphor, which means “a figure of speech in which a word or phrase is applied to an object or action to which it is not literally applicable.” Thus, there are literally no short- or long-term memory registers, no encoding, and no storage. Again, to talk as if there are such things commits the reification fallacy. There is only behavior, the circumstances under which it occurs (discriminative and contextual stimuli), and its ultimate causes, which lie in the environment. All of those are physical events and, thus, observable and measurable, or potentially observable and measurable. Thus, they are all properly scientific.

Consider some examples. If you remember your name, you say or write it when someone asks you—behaviors. When a teacher asks, “What’s 5×4 ?” you say or write “20”—behavior. If I ask you, “What is the capital of California?” you are likely to say “Sacramento”—a behavior. When I pick up a guitar, I can play fluently—behavior. All of these instances of remembering are observed behaviors. But the behaviors were not initially encoded, stored, and then retrieved. They were learned through operant discrimination training in which a stimulus was presented (e.g., “What’s your name?” “What’s 4×5 ?” “What’s the capital of California?” or the presence of a guitar in hand) and the correct responses were reinforced. The reinforcements used at the time were mostly in the form of social praise, but now the reinforcers are what we call *automatic reinforcers*, that is, they are simply getting the answer right or hearing the right notes or chords on the guitar. We don’t need to infer short- or long-term memory registers, or encoding, storage, or retrieval—to do so would be circular as the only evidence for those processes are the very behaviors we want to explain in the first place. Also, most everything from the initial learning to the ultimate responding is observable, measurable, and manipulable. In other words, the operant learning explanation is parsimonious and experimentally testable.

The task for psychologists is to experimentally manipulate variables in the environments of individuals in an effort to understand what causes their behavior. If psychologists then want to look for the underlying neural correlates of the behavior and the learning that produces those neural correlates, that is perfectly acceptable. But looking in the brain for the causes of behavior before identifying the environmental (or genetic) causes is putting the cart before the horse. And making up imaginary cognitive ghosts in the head to account for the behavior is unnecessary, perpetuates Cartesian dualism, and keeps psychology mired in the philosophical mud from which all sciences sprung.

Conclusion

I have tried to make the case that psychologists should study behavior in its own right, that is, not as a window into cognitive or mental processes—*all's behavior*

and the rest is naught. Moreover, there is a discipline—the experimental analysis of behavior—that has been around for more than 80 years and has produced basic laws of learning and behavior capable of explaining parsimoniously much behavior including that which goes by cognitive names. And those laws have been applied successfully to change and treat a wide range of problem behaviors.

Postscript

In our own discipline, there are some fairly recent trends that suggest a move away from the maxim that *all's behavior...* and from the subject matter of behavior analysis itself—the study of behavior in its own right—allowing what may possibly be viewed as a creeping cognitivism. For example, some researchers who study stimulus equivalence talk about stimuli being or becoming equivalent as if this can happen without any more behavior than simply responding on a matching-to-sample task. However, stimuli do not literally become equivalent; there are likely underlying behavioral mechanisms that involve self-talk and problem-solving that aid individuals in responding in such ways. Neglecting these behaviors risks less than parsimonious explanations. Likewise, some researchers who study derived relational responding claim that there are various types of relational frames (e.g., of coordination, sameness). But, once again, there are literally no frames. And responding relationally can only result from an individual’s behavior that is more than simply responding on a match-to-sample, or related, task. As some have argued, derived relational responding (or stimulus equivalence) will not occur in the absence of echoic, intraverbal, or some other—usually unobserved—ongoing behavior by verbal participants. Similarly, there is evidence that pigeons learn to respond accurately on delayed matching-to-sample tasks only as a result of other ongoing behavior being conditioned. Such behavior is said to mediate the S+ and the ultimate response (pecking the correct comparison key), which, as it turns out, may be the least interesting behavior to study. A significant amount of research now strongly suggests that ongoing behavior is involved during these various preparations. As Skinner argued in *Verbal Behavior*, and I (and others) have reiterated, the behavior of a listener with an appropriate history can also be conditioned simply by someone else or the listener him- or herself making a variety of statements. For example, telling a non-Spanish speaker with an appropriate history that, “Cat is ‘gato’ in Spanish” can result in that person now being able to say “gato” when she is asked “What is cat in Spanish?” She can now also point to a cat when asked “Where is the gato?” But how can this work without the individual echoing “gato” and engaging in other (e.g., verbal or visual), mediating behavior? Such behavioral relations often result from one-trial learning and are evident in every verbal individual from a relatively early age. The learning history responsible for the quick conditioning of the listener’s behavior has yet to be identified and should be a source of experimental research questions. This conclusion does not mean behavior analysts cannot use terms like stimulus equivalence or relational frames, only that behavior analysts should understand and make clear that it is the ongoing behavior of the individuals that becomes conditioned by the training and without which there will be no equivalence or derived responding. Remember, *all's behavior and the rest is naught*. ●

Spread the Word!

Some Approaches for Disseminating the Science and Professional Practice of Applied Behavior Analysis

Erin Leif, Allison Parker, and David Celiberti
The Association for Science in Autism Treatment

B. F. Skinner is widely recognized as one of the most influential behavioral scientists and scholars of the 20th century. Rather than analyzing the behavior of groups (as is common in most psychology research), Skinner's research and writing emphasized the analysis of behavior at the level of the individual. Skinner's experimental methods were guided by two defining features of behavior: (a) behavior is an individual phenomenon, and (b) behavior is a continuous phenomenon. These two characteristics led Skinner to employ inductive research methods that (a) emphasized the repeated measurement of behavior of an individual over time and (b) allowed variability in behavior, both within and across subjects, to be detected and further studied. Skinner did not focus on the testing of hypotheses; rather, Skinner was concerned with the generation of new theory about learning and behavior, emerging from the data. One of Skinner's most important contributions was *Selection by Consequences*, or the scientific discovery that much voluntary behavior is strengthened or weakened by its consequences. In his later book, *Verbal Behavior*, Skinner extended the principles of selection by consequences to explain how we acquire language and more complex forms of behavior, including thinking and cognition.

Although Skinner's research was primarily designed to explore basic principles of learning in laboratory settings, his work revolutionized how we think about learning and has left an indelible imprint on autism treatment. In the 1960s, researchers began to apply Skinner's operant theory of learning to teach functional skills to individuals with profound disabilities who were living in psychiatric wards and other residential communities. These early applications of behavior analysis were significant, since they represented a radical departure from traditional methods of caring for people with developmental disabilities which largely involved ascribing blame on parents (namely the mothers), institutionalization, and overreliance on medication. These early researchers and clinicians demonstrated that even people with the

most profound developmental disabilities were capable of learning when Skinner's operant learning paradigm was applied. This research largely involved identifying preferred consequences for an individual, breaking skills down into small component parts, teaching component skills using prompting and prompt fading, and delivering preferred consequences following each demonstration of the skill. Gradually, small component skills were scaffolded into larger functional skills via shaping and chaining procedures. These early clinical applications of the basic principles of learning taught us that everyone (including individuals who were previously thought to be ineducable) was capable of learning.

These early demonstrations subsequently led to the development of the science and professional practice of applied behavior analysis (ABA). ABA is both an applied science and a professional discipline that, according to the Behavior Analyst Certification Board in 2014, focuses on the "analysis, design, implementation, and evaluation of social and other environmental modifications to produce meaningful changes in human behavior." Applied behavior analysis is now perhaps best-known among the public as a treatment for autism and related conditions. Many of Skinner's contributions are still evident in contemporary ABA-based interventions for autism. These include:

- An analysis of behavior change at the level of the individual;
- An understanding of how environmental variables, including antecedents and consequences, influence behavior;
- Efforts to change environmental events (including antecedent stimuli and consequences) and design effective learning environments to produce practical and significant changes in behavior;
- The use of positive reinforcement and other basic principles of learning with strong scientific support;

- The use of direct observation and ongoing measurement of behavior to inform clinical-decision making;
- The use of single subject research methods to demonstrate that behavior change is due to the independent variable, rather than some other uncontrolled variable;
- An emphasis on the function of behavior (or the effect of the behavior on the environment), in addition to the form of the behavior; and
- A functional approach to teaching language to individuals with language delays, using Skinner’s ‘verbal operant’ as the basic unit of analysis.

Skinner taught us that the learner is always right. In other words, if a person is not learning by the way we are teaching, we should not blame the person. Rather, we should change how we teach. The individualized nature of instruction is a hallmark of ABA-based interventions for autism.

Unfortunately, ABA is sometimes portrayed in a negative light, with the media focusing on inaccurate stereotypes regarding punishment and control. Therefore, the dissemination of correct and unbiased information about the science and professional practice of ABA is important. Both the B.F. Skinner Foundation and the Association for Science in Autism Treatment (ASAT) are at the forefront of current dissemination efforts. In what follows, we briefly describe some of the ways in which both organizations make information about behavior analysis and its applications more widely available to the public.

Dissemination Efforts: The B.F. Skinner Foundation

The B.F. Skinner Foundation is dedicated to preserving and sharing Skinner’s works. Formed in 1988 with the help of B.F. Skinner, and now overseen by a board of directors which includes Dr. Julie Vargas, the Foundation provides valuable resources to researchers, practitioners, and past, current, and future students of behavior analysis.

To highlight the important work the Foundation has completed, we would like to acknowledge its many accomplishments since its inception. Like ASAT, the Foundation’s website offers a myriad of useful resources to people for free or at little cost. In fact, we recently informed our subscribers that many of Skinner’s texts have been converted into ebooks, and are available for purchase along with \$0.99 PDFs. *Science and Human Behavior* is currently accessible as a free, full-text download. The Foundation was also responsible for bringing some of Skinner’s most important texts back into print, including *The Behavior of Organisms*, *Schedules of Reinforcement*, *Verbal Behavior*, *Cumulative Record*, and *Beyond Freedom and Dignity*. We applaud the foundation for all of their efforts to translate Skinner’s seminal texts into several languages, as we too are committed to the international

dissemination of science.

The Foundation does much more than link the public to Skinner’s published works. In 2006, an archival committee was formed to preserve historic materials related to Skinner and his work. Here, the public can learn more about Skinner’s personal and professional life, and see a biographical timeline of his scientific discoveries and publications. Using photographs, audio, and video recordings, the Foundation’s archives highlight the scope and depth of Skinner’s research.

Not only does the Foundation promote the science of behavior analysis, it also supports and encourages practices derived from this science. The Foundation’s free magazine, *Operants*, has been in publication since 2014 and covers a wide variety of topics that may be of interest to both professionals and consumers within the autism community. The magazine includes interviews with leaders and pioneers in behavior analysis, as well as articles on special interest topics ranging from experimental behavior analysis to animal behavior. *Operants* offers a unique forum for readers to learn about historical and contemporary topics in behavior analysis.

Dissemination Efforts: The Association for Science in Autism Treatment

Based upon decades of published research, it is abundantly clear that scientifically-validated treatment methods provide individuals with autism the best opportunity for success. Sadly, there is no shared commitment to empirical validation, research, and data-based decision making amongst proponents of the various autism treatments available today. As a result, the vast array of “treatments” for autism can be both overwhelming and confusing for consumers and providers alike. Many of these treatments are aggressively marketed by businesses, prematurely adopted by professionals, sensationalized by the media, and used broadly by hopeful consumers – often in the absence of supporting evidence for their effectiveness or safety.

The Association for Science in Autism Treatment (ASAT) strives to be an important resource for those with autism and their families, as well as for professionals, and para-professionals who work within the autism community. In fact, anyone interested in reliable, evidence-based and accurate information about autism and its treatments will find ASAT’s [website](#) and free, online publication, [Science in Autism Treatment](#), to be of great value. Founded in 1998, the mission of ASAT is to educate parents, professionals, and consumers by sharing accurate, scientifically-sound information about autism and its treatment, and by exposing and responding to inaccurate or unsubstantiated information. ASAT promotes the use of effective, science-based treatments for all people with autism regardless of age, severity of condition, level of income or place of residence. Given the scores of unsubstantiated treatments and the plethora of other organizations with competing, self-serving agendas, an organization

with such a mission is of considerable importance. Since ASAT was established over 20 years ago, it has been our goal to promote higher standards of accountability for the treatment, education and care of all individuals with autism.

How the Association for Science in Autism Treatment promotes the field of applied behavior analysis: ASAT is committed to the promotion of evidence-based practices for individuals with autism. Applied behavior analysis (ABA) is consistently shown to be an impactful, evidence-based practice enjoying abundant scientific support over several decades. It is part of ASAT's goal to ensure that disciplines with a high degree of support, such as ABA, are presented in an objective, clear, and user-friendly manner.

- We embody the values of objectivity, a commitment to science, transparency, treatment fidelity, and data-based decision-making in all we do. We link these values to the core tenets of behavior analysis and urge members of other disciplines to embrace these same values in their work.
- We respond to accurate and inaccurate representations of applied behavior analysis (ABA) in the media. Approximately half of our [Media Watch](#) letters address ABA, and many others are relevant to ABA outside of the United States, such as in Israel, India, Australia, China, South Africa, and Canada.
- We showcase diverse applications of ABA in our [Clinical Corner](#) column targeting a wide array of areas such as food selectivity, safety skills, tolerating trigger words, articulation, toilet training, safety skills for adolescents, catatonia, sleep, and play.
- We review published research (using single case designs extensively) as part of our [Research Synopsis](#) effort, and highlight its relevance and importance within autism treatment. Many of our synopses focus on behavior analytic research.
- Our *Science in Autism Treatment* monthly newsletter frequently features interviews with prominent behavior analysts from across the globe including Mickey Keenan, Bill Heward, Tristram Smith, Catherine Maurice, Carl Sundberg and Genae Hall, Tom Zane and Suzanne Letso, Eitan Elder, and James Todd. These experts weigh in on common themes such as service delivery, dissemination, and access to behavior analytic treatment. We recently interviewed Purnima Hernandez, a dentist and BCBA who discussed the area of dental care with respect to treating people with autism spectrum disorder through the lifespan.
- We frequently write about the ethical issues surrounding the selection and implementation of evidenced-based treatment, such as the limita-

tions of testimonials, understanding the peer review process, and obtaining insurance coverage.

- We highlight the use of ABA in healthcare service delivery including more successful participation in dental visits.
- We actively support the efforts of behavior analytic teaching faculty through our initiatives and [Ten activities for students](#).
- We offer a 150-hour [Externship program](#) for students, professionals, and interested family members to gain experience in disseminating information about science-based treatment. Each extern has the opportunity to work on three individualized goals over the course of their experience with us (in fact, the first two authors are graduates of ASAT's Externship).
- We are promoting the field of ABA worldwide by making our website content available in over 80 languages. We also have flyers that can be translated, printed and shared into over 10 languages showcasing our newsletter and website offerings.

How ASAT supports the interests of BCBA's and center-based ABA programs: BCBA's are tasked with the service delivery of ABA in a variety of settings. With both the preponderance of evidence-based and non-evidence-based practices portrayed in the media and literature, ASAT makes it a goal to support BCBA's and agencies in accessing the appropriate methodologies.

- We provide resources that can be shared with consumers of behavior analytic services.
- We reinforce the messages of behavior analysts who attempt to steer consumers toward evidence-based practices and away from harmful or ineffective practices.
- We write about collaboration with related professions and highlight peer-reviewed research from other disciplines.
- We provide opportunities for new and more experienced professionals to acquire valuable experiences via our externship program.
- We respond to media representations related to autism and ABA allowing BCBA's and center-based ABA programs the ability to share our media letters and alerts with their networks and communities.

How ASAT supports the interests of clients and consumers: A Google search for "autism treatments" yields over 13 million results, some with supporting evidence, however, many without. Perusing the vast number of treatments available can be both daunting and frustrating for consumers, especially consumers with little background knowledge of autism. ASAT's goal is to ensure that consumers, both savvy and inexperienced, have access to the appropriate, evidence-based treatments that children deserve.

- We help to keep families and other subscribers in the know via *Science in Autism Treatment*, our monthly publication (we currently have almost 13,000 subscribers).
- We serve as a reliable and accurate resource for families of newly diagnosed individuals; however, we also are committed to writing regularly for parents of older children and adults on a wide array of lifespan topics.
- Our written works continually stress the importance of asking questions to assess provider competency, adequate experience, credential verification, and goodness of fit.
- We help consumers become educated, skeptical, and savvy when it comes to evaluating various treatment options.
- We teach consumers to discriminate between science and pseudoscience.
- Our content addresses the full range of the autism spectrum.
- We explain behavioral concepts using nontechnical language and help consumers remain

apprised of the latest research in a consumer-friendly manner.

- Our articles often reference and explain the BCBA credential, and refer to behavior analysts as professionals to whom consumers should turn for various areas of need and support.
- We maintain an active Facebook page to help parents and other family members better understand the scope of what evidence-based practice represents and participate in a community that shares those values.

With Skinner’s legacy in mind, ASAT is committed to keeping science at the forefront of discussions about autism and its treatment. In the words of Bill Heward, one of our advisory board members: “Basic research has revealed some powerful principles about how people learn (e.g., reinforcement, stimulus control), and applied studies have discovered and refined strategies and techniques, putting those principles to work for the benefit of individuals with autism.” We hope that you will consider visiting our website and sharing our content in an effort to ensure that people with autism and their families can access safe and effective treatment options. ●

Erin Leif, PhD, BCBA-D



Originally from Boston, Massachusetts, Erin currently lives in the beautiful city of Melbourne, Australia. She is a Senior Lecturer in the Faculty of Education at Monash University, where she coordinates the Masters of Education in Applied Behavior Analysis course sequence. Prior to joining Monash, Erin held various clinical appointments at internationally-recognized organizations providing applied behavior analytic education and treatment to children with autism and related conditions, including the New England Center for Children (Boston and Abu Dhabi) and the Lizard Centre (Sydney, Melbourne, and Adelaide Australia). Erin obtained her PhD in Behavior Analysis from Western New England University in 2012. Her clinical and research interests focus on the design and delivery of early intensive behavioral intervention (EIBI) and in functional assessment and treatment of severe behaviors of concern. Her approach to EIBI and behavioral treatment is skill-based; designing individualized programs that focus on teaching functional and fundamental life skills, including communication, learning to learn and listening skills, social responsiveness, play and leisure, and toleration. In addition, Erin is interested in the evaluation of strategies for building the capacity of the workforce to deliver high quality services to individuals with disability. She is passionate about making sure every individual has access to person-centered, safe, and effective supports to help build their independence. Erin is an avid animal lover and enjoys spending time with her two rescue dogs, Frank the Tank and Bentley, when not busy at work.

Allison Parker, MA, BCBA

Allison Parker is a Board Certified Behavior Analyst and adjunct instructor, and is currently completing her PhD in Applied Behavior Analysis at Caldwell University. Ms. Parker has 10 years clinical



experience providing services and supervision in residential, school, and consultative settings for the treatment of individuals with Developmental Disabilities. She has completed internships with Kennedy Krieger Institute and Children’s Hospital of Philadelphia’s Center for Autism Research. Her research interests include language acquisition, treatment of stereotypy, and staff training and supervision. Ms. Parker has presented her work regionally and nationally, is a member of The Association for Behavior Analysis International (ABAI), the Student Association for Applied Behavior Analysis (SAABA), and The New Jersey Association for Behavior Analysis (NJABA), and has held various positions with the Association for Science in Autism Treatment (ASAT).

David Celiberti, PhD, BCBA-D



David Celiberti, PhD, BCBA-D is the part time Executive Director of ASAT and Past-President, a role he served from 2006 and 2012. He is the Co-Editor of ASAT’s monthly publication, Science in Autism Treatment. He received his PhD in clinical psychology from Rutgers University in 1993. Dr. Celiberti has served on a number of advisory boards and special interest groups in the field of autism, applied behavior analysis, and early childhood education. He works in private practice and provides consultation to public and private schools and agencies in underserved areas. He has

authored several articles in professional journals and presents frequently at regional, national, and international conferences. In prior positions, Dr. Celiberti taught courses related to applied behavior analysis (ABA) at both the undergraduate and graduate levels, supervised individuals pursuing BCBA certification, and conducted research in the areas of ABA, family intervention, and autism.

Matt Cicoria

Behavioral Observations Podcast

Interview by David Roth

Can you tell us a bit of your back story in behavior analysis?

I discovered Behavior Analysis as an undergraduate at the University of New Hampshire. My second course in it was titled “Behavior Modification,” and was taught by Tony Nevin, who pioneered the behavioral momentum work. I was hooked right away, and Tony offered me a job working in his pigeon lab, which was a fun experience for a 20-year-old kid! I knew I needed graduate studies, so I enrolled in Auburn University’s Experimental Psychology PhD program. Back in the mid-90’s, there were very few graduate options for aspiring Behavior Analysts, so off to Alabama I went. I was fortunate enough to get a job in Jim Johnston’s lab, which at the time, was studying canine olfaction with these dog-sized operant chambers, and I ended up doing my master’s thesis on the specific scents dogs respond to when they alert to the presence of TNT explosives.

I needed to leave the program with my masters, and was very fortunate to meet Dr. Judy Favell, who at the time, was the CEO of AdvoServ. Despite having no experience working with humans, she nonetheless took a chance on me and gave me my first job as a Behavior Analyst. This was back in 1999. Fast-forward 20 years, and I’m still enjoying working in this field. Right now, I consult to public schools in New Hampshire and Vermont in private practice.

What works by B. F. Skinner would you say have had the most impact on you professionally or personally, and why?

To be candid, it’s been a while since I’ve read Skinner, so I’m grateful for this prompt to go back and re-engage with his works! The last thing I read of his was, “The Shame of American Education.” What’s so impressive about this is how relevant it is 35 years later!

You currently have a podcast called Behavioral Observations that has become quite popular in the field. When and how did the idea to develop this podcast begin?

About five years ago, I started to get this urge to give something back to the field, or, at the very least, share some of what I have learned about being a Behavior Analyst. Originally, I envisioned a blog that was directed towards students of ABA, and newly minted BCBA’s. Around the same time, I discovered the world of podcasts, and instantly fell in love with the medium, especially given the significant amount of time I spend commuting. Although I had no trouble finding shows that aligned with my hobbies and other interests, I couldn’t find any active podcasts in the Behavior Analysis space. I floated the idea of starting a podcast with a tech-savvy friend of mine, and with his assistance, we published the first episode in February of 2016.

Can you discuss what impact this kind of technology has had for the dissemination of our science?

I think it’s debatable whether my podcast is reaching people who are outside the realm of Behavior Analysis. Dr. Matt Brodhead’s mom listens to my show—perhaps due to his two appearances—and I have also gotten a few emails from the significant others of BCBA’s.



Matt Cicoria is a behavioral and educational consultant in private practice, providing services to school and community settings in New Hampshire and Vermont. Matt earned his B.A. in Psychology at the University of New Hampshire, and then his M.S. in Psychology at Auburn University under the supervision of Dr. Jim Johnston. After graduate school, Matt went to work in the field of Developmental Disabilities, with tenures at large organizations such as AdvoServ and the Institute of Professional Practice. In 2002, Matt earned his BCBA certificate, and in 2007, he started his independent consulting practice, Positive Behavioral Outcomes, LLC. His clinical interests include the assessment and treatment of problem behaviors in public school settings, Acceptance and Commitment Therapy, and Precision Teaching. Matt, along with Dr. Lisa Britton, is the author of Remote Fieldwork Supervision for BCBA® Trainees.

He lives in the Lake Sunapee area of New Hampshire with his wife and three children.

Aside from that, I do think that I'm speaking mainly to behaviorally oriented audiences. However, I try to feature topics that may not be encountered in the typical BCBA coursework, such as Acceptance and Commitment Therapy and Precision Teaching. As a result, I have received many emails from listeners who've told me that the show has helped them broaden their practice, so there may be some within-the-field dissemination occurring.

Do you have any thoughts or predictions with respect to the future impact podcast technology will have on our field?

I think podcasting is an efficient means for conveying ideas or messages. I would say that more people listen to ABA themed podcasts than read JABA or TAVB. So, from a communication standpoint, there's a lot of potential. One thing we're also seeing is BCBA's earning Continuing Education via podcasts. Both Behavioral Observations as well as my friends at ABA Inside Track already provide these opportunities.

You have produced over 80 episodes. Is there any content within those interviews that you found particularly challenging to cover?

Any of the episodes that discuss Relational Frame Theory. Hands down. I am not as well versed in the theory and concepts part of Behavior Analysis as I'd like to be, so debating the Verbal Behavior/RFT stuff is a challenge. That's why I like to bring guests on who are experts in these areas, like the recent episode I did with Drs. David Palmer and Josh Pritchard.

What episode or episodes would you consider your favorite(s), and why?

This is like asking, of my three children, who is my favorite? A nearly impossible question to answer. However, I will not wimp out. Here are a few shows that come to mind:

My first show with Dr. Jim Carr was a lot of fun. I met him at New Hampshire ABA a few months prior to our chat, and discovered what a fun guy he is to chat with. What was cool about that show was in Jim's backstory, he discussed his motor tic that he self-treated with a Habit Reversal intervention. Fortunately, I had some rudimentary knowledge on this topic, and we had a completely spontaneous exchange about Habit Reversal for 10-15 minutes. Going into that conversation, there was no way I could've predicted we'd talk about that.

Another show I really liked was my interview with Dr. Kim Berens from Fit Learning. I think she told a story that wove together these fantastic historical and entrepreneurial lessons. The passion with which she talks about her work is incredible. Shortly after our interview, she came to NH ABA as well and gave what I thought was the talk of the day.

Lastly, I very much enjoyed talking with Dr. Jim Moore about how he's lost over 110 pounds. While it's fun to discuss things like Functional Assessment, Jim's willingness to talk so openly about something so incredibly personal was a great addition to the show.

Now for what it's worth, if you asked me tomorrow to name some favorite episodes, I would likely come up with three completely different shows!

Do you have some kind of data system to track

number of downloads? What sort of numbers are you willing to share with us regarding the popularity of individual episodes? Any surprises along the way?

Yes, the main type of data that podcasters have available to them is the number of episode downloads. At the time of this writing, I have had over 1.2 million downloads across all 86 episodes that I've published. Here are the top five most downloaded episodes:

1. Session 1: Greg Hanley on Functional Analysis (~44K downloads).
2. Session 20: Greg Hanley Answers Listener Questions (~36.5 downloads).
3. Session 7: Greg Hanley on Function-Based Treatment (~27K downloads).
4. Session 34: Megan Miller on Instructional Control and Alternatives to Escape Extinction (~23.5 downloads).
5. Session 50: Get Your ACT Together with Jonathan Tarbox (~23K downloads).

As you can see, Greg Hanley has something of a Midas Touch as it were. Practitioners seem to love not only his message, but the way in which he delivers it. I think that when you take the top five together, one might assume that listeners are drawn to topics that provide solutions for the real problems that they face.

Is there a bucket list "dream interview" you would like to have completed at some point in your life?

I would love to interview Dr. Carl Hart from Columbia University. I saw him speak at Mass ABA a few years ago about drugs and behavior. He is a proponent of decriminalization of drug use and spoke openly about it during his keynote. I was kind of agnostic on this issue at the time, but being a father of three kids, the idea of legal access to drugs is worrying. While I'm not sure that I've entirely come around to Dr. Hart's position, he has influenced how I think about this matter, and it would be awesome to talk about this on the podcast with him. I also like that he seems to have transcended out of our bubble and into the popular media. He's written New York Times best-selling books and has been on shows like The Joe Rogan Podcast (which has downloads in the billions). When the media needs a perspective on an issue pertaining to drugs, he seems to be on their short-list of experts to contact. We need more of that in our field.

Anything else you would like to add for your readers and listeners?

The biggest message I'd like to convey is one of profound gratitude. The Task Analysis for creating a podcast has an untold number of steps, and these responses would have extinguished long ago were it not for the feedback that I get from my audience. I just came back from ABAI and met about 50 or so listeners. Many of them shared stories of how they took a topic they learned about on the show, studied it in more detail, and incorporated it into their practice. Others told me about how the show keeps them entertained while driving to work, exercising in the gym, and so on. It was really overwhelming to hear that these Skype conversations I have in my basement plays such a role in the lives of my listeners. As a result, I'm honored that people enjoy it and take the time to download and listen to the show. ●

The 21st Century Teaching Machines: Advancing Behavior Analysis through AI, VR, and Robotics

Ellie Kazemi and Adisa Ptah
KLab: Simulated-Based & Behavioral
Research Lab

California State University, Northridge (CSUN)



Introduction

We, in KLab, are interested in optimizing training outcomes so that trainees can perform the newly acquired skills flawlessly. In an endeavor to make trainings widely accessible, efficient, and effective, we leverage computer-technology and integrate robotics, virtual reality (VR), and artificial intelligence (AI) in our behavior analytic research.

It is remarkable that the once futuristic sci-fi images of robot-assistants, self-driving vehicles, and voice-controlled home appliances are now a part of our present world. In fact, technology is growing so rapidly that it is easy to forget that smartphones became popularized and available to the public a little over 10 years ago. What is amazing is that the typical smartphone today has more power than all of the computing technology NASA had when they first landed on the moon. Also important is the accessibility of this technology. According to Fideli, recently 95% of all Americans reported having cellphones, 77% of which were smartphones. Advancements in technology have been fueled by a global society in need of efficiency and accessibility. The current potential for growth and contribution to society is insurmountable. In KLab, we are keenly aware of the potentials that computer-technology has in making socially significant change in the world as we collaborate with NASA engineers developing swarm robots for space exploration, computer scientists creating efficient search and rescue robots, and firefighters developing VR for fire escape training.

When we first became interested in using humanoid robots about 10 years ago, many colleagues felt our aspirations were way too far into the future. Well, that future has quickly become a reality. In this essay, we give a sneak preview to a few of the projects KLab members have been conducting. We encourage the readers interested in this topic also to read the special issue of *Behavior Analysis: Research and Practice* on technology and behavior analysis. Kazemi and Ramirez provided the introduction to several fantastic articles published in this special issue on how behavior analysts are using advanced computer technologies in their current research as well as with their clients in their practice.

Dr. Kazemi is a Professor at California State University, Northridge (CSUN) where she has developed and teaches undergraduate and graduate coursework in behavior analysis for the past 13 years. She founded the Masters of Science Program in Applied Behavior Analysis in 2010 and has collaborated with the CSUN community to provide graduate students high quality supervision experiences. She currently has two different primary lines of research. Her applied research interests involve identification of efficient, effective strategies for practical training and supervision. Her laboratory research involves leveraging technology (e.g., robotics, virtual or augmented reality) for optimal simulation-based training. She is currently working on several nationwide large projects (e.g., with FEMA and NASA) with a focus on effective training and behavioral outcomes. She has received several mentorship awards including the ABAI Best Mentor Award, the Outstanding Faculty Award, the Outstanding Teaching Award, and the Outstanding Service Award. She has published articles and book chapters on a variety of topics including training, staff turnover, and the use of technology in behavior analysis. She is the leading author of a handbook for supervision titled, Supervision and Practicum in Behavior Analysis: A Handbook for Supervisees.

Adisa Ptah recently graduated from California State University, Northridge (CSUN) with a Bachelor's Degree in Psychology. He is a KLab research assistant under the supervision of Dr. Kazemi and currently developing his research skills as he pursues applying for a PhD Program. He admits he has a fascination with technology and is passionate about integrating new technological endeavors into Behavior Analysis. More specifically, he is interested in utilizing robotics and virtual reality as a means to simulate human interactions.

We Use Humanoid Robots and VR to Provide Simulation-based Training

Computerized, systematic simulations, such as robotics and VR, have been used to advance training in aviation, military, and medical care professions. Simulated environments allow users to engage in practical skills as many times as needed, without causing harm to themselves or others. Additionally, simulation-based training can be standardized across participants and it allows for standardized assessment of practical skills. Although computer-based instruction could be used to provide standardized training to a large number of individuals, when we conducted a literature review we found that they are effective for teaching knowledge-based information, but not teaching practical skills. Unlike instruction-based methods, simulation-based training would be a closer approximation to the in-situ environment and would allow trainers to provide multiple exemplars, sufficient for generalization of skills. Additionally, a robot can be programmed to provide contingent feedback specific to participants' performances allowing for personalized behavior skills training. Essentially, a well programmed simulation-based training could provide behavioral skills training, thereby maximizing the time of expert trainers and making training more accessible.



A NAO Robot, we named Meebie, standing next to a 3D model.

Our Robot. The robot we use to simulate behaviors of child clients is the H-25-model “NAO,” a 2-ft. tall humanoid robot. NAO features a range of tactile and pressure sensors, motors, sonar rangefinders, and actuators to simulate human mobility and detect movement. It is equipped with high-fidelity speakers, microphones, a voice synthesizer, cameras, voice and object recognition software, and an internal computer (see the [Aldebaran website](#) for more information). NAO can move independently, recognize people and objects in the environment, engage in reciprocal conversation, and can perform behaviors autonomously. To increase its verisimilitude to humans, a feature called Autonomous Life makes NAO appear alive and responsive (it orients its head toward sounds, shifts

its weight as it is standing, appears to be breathing, blinks, etc.) at all times. We use Aldebaran Robotics’ *Choreographe* software to program the robot to engage in prescribed responses.

Adopting NAO robots for our research has led to innovative pursuits in human-robot interaction research projects, for which we recently were awarded a grant through the Department of Defense to work with NASA. These pursuits enable us to collaborate with multidisciplinary teams and contribute to the literature in robotics from a behavior analytic perspective. For example, there is growing literature in human-robot interaction research on trust. Typically, researchers manipulate various features of robots (e.g., movement, frequency of error) to determine which features make people trust a robot more. Our current lab member, Helina Mekonnen, is using a within-subjects design and direct observation of behavior, instead of the usual between-subjects group designs for assessing trust through self-report and survey methods. She will measure trust by having participants select the robot they wish to work with after exposing them to robots with different features.



KLab graduate, Michael Aragon, conducting functional analysis with a NAO Robot throwing a tantrum

Simulation-based Training Using a NAO Robot. A few years ago, Kazemi and Stedman-Falls found that participants successfully learned to conduct paired choice preference assessments with a NAO robot simulating a child client. We also found during generalization probes that participants’ skills generalized to real children. Currently, Aragon, Kazemi, Ramirez, and Esmaeili are testing the efficacy of a simulation-based functional analysis training package. Trainees complete computer-based instructional modules on how to conduct the conditions of a standard functional analysis, record, graph, interpret the data, and troubleshoot when the results are not differentiated. After completing the modules, the trainees interact with a NAO robot that exhibits self-injury, as the target behavior, and other behaviors such

as screaming, crying, saying “No, I don’t want to,” playing with cars, and complying with task demands. As such, they learn to differentiate what to record (target behavior vs. all other behavior) as well as how to provide reinforcement contingent on the target behavior only. The trainees can undergo several different conditions and practice as many times as needed. We presented the preliminary results of this project at ABAI 2017 and CalABA 2017 and are currently collecting more data before submitting the manuscript for peer review and publication.

Simulation-based Training Using VR. In KLab, our focus is on leveraging technology to advance research and practice in behavior analysis. Currently, we have a few projects using VR. For example, Carter and Kazemi presented the outcomes of a large-scale survey we conducted with Board Certified Behavior Analysts (BCBAs). We asked about the rate and impact of workplace conflict and found that the majority of BCBAs self-reported experiencing conflict at work at least once a week. We found that this unresolved conflict can result in case loss and voluntary turnover from employment. To resolve this, we have developed a conflict resolution decision-making tree and piloted the efficacy of behavior skills training on BCBAs’ conflict resolution skills. As we work on publishing the results we have obtained thus far, we are taking steps to develop VR sessions that provide trainees with opportunities to utilize the decision-making model to resolve conflict across of avatars. Example simulations include: (1) a caregiver who is angry with a BCBA about the fact that the behavior technician is frequently late to home sessions, and (2) a teacher who would like to terminate services with a BCBA because the BCBA proceeded with programming for intervention without consulting with the teacher.



A man wearing a VR headset and holding controllers.

Experimental Research of Variables that affect Training Outcomes. Computer-technology provides us with many avenues for experimental evaluations that are otherwise unavailable using human actors. Computerized, systematic simulations allow us to answer questions that involve interactions between two individuals by gaining experimental control over the behavior of one (the simulated client). Although some behavior analysts currently use scripts and actors who simulate clients to gain experimental control in training research, a computerized systematic simulator, such as a NAO robot, would be particularly useful if the scripted client behaviors are highly challenging, or perhaps not feasible for a human actor to perform systematically across conditions and participants. A robot can emit systematically varying intensities of screams, cries, and self-injury repeatedly and across different participants. One of our lab members, Ernesto Beltran, is evaluating the effect of timing of feedback on procedural integrity gains of participants conducting functional communication training for his thesis. Research evidence suggests immediate delivery of feedback is most effective at improving performance compared to delayed feedback. However, the time between feedback and the next performance of a task is a confound across all published studies. Ernesto can take advantage of the systematized nature of using the robot for his research study and evaluate whether immediate feedback significantly affects participants’ performance by comparing results between groups experiencing immediate versus delayed feedback as well as immediate versus delayed opportunities for task performance.



KLab members, Victor Ramirez (center) and Melaniez Saez (right), guiding a student through differential reinforcement procedures with a NAO Robot at California State University Northridge 2018 AI JAM Competition. KLab won first place in the research track.

We Use Humanoid Robots to Conduct Experimental Analysis of Human Behavior (EAHB)

Currently, to conduct operant research EAHB, researchers rely on computers and touch screens, which have several limitations for developing functional

analogues to human interactions. First, the behavior under investigation is narrowed to clicking with a mouse or using a touch screen. Second, antecedents and consequences of behavior are two-dimensional and limited to whatever can be programmed on a computer (e.g., point gains or deductions). Third, consequences of behavior do not resemble human interactions, whereby the antecedent and consequent stimuli are often either delivered or mediated by another human. For example, the consequent to a parent delivering punishment may be the child ceasing to engage in the problem behavior temporarily, which could maintain the parent's behavior through negative reinforcement. With advancements in AI and robotics, it may be possible to conduct experimental analysis of operant phenomena, such as resurgence, with human participants, marking a new frontier for behavior analysis.



Depicting the Similarities between the Operant Chamber and a Humanoid Robot for Conducting Experimental Analysis of Human Behavior

Proof of Concept Study. Much like in an operant chamber, NAO robots can be programmed to record behavioral data and deliver consequences for specific responses. However, the concept that a robot could be used as an operandum to influence and study human behavior has yet to be tested. Senior lab members, Michelle Padilla and Victor Ramirez set out to investigate whether our robot could be used to gain systematic control of participants' behaviors. To test this, we programmed NAO to simulate a child engaging in compliance and noncompliance during a teaching session. During Phase 1, participants' target responses (e.g. touching NAO's head sensor) resulted in NAO complying with participants' instructions on an FR1 schedule. During Phase 2 (i.e. extinction), NAO engaged in noncompliance regardless of the participants' behavior. To confirm whether participants' behavior was influenced by NAO's, we utilized a reversal design by repeating Phases 1 and 2 with different target responses. In collaboration with Anne Macaskill

who is in New Zealand, Ramirez programmed NAO to generate cumulative records based on participants' responses across phases. During Phase 1, two of three participants' cumulative touches to the target sensor were higher than touches to other sensors. During Phase 2, cumulative touches to all sensors decreased, demonstrating some evidence that NAO's behavior influenced participants' behavior. Padilla presented the preliminary findings at ABAI 2018, which demonstrated support for the use of a humanoid robot as an operandum to study human behavior. We are currently working on preparing this the results of this study for publication.

Future Directions

In this article, we have shared many ways we have been leveraging technology to advance science in the areas of simulation-based skills training and human behavior. Of course, robotics and VR are also being used for therapy with clients (see <https://klab-csun.weebly.com/simulators-in-behavior-analysis.html> for more information) and there is a dire need for more behavior analysts to become involved with such projects. It is noteworthy to mention that one of our biggest gains has been the increased opportunity to collaborate with scientists from other fields, such as the project with NASA. Our early adoption of technology and simulation-based training has opened new doors for behavior analysts. For example, we are collaborating with Alissa Ann Ruch Burn Foundation on a FEMA grant to measure the outcomes of fire safety training provided by firefighters in the community, such as to children in local schools. The collaboration has resulted in widespread interests in including us on future fire safety training projects.

The rapid growth in computer technology means that nearly anything imaginable is either possible or will soon become possible. The field of machine learning and AI would benefit greatly from merging with behavior analysis and vice versa. Currently, machine learning relies heavily on cognitive theories of learning. However, in our experience when engineers are exposed to the principles of learning, they are absolutely hooked! It would be wonderful to see more behavior analysts becoming involved and contributing as experts in learning and behavior. Then, behavior analysis would be able to grow alongside computer technology, rather than be left behind. Our founding father, Skinner, was not just a visionary, but also much of an engineer in that he devised the equipment he needed to carry out his vision. That is how he created the first teaching machines, the operant chamber, and the cumulative recorder. He was only limited by the computer technology of his time; not his imagination. He saw a world in which behavior analysts used or engineered the machines they need to understand behavior, teach, and create environments that increase quality of life. ●

The Verbal Summator: Modernizing and Expanding an Often Forgotten Early Project in Verbal Behavior

Spencer Gauert

When attempting to understand the foundation of a theory, it's often useful to evaluate the contributions that helped to establish that theory. As an example, most of what behavior analysts draw from when talking about verbal behavior comes from principles outlined in B. F. Skinner's 1957 book, *Verbal Behavior*. This is despite the fact that the framework presented in *Verbal Behavior* is theoretical rather than experimental. In the book, Skinner does not draw from any empirical studies in his final analysis, and only references empirical studies in a few places. Yet Skinner's first experience with verbal behavior came through a series of empirical studies, beginning around 1934 by his account. As a junior fellow at Harvard, he pursued several empirical studies that evaluated verbal behavior in operant terms. Between 1934 and the publication of *Verbal Behavior*, these studies would inform the radical interpretation of language we now know, one defined entirely by principles of operant and respondent learning. The following recounts my experience at attempting to evaluate and recreate the findings of one of these early studies, and what that process helped to illustrate about Skinner's work.

Part 1: The Verbal Summator, or "How I Learned to Stop Worrying and Interpret Skinner"

The following is my summary of Skinner's original work, along with my perspective on the work. The study I will outline here is the only empirical verbal behavior study published by Skinner to my knowledge. In his 1934 paper, "The verbal summator and a method for the study of latent speech," Skinner described a tool to isolate the development of behavior emitted by participants when presented with obscured environmental stimuli. Skinner describes this tool as an audio equivalent to the Rorschach inkblot test, as the participant's verbal responses were influenced by the framework of their own histories. The device that Skinner used to evaluate this interaction was what he called the *verbal summator*, which consisted of a record player that played a selection of 684 sound arrangements. Skinner used the verbal summator to evaluate the verbal responses made by subjects when they were asked to identify the sounds being played on the record. These sounds consisted of samples of preverbal syllables (that is, portions of complete words such as *ah* or *uh*) in 3-5 syllable arrangements¹. These samples were distorted and played at a low volume in order to obscure what they really said (nothing). This design was meant to make the content of the recordings unclear, while still allowing the samples to be similar enough to actual speech that a subject could "identify" what was being said when prompted. The effect was like trying to accurately repeat a conversation barely over-

¹ A sample of Skinner's original verbal summator is available at: <http://www.bfskinner.org/verbal-summator-files/>



Spencer Gauert received his Masters in Applied Behavior Analysis at University of the Pacific in 2015. He is currently completing his doctoral dissertation at the Applied Behavior Analysis program at the University of South Florida. His research interests include applying research from applied behavior analysis to education, language development, and early intervention of developmental skills.

heard from the other room. Skinner arranged a scenario in which the recorded sounds could be mistaken for speech under the conditions of the study, but with the sounds ambiguous enough that they could not be accurately repeated.

Indeed, Skinner noted that most of the speech emitted by subjects during the study did not resemble the recorded sounds at all. Instead, he speculated that they might have been relevant to their immediate environment or personal histories. Here, Skinner introduces the term *latent speech*; a term that Skinner uses in *Verbal Behavior*, but does not explicitly define therein. As Skinner does not discuss latent speech in detail in *Verbal Behavior*, Skinner's definition of the term is somewhat ambiguous. However, from context, it seems that Skinner considered latent verbal responses as those whose probability has been heightened by variables in the immediate environment or learning history, but not to the point where they are actually emitted. However, novel stimuli, such as those supplied by the verbal summator, might be sufficient to bring them to the point of emission. As the responses emitted in these scenarios are shaped by other factors, they might result in reduced correspondence between the stimulus and response. Thus, people with certain backgrounds or preferences would be more likely to emit words that had been previously reinforced in verbal behavior (for example, someone with a history of aggressive behavior might emit more words related to violent actions). At this point, I want to note that Skinner provided an anecdote of one participant who claimed she heard sounds that were lewd or overtly sexual—an anecdote which reads to me like gossip during a hypothetical brunch between Skinner and Freud.

In the verbal summator paper, Skinner described two more types of speech that did not find their way into *Verbal Behavior*, *imitative* and *summative*. Imitative speech is a precursor to what was later identified as echoic verbal behavior (or speech which has point to point correspondence to the original stimulus). Imitative verbal behavior were vocalizations that resembled the sounds presented by the verbal summator. This was the stated reason for the audio samples being unclear—if the samples were clear to the subject, they would simply imitate them. Summative speech, by contrast, referred to speech that was emitted when two or more verbal stimuli interacted, and a novel verbal response was evoked. This phenomenon is closest to later discussions of intraverbally controlled verbal behavior. The form that summative speech took was controlled partly by the auditory stimuli presented via the verbal summator, but also, presumably, by other environmental variables present but uncontrolled by the experimenter. In one example, Skinner states his belief that a subject had unwittingly been influenced by a passing conversation in the waiting room prior to starting the experiment. The phenomenon of summation was the primary focus

for Skinner, and he was not just interested in whether we emit a certain verbal response, but how likely we are to do so on any given occasion.

The challenge in interpreting these concepts was not just in attempting to parse Skinner's language (antiquated by now, but also as dense and referential as any other work by the man) or the complexities of verbal behavior theory, but also working backwards against my own understanding of the material. When reading the summator article, I had to understand the pieces that Skinner was laying in place long before he had finalized his behavior theory. This alone gave a new perspective into the ideas of a young Skinner and an appreciation for the work that went into developing his theories. Then the question was about how to apply what we had learned to the replication.

Part 2: The Lost Word

Despite some interest in these findings, extensions of the verbal summator largely ignored Skinner's central interest of stimulus control and its effects on verbal operants, and instead looked at the use of the verbal summator as a psychological diagnostic test. Many of these studies, such as work by Wilmer and Harry in 1953, looked to evaluate the verbal summator as an audio assessment of psychological abnormalities, rather than an evaluation of verbal behavior. Others, such as John Carroll in 1944, focused on using the summator to study language structure, rather than language as an operant behavior. Thus, with its initial purpose lost, much of our interest in the replication of this study came from the perspective of preservation.

Replication came with a few unique challenges. First was the fact that the article was then 81 years old and the findings had not been directly replicated. While the original manuscript included a number of graphs as well as some anecdotal discussions, the graphs only included data for 8 of the 30 participants. In addition, due to the age and lack of preservation of the study, I had no opportunity to draw from raw data when interpreting analyses. Second was that many of the concepts explained in the study, such as latent and summative speech, did not appear in later works on verbal behavior, meaning that I could only attempt to interpret their meaning and implications using the original summator article. Additionally, some of the analyses Skinner conducted in the course of his study, such as the perseveration of theme across samples, were difficult to extract from the manuscript. Finally, there was the design of the study itself. Although the types of sound files that Skinner included were fairly well explained, there were no clear indications of what the samples should sound like to the participants. The sounds should be low, but to what level? The samples should be obscured, but to what extent and using what method? Should the sound level be adjusted for each participant?

Our answer for the first two challenges was to simply collect our own raw data and to attempt to determine the degree to which our findings could be mapped onto the reported graphs presented in the original study. For the third challenge, we ultimately had to make a judgement based on the best available information. We were fortunate enough to find some preserved sound files through the B. F. Skinner Foundation's preservation project, which guided our sound-sample designs. Extrapolating from those, and the vowel sounds Skinner described in his manuscript (*a, aw, e, i, oh, uh*), we recreated the 684 sound files in a manner consistent with that of Skinner's original recording (as an aside, I lost my voice during the course of recording all sound files). To meet the same volume levels described by Skinner, we simply lowered the decibel-level until three members of our research team independently reported that the sounds were just barely audible, and we further obscured the sounds by placing the playback speaker in a cupboard. With our recordings intact, we designed a simple computer program that presented each sound file randomly, and collected the phrases that each of our participants reported hearing. This digital presentation method benefitted us a couple of ways. We were able to present sound files in a true random presentation, as well as collect data from participants without leaving a permanent product to which the participants could later refer (which Skinner noted as a potential confound in his original study). We then compiled all the phrases emitted by subjects into spreadsheets and ran several of Skinner's reported analyses to determine the structure of the words used.

Skinner's reported intention in the design of the study was twofold. First, he wanted to evaluate whether the sounds emitted by the participants were structurally similar to what would be expected from "real speech" in terms of syllable length, word choice, and similarity of the sample to the sound being played on the verbal summator. Second, he wanted to determine the degree to which the sounds emitted were the result of environmental stimuli or prior learning history. To address the first question, we directly replicated as many of the original analyses as we could from those described in the initial document. We compiled a list of all words emitted over the course of the experiment, how frequently each word appeared, and the syllable length of each full response. We then compared our findings to Skinner's original reported results and found them to be very similar, suggesting that our summated speech followed the same language patterns as his. Thus, we found the structure of the responses mapped on to Skinner's analysis of "real speech."

To address the second question, we determined that participants did not emit responses that were structurally similar to the sounds they heard, suggesting that some degree of distortion had occurred. However, Skinner suggested evaluating whether environmental stimuli affected the types of words emitted, or whether

the participants created "narratives" with the words they reported. However, Skinner did not suggest analyses that could evaluate the presence or absence of such narratives that were not inherently subjective. This question of narrative is an interesting area to evaluate in Skinner's design. While the presence of environmental stimuli presumably affects the types of responses that would be emitted, the informal analyses Skinner proposed to evaluate them did not address the question of participant narrative. For example, consider a scenario Skinner posed in which a participant in a warm stuffy room would be more likely to emit the word "hot" than he would be due to the environmental context. Although this is a potentially meaningful analysis, there was no point in the manuscript during which Skinner reported manipulating the temperature in order to control the degree to which the participant stated "hot." However, pondering this question lead to a new question.

There is always a degree of cultural and linguistic context that might change the meaning of a word from person to person. It is impossible to say for certain whether the emission of the word "hot" refers to temperature at all without rigorous study. Other interpretations of the word should also be considered, such as whether it does not mean temperature, but rather something popular or, perhaps, sexy. As a bit of speculation, I now present the only form of possible narrative observed in the course of our replication. One participant, over the course of four responses, emitted the phrases "the person," "under my bed," "my father in law," "oh no." If interpreted through the lens of a narrative through line, these samples might present as a made for TV psychosexual domestic thriller. However, that's only my interpretation of these samples. Putting aside the question of whether the narrative influenced future responding, the second question is reader interpretation. Perhaps another observer, reading the same samples, would have not seen this as a narrative, or instead picked up on another ongoing narrative that I didn't. The same can be said of Skinner's analyses—the possibility exists that any narrative Skinner reportedly observed in the course of his study was entirely the result of his own learning history. Although not his stated goal, the sounds Skinner reported were an interaction not just with the verbal behavior of his subjects, but with his own verbal behavior, as well.

In some ways, this seems like the ultimate takeaway from replicating such an early study of verbal behavior. In the two decades between the development of the verbal summator and the publication of *Verbal Behavior*, Skinner proposed, evaluated, revised, and sometimes discarded certain interpretations of verbal behavior. Some ideas, such as latent and summative speech, needed to be refined and redesigned before they find their ultimate expression in forms such as intra-verbally controlled behavior. Some areas of study, such as the development of self-referential narrative speech

Order	Word	Occurrences
1	You	124
2	I	91
3	Are	60
4	Do	40
5	That	37
6	The	37
7	It	36
8	What	35
9	No	35
10	Ha	35
11	Go	32
12	Not	30
13	There	29
14	Is	29
15	A	25
16	Me	24
17	How	22
18	Oh	21
19	To	21
20	Now	20
21	Hut	20
22	My	19
23	Here	17
24	Have	17
25	Come	17
26	Who	16
27	Don't	16
28	Hey	15
29	Stop	15
30	All	14
31	Woof	14
32	Hi	14
33	Up	14
34	On	13
35	Alright	12
36	One	12
37	Thank	12
38	Hello	12
39	Right	11
40	Doing	11

Table 1. This table contains the 40 most frequently occurring words in the responses provided by participants over the course of the study. Each word is also accompanied with the number of instances it occurred. This is not a complete list of words. A complete list with this information can be obtained on request.

might have been outside of the scope of even as comprehensive a volume as *Verbal Behavior*. The ideas put forth in the verbal summator report are all the more interesting because they ultimately did not survive in their initial form. Perhaps some of them were not yet ready for their final analysis. Such a critique of Skinner's conclusion is not to undermine his work as furthering an understanding of the operant nature of language.

Instead, it underlies the complexity of verbal behavior as a branch of science, and the possibility of greater expansions by those that, like Skinner, are willing to look empirically at the complexities of our own language. In the end, this is the benefit that comes from evaluating this piece of work—a new perspective, and appreciation, of the man and the study of verbal behavior. ●

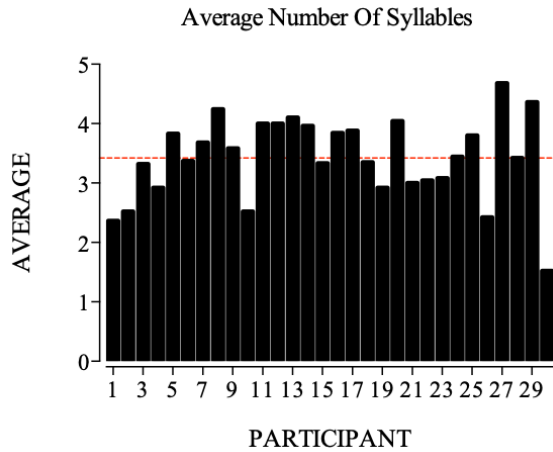


Figure 1. This figure depicts the average number of syllables in the responses provided by each participant. The number of syllables in each response provided by the participant was totaled, and divided by the number of responses that participant had provided in order to find the final number. The average across participants 3.42 syllables per response. However, there were some participants with averages much higher or lower than this.

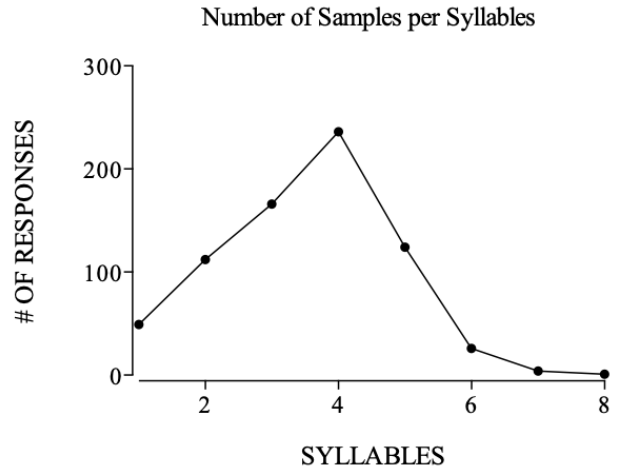


Figure 2. This figure depicts the number of samples that contain each number of syllables. The majority of samples contained 4 syllables, with progressively fewer samples containing more or less than this number. Very few samples contained 6, 7 or 8 syllables, as most samples tended to be relatively short.

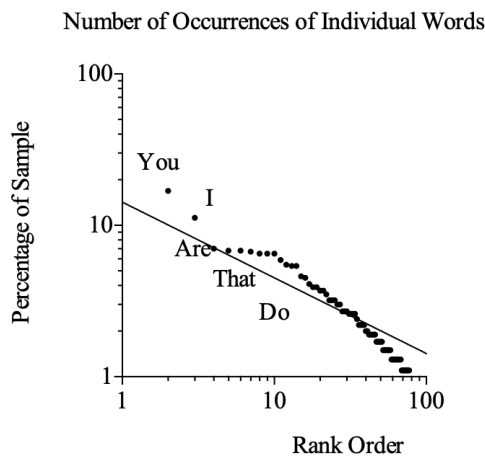


Figure 3. This figure depicts the number of occurrences of each word in the collected data set in a logarithmic data set. The line is meant to approximate the linear regression of word frequency predicted by Zipf's law. The results obtained in this study are roughly similar to those predicted by the Zipf's law function.

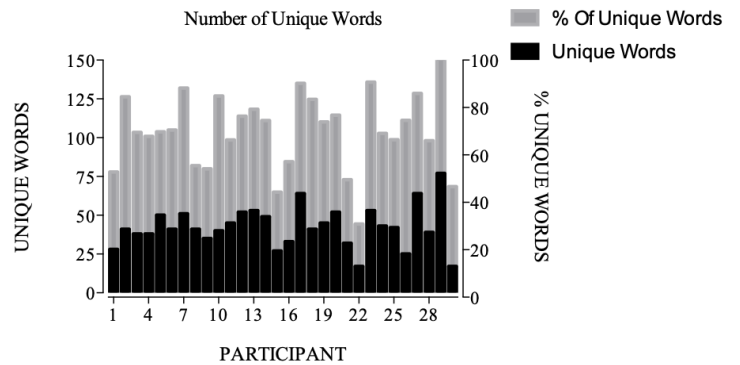


Figure 4. This figure depicts the number of unique words in the collected responses of each participant. In addition, these unique words were divided by the total number of words in each participant's data set, in order to determine the percentage of words that were unique. Some participants had high percentage of unique words, and their data sets contained a variety of different responses that differed on theme content or style. Some participants had low percentages of unique words and had higher rates of perserveration of some kind.

Notebooks Entries that Resonate With Me



Henry D. Schlinger, Jr.
California State University, Los Angeles

I'd like to thank *Operants* for inviting me to comment on a couple of notes of my choosing from Skinner's *Notebooks*. I'd also like to thank my friend Dave Palmer for sending me the first note. He obviously thought of me when he came upon it. I then asked him if I could use it for this purpose, and he graciously agreed. He said he had many others on which he could comment. That was good news for me because it's not easy going through *Notebooks* note by note to find just one (there are so many!) that strikes one in a personal way (many of them do!). Having one that seems perfect for the task handed to me on a silver platter is what some would call a blessing. So, thank you, Dave. The second note I am using is related to the first one as I describe below.

"So Much to Be Done"

Everywhere I turn I see people overlooking the enormous contribution a behavioral analysis can make. A paper called "A Prelude to a Phenomenology of Sound" gets nowhere.

Music is not a matter of sense data, not even sense data interpreted by the listener. It is a pattern of stimuli determining action. Much of the time the listener is (to put it crudely) imitating—singing along with the singer, playing along with the player. The listener's behavior is guided, forced, tricked, foiled, confirmed—as in the logopoeia of poetry.

Rhythm is perhaps the best example. Steady, accelerated, retarded, syncopated, duple, triple—all these terms describe modes or manners of action. Melodies go up and down and steady on.

Harmony is harder to analyze. It came late in the history of music, as simple intervals yielded to less familiar, which then became familiar.

All this is evident in the remarkable effect of getting to know a piece of music well.

Music is action. Listening, a form of singing or playing, is much more than phenomenology! (pp. 247-248)

"Turning Stimuli On and Off"

*Broadbent makes a lot of this. I believe it is he whom I quote in *About Behaviorism* to the effect that the brain can turn on one ear or the other. I have just been listening to two dictated passages, one on my Sony cassette recorder, one on my Norelco. If I hold the speakers near my two ears, I find it quite easy to attend to the one rather than the other, and the other is then little more than noise. But it is clear that I am*

*not turning an ear on or off. Both are equally loud. I am "attending" to one. That seems to mean speaking along with the voice. This is the active side of understanding, as I present it in *Verbal Behavior*. There is no "gating" of stimuli; there is active supplementation and "understanding" of one source and not of the other. (pp. 351-352)*

Why do these particular *Notebooks* entries resonate with me?

First, they both deal with a topic on which I have written and which Skinner mentioned in passing in *Verbal Behavior*. Second, the first note deals with two things near and dear to me: behavior analysis and music.

Both notes deal with the same general topic: the difference between what are traditionally called sensation and perception and the difficulty traditional theorists have in talking about them. From a behavioral perspective, perception is not the interpretation of sensation (the transduction of sensory stimuli into nerve impulses); it is the behaviors evoked by the sensory stimuli as discriminative stimuli (S^D s). Thus, when we talk about listening to speech or music, we can distinguish between the auditory stimuli (sensation) and the behaviors evoked by them (perception). But what are the specific behaviors that we speak of as perception, in particular the perception of speech and music?

In 2008, I published an article in the now-defunct *The Behavior Analyst*, titled "Listening Is Behaving Verbally," in which I argued that what we typically speak of as listening is verbal (usually vocal) behavior and that when we are said to listen to speech or to music we are behaving (usually, but not necessarily) sub-vocally. I argued that when we listen (or pay attention) to speech, we are engaging in sub-audible echoic and intraverbal behavior, and when we listen to music we are singing or humming to ourselves. The difference, if any, between the two types of behaving is that when listening to music some of us are much more likely to listen, that is, to sing or hum, out loud. Singing out loud to music does not normally distract from the music's effects on the behavior of singing or humming; talking out loud when someone else is talking, however, would be distracting for both speakers/listeners in the sense of creating numerous S^D s for competing verbal responses in both individuals.

Of course, like much else I have written about verbal behavior, the idea that listening is behaving vocally and verbally was first suggested by Skinner in his book *Verbal Behavior*. For example, early in the book, Skinner wrote: "As another consequence of the fact that the speaker is also a listener, some of the behavior of listening resembles the behavior of speaking...." I would simply tweak that statement and say that *all* of the behavior of listening resembles the behavior of speaking because "listening is behaving verbally."

Likewise, in the first note above, Skinner once again stated that listening is action and that the action of listening to music is "singing along with the singer" or "playing along with the player." But, as he notes (pun not intended, but tacted) in the first note, we don't only sing or hum melodies or harmonies, we also engage in a variety of other rhythmic behaviors (e.g., hand- or foot-tapping, head nodding, etc.), some public and some private.

As both a musician and a behaviorist (like myself), Skinner was perhaps in a unique position to recognize the obvious fact that listening to music involves a variety of behaviors, having probably observed his own behavior when he was listening to or playing music. Once recognized, it would then be but a small step to analyze listening using the same tools we would use to analyze speaking: the basic unit of operant analysis or four-term contingency. Thus, as Skinner wrote, "The listener's behavior is guided, forced, tricked, foiled, confirmed...." These terms refer to the fact that listening or playing music is evoked by different SDs in conjunction with motivating operations and is "confirmed," that is, reinforced (or not), by what is heard as a consequence.

And what does it mean to be *familiar* with or *know* a piece of music well? It means singing or humming along with it, sort of like echoic behavior, although as Skinner noted in *Verbal Behavior*, the echoic responding can never be simultaneous with the echoic SDs. If there are multiple instrumental lines as there are in orchestral or chamber music, or even in solo piano music, knowing the piece means being able to sing or hum all the lines—melody, harmony, and bass lines, as well as behaving rhythmically. It also means that given a brief segment, one can sing or hum the next notes or lines, sort of like intraverbal behavior.

And the reinforcement for such musical behavior is mostly automatic in that the response produced stimuli either match the musical stimuli, or what one hears after one sings a segment of the piece is the correct continuation of that line. Musicians probably learn to sing or play on key because of the automatic reinforcement for the correct match, just as children learn to babble the phonemes of their native language and song birds learn to sing their father's song.

Postscript

My other contribution in this issue of *Operants* is titled "All's Behaviour—and the Rest Is Naught," which goes to the heart of the matter: Everything we talk about with words such as *listening*, *thinking*, *imagining*, *perceiving*, *remembering*, etc. is behavior. Once we come to that profound realization, it becomes easier to analyze the causes of the behavior in terms of our basic units of analyses discovered and confirmed for decades in the basic laboratory. ●

brevis

B. F. Skinner Foundation Celebrates its 30th Anniversary



COLD

HOT

Heat-Sensitive, Top-Rack Dishwasher Safe

The B. F. SKINNER FOUNDATION celebrates its 30th anniversary in 2019. To commemorate, we will sell a limited amount of 15 oz. coffee mugs through the online store at bfskinner.org. The design is blue-on-black and when hot liquid is poured in, the color changes and a quote from B. F. Skinner is revealed. The mugs are sold for \$30 and the proceeds will go to support the Foundation's activities, including production of the *Operants* magazine; creation of the B. F. Skinner online virtual museum; publication of an expanded edition of *Verbal Behavior* (with three additional articles); student research awards; and international internships.

The mugs can be mailed only to US addresses.

The Newest Member of the B. F. Skinner Foundation's Board of Directors

The B.F. Skinner Foundation is excited to introduce the newest member to its board of directors, Dr. Francesca degli Espinosa.

Francesca worked for several years as the principal clinical architect of the first UK outcome study that compared the effects of early intensive behavioral intervention (EIBI) in children with autism to treatment as usual. (Not surprisingly, EIBI was more effective). Within that context, she developed the Early Behavioural Intervention Curriculum (EBIC), an intervention framework derived from functional analyses of language that focused on defining and establishing complex and generative verbal behavior. This work subsequently formed the principal focus of her Doctoral thesis under the direction of Bob Remington (2011).

Since receiving her degree, she has been in private practice in Italy and the UK. Being an independent consultant enables her to work closely with each client and to test directly the effects of the programs she designs. This too has had an important effect: She has engaged in moment-to-moment problem-solving in the analysis of behavior guided by

fundamental principles and conceptual analyses. Francesca's curriculum design is exceptional, and she has found reliable ways to teach children with autism to respond to complex questions and to advance to conversational give-and-take. Francesca has offered a behavioral interpretation of "theory of mind," the perspective-taking concept loaded with a history of mentalistic accounts. Francesca's interpretation and application, however, has shown how children with autism can be taught to tact the controlling variables of the behavior of others and thereafter "pass" the standard theory-of-mind tests.

Francesca was born of a Cuban mother and an Italian father. She was raised in Italy but has lived in the UK for over 20 years. She regularly lectures on behavior analysis in the US and Italy, and she has supervised many of the BCBAs in Italy. As a result, her perspective on the field, and on other matters, is unusually broad.

The terms of Francesca's reply when nominated to join the B. F. Skinner Foundation were gratifying: "Of course I will accept. It's the last thing I expected, and to say that I am both surprised and honoured would be an understatement." ●



Dr. Francesca degli Espinosa



B.F. Skinner