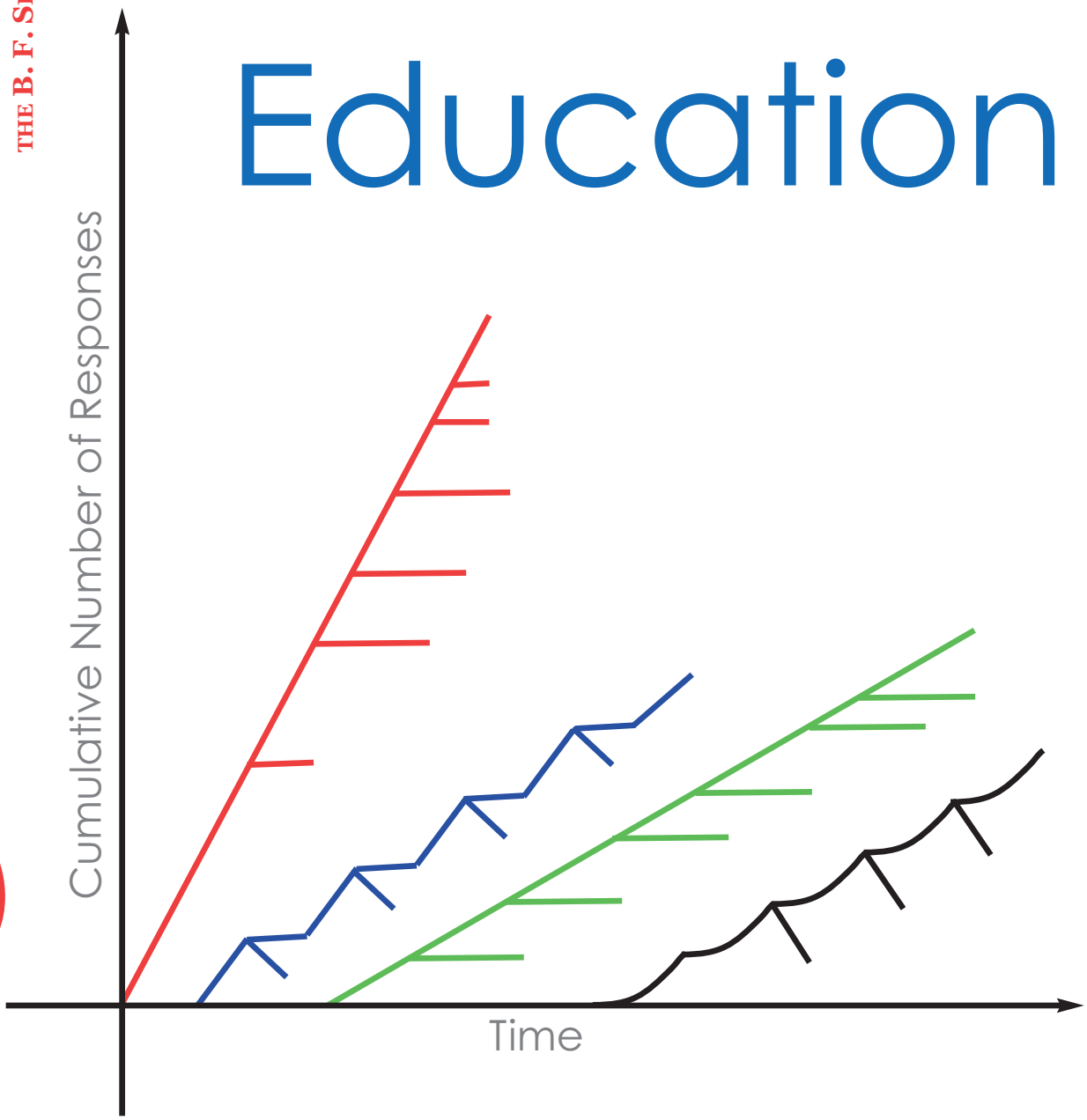
Quarter II, 2015

OPERANTS
The B. F. Skinner Foundation Report

# Shaping the Future of Education



## from the president

I read the *Boston Globe* comics every day. They portray going to school as something students avoid. Certainly, American education could be made more rewarding. A first step would be for teachers to learn the science behind effective instructional design. Teachers in the United States rarely take courses in behavioral principles. Without knowing the basics of shaping, teachers tend to follow the lecture method. Explaining, even with impressive graphics, is only a part of teaching and not the most important part. Shaping requires that the student, not the teacher, be the central participant. Furthermore, all of each student's behavior needs feedback, not just the bits sampled by tests.

This issue of *Operants* discusses some positive educational procedures. With these and other behavioral procedures, students begin to work more because of the reinforcement of seeing their own progress than from fear of failure. Seeing students progress effectively, not only rewards students themselves but also their teachers. That is, after all, why they enter the teaching profession. With the spread of behavioral practices, daily comics may someday show students upset when school is canceled and joyous when a new school year is about to begin.

**Julie S. Vargas, Ph.D.**
President, B. F. Skinner Foundation

**from the president**

**Chinese Traditional Translated by Sue Shu-Hwei Ke**

我每天閱讀波士頓環球報漫畫，他們將上學描繪成是學生想避免的事件。當然，美國教育可以是更有益處的。首要步驟應是讓老師學習有效教學設計背後的科學。在美國的教師幾乎很少學習行為原理的課程，因不具備塑造的基礎知識，老師們通常只會遵循講課的方法，即使運用令人印象深刻的圖表解釋，也只是教學的一部分，但並非是最重要的。塑造所強調的重點在於學生的參與而非老師。此外，所有每位學生的行為都需要回饋，而非只是藉由考試取得的小部分訊息。

本期的Operants討論了一些正向教育的程序。藉由這些程序和其他的行為程序，學生們開始更積極的學習，這是因為看見自己的進步得到強化，而不是因為害怕失敗。看見學生有效的進步，不只獎勵了學生自己，同時也獎勵了老師。換言之，畢竟這是為什麼他們選擇教學專業的原因。藉由行為實踐的傳播，每日漫畫有一天可能會報導，學生因為學校學習被取消而感到失望，當新的學期要開始時而感到喜悅。

**Chinese Simplified Translated by Jeremy Greenberg**

每一天我也会阅读波士顿环球报的漫画，他们嘲讽学生都是很想逃避上学的。我肯定地说,美国的教育制度应该是更有价值的。首先，教师们应该更充分地了解教学效率设计背后的科学理据。美国教师很少去学习有关行为分析。如果不懂得塑造的基础理念，老师都倾向以演讲的方式去教学，即使有令人赞叹的图案，但这根本不是重点。 塑造是期望以学生为重点，而非老师。此外，每个学生的行为是需要有回应的，而非以偶然的测试而作为一个参考或基准。若果使用正面教育程序及行为程序，学生可以更体会自己的进步，而非害怕自己的失败。学生会因为自己的进步而得到鼓励，老师亦然。做老师的原因，也不过是如此。 行为理念如可实践，终有一天，漫画中的嘲笑，也不会存在。相反，可能是赞叹学生因为新学期开始而感到兴奋。

**French Translated by MarieCelina Clemenceau**

Je lis les bandes dessinées du Boston Globe chaque jour. Ils dépeignent aller à l'école comme quelque chose que les élèves évitent. Certes, le système éducatif américain pourrait être plus gratifiant. Une première étape serait pour les enseignants d'apprendre la science derrière la conception d'un enseignement efficace. Les enseignants aux Etats-Unis prennent rarement des cours sur les principes comportementaux. Sans connaître les bases du façonnement, les enseignants ont tendance à suivre la méthode de la lecture du cours. Expliquer, même avec des graphiques impressionnants, est seulement une partie de l'enseignement, et non pas la partie la plus importante. Le façonnement nécessite que l'élève, et non l'enseignant, soit le participant central. De plus, tous les comportements de chaque élève ont besoin de retours, pas seulement des éléments échantillonnés dans des tests.

Ce numéro de Opérants traite certaines procédures éducatives positives. Grâce à celles-ci et d'autres procédures comportementales, les élèves commencent à travailler plus en raison du renforcement de voir leur propre progrès que de la peur de l'échec. Voir les élèves progresser efficacement récompense non seulement les élèves eux-mêmes, mais aussi leurs enseignants. Autrement dit, ce pourquoi ils ont embrassé la profession d'enseignant. Avec la dissémination des pratiques comportementales, les bandes dessinées quotidiennes pourraient un jour montrer des élèves contrariés quand l'école est annulée et joyeux quand une nouvelle année scolaire est sur le point de commencer.

**German Translated by Natalie Werner**

Jeden Tag lese ich die Comics im Boston Globe. Dort wird das zur Schule gehen als etwas dargestellt, das Schüler vermeiden. Sicher könnte man Bildung in Amerika belohnender gestalten. Ein erster Schritt wäre, dass Lehrer etwas über die Wissenschaft lernen, die hinter effektiver Lehrplanung steht. Lehrer in den Vereinigten Staaten besuchen selten Kurse zu den Gesetzmäßigkeiten menschlichen Verhaltens. Da sie die Grundlagen von „Shaping“ (deutsch: Formung; eine Methode zum Aufbau neuen Verhaltens) nicht kennen, wählen Sie die Methode des Vortragens. Etwas zu erklären, auch unter dem Einsatz von graphischen Darstellungen, ist nur ein Teil des Unterrichtens und nicht der wichtigste. Der Aufbau neuen Verhaltens mittels Shaping erfordert, dass der Schüler und nicht der Lehrer, die zentrale beteiligte Person ist. Darüber hinaus bedarf das gesamte Verhalten eines jeden Schülers Rückmeldung und nicht nur Ausschnitte, die von Tests abgefragt werden.

Diese Ausgabe von Operants diskutiert einige positive Unterrichtsmethoden. Mit diesen und anderen auf den Lerngesetzen basierenden Methoden beginnen Schüler eher wegen der Verstärkung zu arbeiten, die daraus resultiert, die eigenen Fortschritte zu sehen, als aus der Angst vor dem Versagen. Zu sehen, wie Schüler effektiv vorankommen, belohnt nicht nur die Schüler selbst, sondern auch ihre Lehrer. Dies ist schließlich der Grund, aus dem sie sich für den Lehrerberuf entscheiden. Mit der Verbreitung einer Praxis, die auf den Gesetzmäßigkeiten menschlichen Verhaltens basiert, könnten die tägliche Comics eines Tages Schüler zeigen, die verärgert sind, wenn die Schule ausfallen muss und erfreut, wenn das neue Schuljahr beginnt.

**Greek Translated by Anna Plessa**

Διαβάζω καθημερινά το κόμιξ τής Boston Globe. Το σχολείο παρουσιάζεται σαν κάτι που οι μαθητές αποφεύγουν. Πράγματι, το Αμερικανικό σύστημα εκπαίδευσης θα μπορούσε να επιβραβεύει περισσότερο τα παιδιά. Το πρώτο βήμα θα ήταν οι εκπαιδευτικοί να μάθουν την επιστήμη που σου δίνει το υπόβαθρο για έναν αποτελεσματικό διδακτικό σχεδιασμό. Οι δάσκαλοι στις Ηνωμένες Πολιτείες σπάνια επιλέγουν μαθήματα για τις αρχές του συμπεριφορισμού. Κι αφού δεν ξέρουν τα βασικά της διαμόρφωσης συμπεριφορών, οι δάσκαλοι τείνουν να ακολουθούν την κλασσική μέθοδο της από καθέδρας διάλεξης. Το να εξηγείς, ακόμα και με τη χρήση εντυπωσιακών γραφημάτων, είναι μόνο μέρος της διδασκαλίας και όχι το πιο σημαντικό. Η τεχνική της σταδιακής διαμόρφωσης συμπεριφορών απαιτεί να είναι ο μαθητής πρωταγωνιστής στο μάθημα, και όχι ο εκπαιδευτικός. Επιπλέον, ο δάσκαλος θα έπρεπε να ανατροφοδοτεί τα πάντα στην όλη συμπεριφορά του μαθητή, κι όχι απλώς τα τεστ και τα διαγωνίσματα.

Το συγκεκριμένο τεύχος του Operants πραγματεύεται κάποιες θετικές εκπαιδευτικές μεθόδους. Είναι από τις συμπεριφοριστικές μεθόδους, που κάνουν τον μαθητή να προσπαθεί περισσότερο επειδή ενισχύεται από το γεγονός ότι βλέπει ο ίδιος την πρόοδό του, παρά από το φόβο αποτυχίας. Το να βλέπεις ότι οι μαθητές όντως προοδεύουν δεν επιβραβεύει μονάχα τους ίδιους τους μαθητές, αλλά και τους δασκάλους τους. Αυτός άλλωστε είναι και ο λόγος που διάλεξαν αυτό το επάγγελμα. Με τη διάδοση των συμπεριφοριστικών πρακτικών, τα κόμιξ των εφημερίδων ίσως να δείχνουν κάποτε τους μαθητές να αναστατώνονται όποτε το σχολείο για κάποιο λόγο είναι κλειστό, και να είναι χαρούμενοι όταν πλησιάζει η αρχή της σχολικής χρονιάς.

# from the president

**Hebrew Translated by Shiri Ayvazo**

אני קוראת את הקומיקס של *הבוסטון גלובוס* כל יום. הם מתארים הליכה לבית ספר כמשהו שתלמידים נמנעים ממנו. כמובן שהחינוך האמריקאי יכול להיות יותר מתגמל. השלב הראשון עבור מורים יהיה ללמוד את המדע שמאחורי תכנון הוראה יעילה. מורים בארצות הברית לעיתים נדירות לוקחים קורסים בעקרונות התנהגותיים. מבלי לדעת את היסודות של עיצוב, מורים נוטים לעקוב אחר שיטת ההרצאה. הסברים, אפילו מלווים בגרפים מרשימים, הם רק חלק מהוראה, ולא החלק החשוב ביותר. עיצוב דורש שהתלמיד, לא המורה, יהיה המשתתף המרכזי. יתרה מזאת, כלל ההתנהגויות של כל תלמיד זקוקות למשוב ולא רק הפיסות הנדגמות באמצעות מבחנים.

הגיליון הנוכחי של *אופרנטס* דן בכמה הליכים חינוכיים חיוביים. הליכים אלו יחד עם הליכים התנהגותיים אחרים מביאים לכך שתלמידים מתחילים לעבוד יותר עקב החיזוק של לראות את התקדמותם, מאשר לחשוש מלהיכשל. לראות תלמידים מתקדמים ביעילות מחזק לא רק את התלמידים עצמם, אלא גם את מוריהם. אחרי הכל, זוהי הסיבה שלשמה מורים נכנסים למקצוע ההוראה. עם ההפצה של פרקטיקות התנהגותיות, הקומיקס היומי אולי עוד יראה יום אחד תלמידים כעוסים כאשר יום בית ספר מבוטל ושמחים כששנת הלימודים עומדת להיפתח.

**Italian Translated by Anna Luzi**

Leggo ogni giorno i fumetti sul Boston Globe. Raccontano storie di studenti che vanno scuola e come cerchino in tutti i modi di evitarlo. Certo, i modelli formativi americani potrebbero essere resi più gradevoli. Un primo passo per gli insegnanti potrebbe essere quello di apprendere il fondamento scientifico che sottende un'efficace progettazione didattica. Raramente gli insegnanti negli Stati Uniti frequentano corsi sui principi del comportamento. Senza conoscere le basi dello shaping, gli insegnanti tendono a seguire il metodo della lezione frontale. L' utilizzo di strumenti grafici d'impatto per le spiegazioni è solo una parte di un buon metodo di insegnamento, ma non è quella più importante. Lo shaping richiede che lo studente, non l'insegnante, sia il protagonista del processo. Inoltre, ogni studente ha bisogno che tutti i suoi comportamenti siano seguiti da un feedback, non solo le sezioni campionate nei test.

In questo numero di Operants verranno discussi alcuni possibili metodi di insegnamento fondati sull'utilizzo del feedback positivo. Grazie a questi e ad altri metodi basati sulla scienza del comportamento, ciò che spinge gli studenti a lavorare è il rinforzo positivo sui loro progressi più che il timore di fallire. Vedere che gli studenti progrediscono e apprendono in modo efficace non solo è gratificante per loro stessi, ma anche per i loro insegnanti. Il che, dopo tutto, rappresenta la ragione per cui intraprendono questa professione. Con la diffusione di metodi di insegnamento fondati sulla scienza del comportamento, verrà il giorno in cui i fumetti sui quotidiani mostreranno studenti addolorati quando le lezioni verranno per qualche motivo sospese ed esultanti quando un nuovo anno scolastico starà per iniziare.

**Japanese Translated by Naoki Yamagishi**

私は毎日、ボストン・グロウブという新聞の漫画欄を読みます。そこでは、生徒は学校に行くのを避けるものだと表現されています。確かにアメリカの教育はもっと生徒が報われるものにできるはずです。最初の段階は、効果的なインストラクショナル・デザインの背後にある科学を学んでもらうことでしょう。アメリカの教師はほとんど行動原理についての科目を履修しません。教師は、シエイピングの基礎を知ることなく、講義方法に従おうとします。説明することは、たとえそれが印象的な図と一緒だったとしても、教えることのごく一部です。そして最も重要な部分ではありません。シエイピングでは、教師ではなく生徒が中心的な参加者になる必要があります。さらに、試験において抽出されたわずかな行動だけでなく、生徒ひとりひとりの行動全てがフィードバックを必要としています。

今回発行されたOperantsはポジティブな教育方法について考察しています。これらのそしてそれ以外の行動的な方法を用いることで、生徒は間違うことを恐れてではなく、自分たちの上達を知るという強化によって勉強しはじめます。生徒の上達を知ることは、生徒にとって報酬となるだけでなく、教師にも報酬となります。結局、彼らが教師になった理由はそれなのです。行動的な実践の普及によって、新聞の漫画欄はいつの日か、生徒は学校が休みになるとイライラし、新学期が始まるときには喜ぶのを描くかもしれません。

**Korean Translated by Yunhee Shin**

저는 Boston Globe comics를 매일 읽고 있습니다. 그 만화에는 학교에 가기를 기피하는 학생들이 나옵니다. 물론, 미국에서 교육은 더 보람있도록 만들어야 할지 모릅니다.

그 첫번째 단계는 교사들이 과학적인 방법을 배워 효과적인 수업 설계를 하여야 할 것입니다. 미국의 교사들이 행동적 원칙을 배운다는 것은 드문편입니다. 행동형성의 단계에 대한 지식없이, 교사들은 수업방법을 그저 따라하려는 경향이 있습니다. 인상적인 그래프들을 사용한 설명조차도 교수의 한 부분이라고 생각하고, 대단히 중요한 부분은 아니라고 생각합니다. 그러나 교사가 아닌 학생에게 있어서 행동형성은 수업참여에 있어서 가장 중요한 부분입니다. 더 나아가 모든 학생들의 행동들은 평가와 같은 단순한 것들을 시행하는 것을 필요로 하는 것이 아닌, 행동개선을 위한 정보나 의견을 주는 피드백을 필요로 합니다.

이번 호의 Operants는 긍정적 교육의 절차들에 대해서 논의하고자 합니다. 긍정적 교육 및 그 외의 행동적 절차들과 함께, 학생들이 실패의 두려움보다는 그들 자신의 성취를 스스로 살펴봄으로써 강화를 받아 더 나은 수행을 하도록 이끄는 것입니다. 학생들의 진전도를 효과적으로 살펴보는 것은 학생 개인뿐 아니라 교사들까지도 보람을 가지는 것입니다. 결국, 이 모든 것들은 교사들이 왜 가르치는데 전문적이어야 하는 가를 의미합니다. 행동적 실천의 확산을 통해, 매일 연재되는 만화들이 언젠가는 학교가 없어지는 것에 대해 학생들이 화를 내며, 새로운 학기가 시작되는 것을 즐거워하는 학생들을 그려주시길 바랍니다.

**Norwegian Translated by Monica Vandbakk**

Jeg leser tegneseriestripene i Boston Globe hver dag. De illustrerer stadig det å gå på skole som noe studentene helst vil unngå. Det er sikkert at det amerikanske skolesystemet kunne vært gjort mer belønnende. Et første skritt kunne være å lære lærerne vitenskapen bak effektive instruksjoner. Lærere i USA tar nesten aldri kurs i atferdsanalytiske prinsipper. Uten kunnskap om prinsippene i shaping har lærerne en tendens til å drive med tradisjonell «tavleundervisning». Det å forklare noe, selv med imponerende figurer som støtte, vil kun være en smal del av undervisning, og ikke engang en viktig del. Med shaping blir studenten og ikke læreren den viktigste deltakeren. I tillegg kreves det tilbakemelding på all atferd hos hver eneste student, og ikke bare små deler som velges ut gjennom tester.

Denne utgaven av Operants drøfter enkelte positive undervisningsprosedyrer. Med disse, i tillegg til andre atferdsprosedyrer, kan man se at studentene arbeider bedre og hardere, på grunn av forsterkning ved å se egen progresjon og ikke av frykt for å feile.

Det å observere framgang hos studenter belønner læreren så vel som studentene. Dette er jo den egentlige grunnen til at de valgte å bli lærere I utgangspunktet. Ved å spre atferdsanalytisk praksis kan kanskje tegneseriestriper en dag vise studenter som blir fortvilt når skolen er avlyst og som blir kjempeglade hver gang et nytt skoleår starter.

**Polish Translated by Monika Suchowierska**

Codzienne przeglądam komiksy w Boston Globe. Przedstawiają one chodzenie do szkoły jako aktywność, której uczniowie unikają. Jest pewne, że szkolnictwo w USA mogłoby być tak zmienione, aby nauka sprawiała uczniom więcej satysfakcji. Pierwszym krokiem do tego celu byłoby poznanie przez nauczycieli zasad efektywnego przekazywania wiedzy. Nauczyciele amerykańscy rzadko uczestniczą w zajęciach poświęconych podejściu behawioralnemu. Bez znajomości fundamentalnych technik, jak na przykład kształtowanie, nauczyciele polegają na wykładzie jako podstawowej formie instruktażu. Omawianie danego zagadnienia, nawet jeżeli wsparte robiącymi wrażenie wizualizacjami, jest tylko częścią – i to nie najważniejszą – nauczania. Kształtowanie sprawia, że to uczeń, a nie nauczyciel, jest głównym uczestnikiem procesu nauczania. Ponad to, uczniowie powinni otrzymywać informacje zwrotne często, za wiele różnych zachowań związanych z uczeniem się. Feedback w postaci wyniku na teście nie jest wystarczający.

Obecny numer Operants omawia niektóre z efektywnych technik nauczania. Wykorzystując te techniki oraz inne, tutaj nie omawiane, uczniowie chętniej podejmują wysiłek związany z uczeniem się ponieważ są zmotywowani obserwowaniem własnych postępów, a nie obawą, że doświadczą porażki. Fakt, iż uczniowie odnoszą sukces jest nie tylko motywujący dla nich samych, ale także dla ich nauczycieli. Przecież to jest powód, dla którego wybrali właśnie taki, a nie inny zawód. Jeśli podejście behawioralne stanie się bardziej popularne, jest możliwe, że komiksy w Boston Globe będą pokazywały niezadowolonych uczniów gdy lekcje są odwołane i rozradowanych z powodu rozpoczynającego się roku szkolnego!

**Portuguese Translated by Bruna Colombo dos Santos**

Eu leio os quadrinhos do Boston Globe todo dia. Eles retratam a ida para a escola como uma coisa que os estudantes evitam. Certamente, a educação Americana poderia tornar-se mais recompensadora. Um primeiro passo, seria os professores aprenderem a ciência por detrás do delineamento instrucional efetivo. Nos Estados Unidos os professores raramente fazem cursos sobre princípios comportamentais. Sem conhecer os princípios básicos da modelagem, os professores tendem a seguir o método expositivo. Explicar, mesmo que com ilustrações impressionantes, é apenas uma parte do ensinar, e não é a parte mais importante. Modelagem requer que o estudante, não o professor, seja o participante central. Além disso, todos os comportamentos de cada estudante precisam de feedback não apenas as partes amostradas por testes.

Esta edição do Operantes discute alguns procedimentos educacionais positivos. Com esses e outros procedimentos comportamentais, estudantes começam a trabalhar mais por causa do reforçamento de ver seu próprio progresso do que pelo medo do fracasso. Ver estudantes progredir de forma efetiva não apenas recompensa os próprios estudantes, mas também seus professores. Isso é, acima de tudo, o motivo pelo qual eles entram na profissão docente. Com o alastramento das práticas comportamentais, os quadrinhos diários podem algum dia mostrar estudantes aborrecidos quando a escola é cancelada e alegres quando um novo ano escolar está para começar.

**Russian Translated by Alexander Fedorov**

Каждый день я читаю комиксы в Boston Globe. Школа в них изображена как место, которого ученики избегают. Безусловно, американское образование можно было бы сделать более вознаграждающим. Первым шагом для учителей могло бы стать изучение науки, лежащей в основе эффективного приобретения знаний, умений и навыков. Учителя в Соединенных Штатах редко посещают курсы, посвященные поведенческим принципам. А без знания основ формирования поведения (шейпинга), учителя склонны использовать лекционный метод. Но объяснение, пусть даже с использование впечатляющих графических средств, – это всего лишь часть обучения, и при этом не самая важная. Формирование поведения требует, чтобы центральным участником процесса был ученик, а не учитель. Кроме того, все поведение каждого студента нуждается в обратной связи, а не только части, представленные тестами.

В этом номере Operants обсуждаются некоторые позитивные образовательные процедуры. Вместе с ними, а также другими поведенческими процедурами ученики начинают больше трудиться благодаря тому, что они подкрепляются тем, что видят собственный прогресс, а не страхом неудачи. Наблюдение за прогрессом учеников эффективно вознаграждает не только самих учеников, но также и их учителей. А это, в конце концов, и есть то, ради чего они выбрали профессию учителя. И, возможно, по мере распространения поведенческих практик, в ежедневных комиксах однажды будет показано, как расстроились ученики, когда закончились занятия в школе, и обрадовались, когда начался новый учебный год.

from the president

**Spanish Translated by Cristina Franco**

Yo leo los cómics del Boston Globe todos los días. En ellos se retrata la ida a la escuela como algo que los estudiantes evitan. Ciertamente, la educación americana podría ser más reforzante. Un primer paso sería que los que los profesores aprendieran la ciencia detrás del diseño instruccional efectivo. Los profesores en Estados Unidos rara vez toman cursos de principios del comportamiento. Sin el conocimiento de las bases del moldeamiento, los profesores tienden a seguir el método de la conferencia. Explicar, incluso con impresionantes gráficas, es sólo una parte de la enseñanza, y no la más importante. El moldeamiento requiere que sea el estudiante, y no el profesor, sea el participante central. Por otra parte, todo comportamiento del estudiante necesita retroalimentación, no solo los pedazos muestreados por las pruebas.

Este número de Operantes discute algunos procedimientos educativos positivos. Con estos y otros procedimientos positivos, los estudiantes comienzan a trabajar más por el reforzamiento de ver su propio progreso que por el miedo a fallar. Ver que los estudiantes progresan de manera efectiva no sólo refuerza a los estudiantes mismos, sino también a sus maestros. Es decir, después de todo, ¿por qué ellos entraron en la profesión docente? Con la difusión de las prácticas comportamentales, algún día los cómics podrían mostrar a los estudiantes molestos cuando la escuela es cancelada, y alegres cuando el año nuevo está por comenzar.

**Thai Translated by Sirima Nan**

ดิฉันอ่านหนังสือการ์ตูน เดอะ บอสตัน โกลบ ทุกวัน เรื่องในการ์ตูนสื่อให้เห็นว่า การไปโรงเรียนเป็นสิ่งที่เด็ก ๆ พยายามหลีกเลี่ยง ที่จริงแล้วเราสามารถทำให้การไปโรงเรียนเป็นสิ่งที่น่าพิสมัยสำหรับพวกเขาได้ อย่างแรก คือ บรรดาคุณครูควรได้รับการอบรมให้มีความรู้ในเรื่อง ทฤษฎีด้านการปรับพฤติกรรม ซึ่งเป็นศาสตร์ของการสอนที่มีประสิทธิภาพมาก หลักสูตรของครูในสหรัฐอเมริกามักไม่ค่อยมีการสอนเรื่องนี้ โดยเฉพาะเทคนิคการปรับพฤติกรรมเบื้องต้นที่เรียกว่า shaping

เมื่อไม่มีการใช้เทคนิคนี้ในแผนการสอน คุณครูก็จะใช้แต่วิธีการบรรยายและการอธิบายวิชาการเป็นหลัก ถึงแม้จะมีภาพสไลด์ที่สวยงามประกอบ การสอนนั้นก็ยังขาดส่วนสำคัญที่สุด ได้แก่ การสอน หรือ การปรับพฤติกรรม ให้เด็ก ๆ รักและสนุกกับการเรียนหนังสือ

เทคนิคพื้นฐานการปรับพฤติกรรม ที่เรียกว่า shaping มีหลักการสำคัญ คือ ต้องเอาเด็กนักเรียนเป็นศูนย์กลางของการเรียนการสอน ไม่ใช่เอาครูผู้สอนเป็นหลัก นอกจากนี้เด็กนักเรียนแต่ละคน ต้องได้รับทราบผลการประเมินด้านพฤติกรรมด้วย ไม่ใช่รับทราบเฉพาะผลการสอบ ซึ่งเป็นผลการประเมินด้านวิชาการเท่านั้น

ทฤษฎีการปรับพฤติกรรม เน้นการเรียนการสอนที่ให้ความรู้สึกในแง่บวก การสอนหรือปรับพฤติกรรมให้เด็กนักเรียนชอบ และ สนุกกับการหาความรู้ เด็กจะรู้สึกภูมิใจในความสามารถและความก้าวหน้าของตนเอง แทนที่จะรู้สึกว่าจำใจต้องเรียน เพราะกลัวจะสอบตกและถูกซ้ำชั้น

ความภมูใิจในความสามารถ ความก้าวหน้า และ ความสนุกในการเรียน ไม่ได้เป็นรางวัลสำหรับเด็กเท่านั้น แต่ยังเป็นรางวัลสำหรับคุณครูด้วย เพราะถ้าคิดย้อนกลับไปสู่วันแรกที่คุณครูตัดสินใจเลือกสายวิชาชีพครู ท่านก็คงมีจุดมุ่งหมายที่จะประสิทธิ์ประสาทความรู้ ความสามรถ และความภาคภูมิในตนเอง ให้แก่เด็กที่ท่านจะไปสอน

หากเราสามารถเผยแพร่ ทฤษฎีด้านการปรับพฤติกรรมให้แพร่หลาย สักวันหนึ่งหนังสือการ์ตูนอาจเล่าเรื่องของเด็ก ๆ ที่รู้สึกเสียใจในวันที่ไม่ได้ไปโรงเรียน และตื่นเต้นรอคอยให้ถึงวันแรกที่โรงเรียนเปิดเทมอก็ได้

**Turkish Translated by Hande Cihan**

Boston Globe mizah dergisini her gün okurum. Bu dergide okula gitmek çoğunlukla çocukların kaçındığı bir durum olarak gösteriliyor. Tabi ki de Amerika eğitim sistemi çok daha faydalı bir hale getirilebilir. Bunun için ilk adım ise; öğretmenleri etkili öğretim planlarının ardındaki bilimi öğrenmeleridir. Ancak Amerika Birleşik Devletleri'ndeki öğretmenlerin çok azı davranışsal ilkeler ile ilgili dersler alırlar. Davranış şekillendirmenin temellerini bilmeden doğrudan öğretim yöntemini kullanma eğilimini gösterirler. Anlatım, etkili grafiklerle yapılsa da öğretimin sadece bir parçasıdır, en önemli parçası değil. Şekillendirmenin merkezinde ise öğretmen değil öğrenci bulunmaktadır. Dahası her bir öğrenci davranışını test etmek yeterli değildir, bunlar için geri dönüt gerekmektedir.

Operants dergisinin bu sayısında bazı olumlu eğitim yöntemleri ele alınacaktır. Bu yöntemler sayesinde öğrenci başarısızlık korkusu yerine, kendi gelişiminin onu pekiştirmesi ile daha çok çalışmaya başlar. Öğrencinin gelişimi sadece öğrencinin kendisini değil aynı zamanda öğretmen için de olumlu bir etkidir. İşte bu nedenle öğretmenler bu mesleği yaparlar. Davranışsal uygulamaların yaygınlaşması ile, belki bir gün, günlük mizah dergileri öğrencilerin okula gidemediklerinde üzgün, yeni okul dönemi başladığında ise mutlu olduklarını gösterirler.

*Operants* is a quarterly report produced by the B. F. Skinner Foundation. The opinions reflected in this *Operants* do not necessarily represent the views of the Foundation.


## in this issue

editor's column

# Redesigning the Future of Education

## By Sheila Habarad, Editor-in-Chief, *Operants*

*Sheila Habarad joined the editorial staff of* Operants *in September, 2014, and became Editor-in-Chief in January, 2015. Before Sheila became involved in planning and production of* Operants, *she was a regular contributor.*

*Ms. Habarad is a member of Morningside Academy's Faculty in Seattle, WA. She spent the previous fourteen years in the field of behavior analysis working with public schools. She is a Board Certified Behavior Analyst who received her Master of Arts in Behavior Analysis from Ball State University. Sheila has been an active member with Indiana's state chapter of ABA-I, serving as Secretary, Vice President, President, and Conference Chair over the past six years.*

The longstanding conversation about the debacle of education is a common discussion that is heard in many homes around the world. These discussions can lead to never-ending arguments without effective problem solving taking place. School systems declare that with more money, or more teachers, or fewer students, education outcomes will improve. Yet, as the money rolls in, student scores remain stagnant. This exhausting discussion continues to repeat itself like a broken record. The money solution has proven faulty. The United States holds the torch for spending the most money per student, but a person could not tell based on student performance. Consequently, the process of identifying an effective solution has grown into an insurmountable mountain, a mountain where the students keep falling off as more money is fed into the broken system.

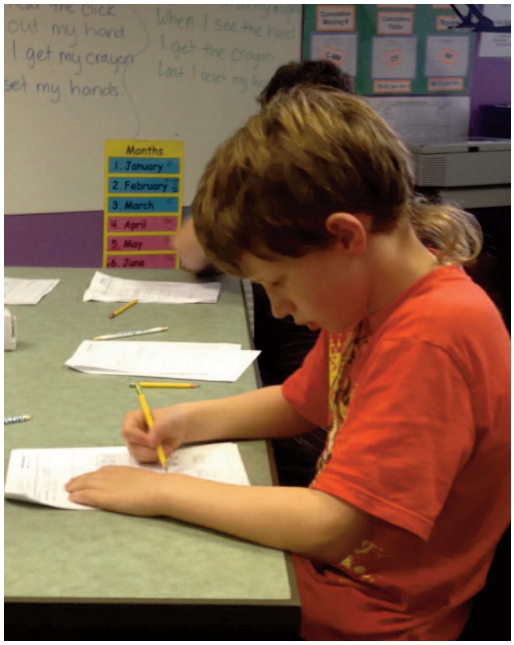
The *New York Times* recently published *More in School, but Not Learning*. The article discussed the current state of education worldwide. The author focused on numbers, both quantity of students and quality of education, implied by the results of standardized testing. The article noted the significant increase in the number of students in primary grade levels attending school from sub-Saharan Afrtica to Southern Asia to Chicago. This single fact should gain everyone's attention and is worthy of praise. Even so, one must consider the results of student performance now that substantial progress has occurred in getting children to school.

An increase of the number of students in schools without a strategy to ensure quality education promoted the disaster currently being observed worldwide. The numbers of students soared, while the demand for teachers intensified. This demand resulted in reduced standards for teachers, wiping quality off the plate. The article discussed the status of Uganda, where only one in five of the teachers met proficiency in the key subjects areas of math, language, writing, and instruction. Uganda and many other poverty-stricken countries, all of which tried to meet the influx of students, could benefit from additional aid, but concurrently, schools from rich countries still demand more money to ensure quality. But as more money comes in,

student performance shows little, if any progress. The broken record continues to sound louder, while poverty-stricken countries barely merit a whisper.

The United Nations convened to discuss interventions to address the current status of education. Primarily, it focused on the development of global standards. The current standards and testing within the United States have flaws. Although the standards and testing provide a measurement of student progress, they do not foster student learning. The United Nations failed to consider a science that understands human behavior, a science that has made significant advancement in curriculum design, instructional delivery, behavior management, and teacher performance. Until this science is applied in classrooms worldwide, student progress will show little, if any, growth, and the debate over the broken education system will only intensify.

As a teacher and a behaviorist, I am fortunate to pursue pedagogy in a purely behavior analytical environment. In my teaching career, I will not manage a thirty-student classroom, meet the standards of the Common Core, nor teach in a poverty-stricken environment. Yet, I still face daily obstacles to ensure the academic growth of my students. I cannot imagine the burden that the majority of teachers face across the planet. A student's success is dependent on the teacher's performance. Setting higher expectations or requiring more standardized testing will not




guarantee academic growth. Rather, student failure will result if that is the only intervention.

The influx of students and a lack of learning presents a distressing situation, but there is something particularly promising because people outside of the world of behaviorism are noticing and discussing the importance of measurement, data collection, teacher performance, and student outcomes in educational settings across the world. Education is a field that embraces behavior analytic principles even though some of those involved may not admit to applying them. A person can walk into a classroom and see positive reinforcement in action. It may be delivered at a lower rate, not only in frequency but also in quality of the delivery than one would see in a classroom solely dedicated to applying behavior analytic principles; nonetheless, it is happening. Token economies, the Good Behavior Game, fluency measurements, and data collection on student performance, may be witnessed walking through the hallways of a public school in the United States and across the world even if the administrators and teachers may cringe when they hear the words "behavior analysis."

In the near future the United Nations might demand worldwide educational standards, but this should not cause teachers and behavior analysts to wince. Rather, we should embrace this call for action together as an opportunity to collaborate and redesign the future of education for a better tomorrow. ●

science corner

# The Analysis of Behavior in Instruction: Science and a Technology Based on Science

by James G. Holland, Ph.D.

*This article first appeared as a Foreword to* The Technology of Teaching *by B. F. Skinner, published by the B. F. Skinner Foundation in 2003. It is a version of a talk given in November 1975 at the Third National Conference on Behavior Research and Technology in Higher Education, and published in the conference proceedings.*

*On the photo: B. F. Skinner( left) and James Holland, discussing* The Analysis of Behavior *project.*

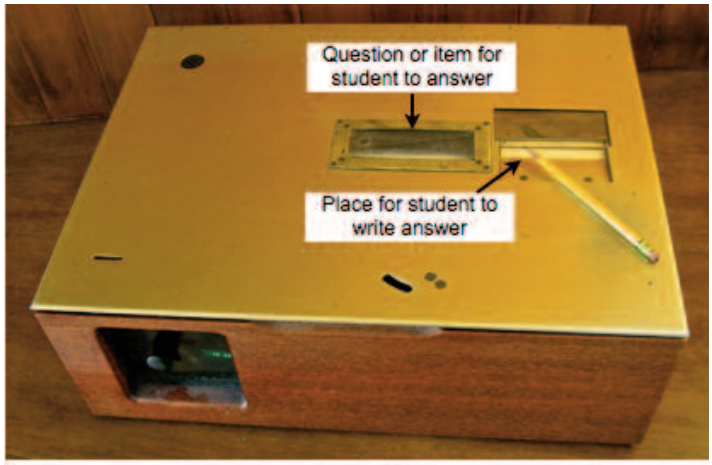
For me, the beginning of behavior analysis in education began when I arrived in the fall of 1957 at a gray clapboard building, Batchelder House. Batchelder House, then in decay, had been a rambling residence just across the street from Harvard's Memorial Hall, where the Psychology Department, including Skinner's office and laboratory, was housed. A year earlier, Skinner had received a modest grant from the Ford Foundation and, to accommodate the new staff of two, was assigned one medium size room in this off-campus building which had dust that must have dated back to the days of the McGuffey Reader. Memories of those days in Batchelder House give me a special personal verification of humorist Francis Parkinson's claim that active, productive, and innovative activities are to be found, not in new buildings that instead house moribund organizations, but in small, converted, understaffed, and unkempt buildings. In this light, it seems fitting that this room in Batchelder House served as cradle for an offspring of Skinner's basic science, the experimental analysis of behavior. The infant, programmed instruction and teaching machines, was to take many forms as it grew and exerted an influence on many educational practices. Moreover, the efforts at instructional design were to reveal omissions in the basic science and were to prompt new directions of research, which would, in time, enrich the parent theory.

But when I moved into Batchelder House that fall day in 1957, this scenario was unclear. Lloyd Home and Sue Markle had been at work for a year. Homme was about to return to the University of Pittsburgh as his year's leave was over. In Batchelder House, he had prepared units teaching the uses of suffixes and prefixes to build vocabulary. These units were both exercises in programming aimed at discovering more about the process, and examples of the possibilities that this use of the science of behavior held for instruction. I joined this enterprise by setting out to prepare a program to teach the content of a course that Fred Skinner had taught for many years.

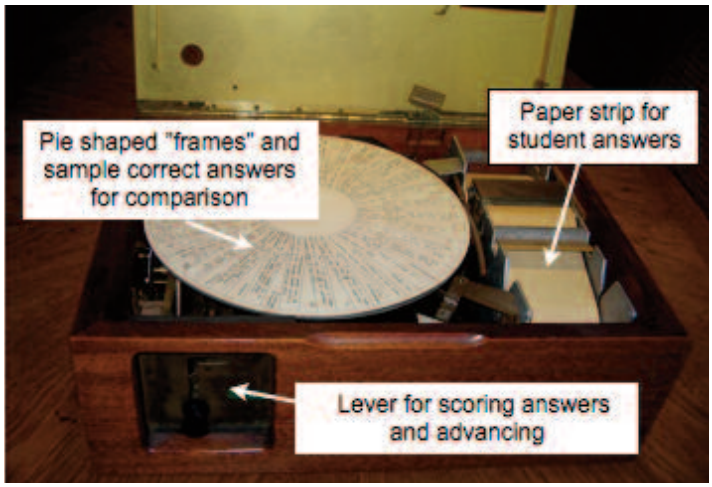
Harvard's course—Natural Sciences 114—taught undergraduates the nature and findings of the experimental analysis of behavior pioneered by Fred Skinner. It dealt con-

siderably with Skinner's extrapolation of the science to interpreting human behavior in society at large. He had earlier written his book, *Science and Human Behavior,* for this course, and now, our task was to prepare a teaching machine program covering this content. We were particularly pleased that the first actual use of our new technology in a regular educational setting would be to teach the science which provided the fundamental principles of the technology itself.

The teaching machine portion of the course took




place in a small room in the basement of Sever Hall, a venerable old building in Harvard Yard. Our room had been used for storage but now was remodeled to accommodate ten cubicles each lined with acoustical tile and each containing a teaching machine. The machine itself was one of several designed by Skinner. It was a mechanical marvel




*Pictures of the teaching machine by J. S. Vargas*

and was reminiscent of the age of brass instrument psychology. It was, in size and shape, like a small suitcase. The brass coated lid and face was one of the larger sides of this box. The student opened the lid and placed in it a paper disc, 12 inches in diameter, which was divided into 30 wedge shaped areas each containing a single item, or frame, of the teaching program. The usual form was a completion item, a sentence with one or more words missing. A small triangular corner of each frame contained the answer to the item. With the lid closed, a single frame was exposed. Under an additional window, the students could write their answers on a strip of adding machine tape. They would then move a lever that operated a small shutter that exposed the correct answer, simultaneously advancing their own constructed answer to a position under a glass plate, where it could be seen and compared with the correct answer but not changed. If the student judged the answer to be correct, an additional movement of the lever punched a small hole beside the constructed answer and internally set a detent so that this item would not be presented again. On completion of all 30 frames, the student would start through a second time, and the disc would rapidly rotate past all correctly answered items stopping only on the few items answered incorrectly. The lever used for exposing items and indicating correctness of answers also wound a spring that powered the disc mechanism.

It was not long after my arrival that Natural Science 114 was due to be taught, so we rapidly began to program material but had only a small portion of the course ready on the first day of class. The lights of Batchelder House burned late as I worked to stay ahead of the students in generating material for the machine. During the day, students appeared at the machine room at times of their own choosing, worked as long as they wished, and left better prepared to understand and enjoy the lecture part of the course.

The 30 small wedges were a tight constraint on the writing of material. Strunk and White in their classic book, *Elements of Style*, gave the would-be author the strong dictum, "Get rid of unnecessary words." Writing small frames to fit the boundaries of the wedge made it important to get rid of unnecessary words. Unfortunately, those very small frames became identified by many as the defining characteristic of programmed instruction, a characteristic that

took a decade to outgrow.

As the semester progressed, box after box filled with strips of adding machine paper covered with student answers. There was our data. At the end of the term, we tallied item by item, correct and incorrect, for each student. Each of the 250 students had generated about 3000 answers. We were interested in precisely what answers they might give when the item was answered incorrectly. We had attempted to prepare items that were correctly answerable only through mastery of what the item was supposed to teach. That is, we designed, in the language of our science, a contingency of reinforcement. At the same time, it was important for the student to be able to perform what was expected of him at each step along the way. Hence, we were striving for error-free performance. In this first year we were very far from error free performances or even the 5% error rate which, as pragmatists, we considered the maximum allowed without requiring revisions. After our tally of the data, we carefully rewrote the program. We were excited by the fact that unlike any other efforts in education, we had the means to gather detailed data on our teaching procedures and were able thereby to make fine adjustments. As behaviorists, after all, we were not allowed the luxury of accusing the nonlearner of stupidity. The fault, according to an experimental analysis of behavior, must rest in environmental contingencies, and it was just those contingencies which formed our program.

Three development cycles, classroom use, data analysis, and revision, were completed with dramatic improvement in our program after each recycling, and eventually, it was published under the title *The Analysis of Behavior*.

But back at the time of our first use at Sever Hall, interest and activity in programming materials began to sweep the country. The concept had excited many in universities who enthusiastically set out to program their courses or to prepare materials for the primary grades. Publishers became interested. Authors of industrial training material turned in overwhelming numbers to programming. Special new companies devoted to teaching machines and programming emerged, and large industrial firms explored the possibilities for teaching machines. But before considering where this interest led, let us consider the antecedents, for programmed instruction is an example of the use of a basic science in generating specific, deliberate applications. In addition, the use of this basic science in programmed instruction eventually permeated standard practices until the new principles became intuitive truths.

In the 1930s, Skinner had developed the concept of operant behavior and the means of analyzing the controlling variables for the behavior of individual organisms. His approach and the shape of his science was articulated in 1938 in his book, *The Behavior of Organisms*. Most that has followed in the science has been refinement and expansion of the discoveries revealed in this seminal work. In the concluding chapter of the book, Skinner says:

> The reader will have noticed that no extension to human behavior is made or suggested. This does not mean that he is expected to be interested in behavior of the rat for its own sake. The importance of a science of behavior derives largely from the possibility of an eventual extension to human affairs. But it is a serious, though common, mistake to allow questions of ultimate application to influence development of a systematic science at an early stage. I think it is true that the direction of the present inquiry has been determined solely by the exigencies of the system. It would, of course, still have been possible to suggest applications to human behavior in a limited way at each step. This would probably have made for easier reading, but it would have unreasonably lengthened the book. Besides, the careful reader should be as able to make applications as the writer. The book represents nothing more than an experimental analysis of a representative sample of behavior. Let him extrapolate who will.

It was not long after this that Skinner did extrapolate. He did so first in his teaching. Natural Science 114 was just such an extrapolation to day-to-day life. But it was only when he began using these principles to design teaching machines that an explicit effort was made to apply his science and create a technology for the solution of behavioral problems.

Our early programming activities functioned in the development of the technology. These served as models for

the use of fundamental behavior principles and the basis for describing this new technology. The lab had taught us the power of establishing contingent relationships between behavior and reinforcement, and we defined programmed instruction as the arrangement of careful sequences of contingencies of reinforcement leading to the objectives of education. From the laboratory, we knew that through shaping, difficult forms of behavior could be established that would never appear naturally without the arrangement of a progressive series of contingencies, and here was the basis for designing programs. The science had abandoned mythical inner causes of behavior and had demonstrated the power of analyzing behavior and its controlling events. In this, the science has provided the basis for behavioral objectives in education and holds the possibility, as yet unfulfilled, of an experimental analysis of knowledge itself.

In the flurry of activity that followed these first examples of applied behavior analysis in instructional design, many impressive results were obtained for a wide variety of skills and subject matter areas. At the same time, a number of programs followed the superficial characteristics of the techniques without reflecting the laboratory-based principles. One common failure of teaching materials is to aim at certain behavioral objectives while allowing the student to perform tasks that only superficially resemble the desired behavior. For example, science education materials may have a goal of teaching scientific inquiry, while the instructional techniques only guide the student through certain problem-solving methods without ever teaching the student to generate the steps.

But perhaps, the most frequent and damaging problem in poorly designed educational materials is the failure to ensure a contingent relationship between the student's correct answer and what is to be learned through that answer. A student learns what he or she performs. Usually, in an instructional situation, only a small part of the student's activity is public and available to the instructor; i.e., a question is answered about material the student has read, or an answer is written to a problem in the lesson material. The task of the developer of educational materials is to ensure that the final public performance depends upon the correct execution of the private act—a correct answer indicates that the material has been read and that the problem has been worked out. This is the problem of response contingency. This common failing in poorly-prepared materials involves over—cueing or inappropriate cueing, which enables the student to answer correctly without having actually performed the task that the lesson was intended to evoke.

We had failed apparently to make this principle clear. Subsequently, we developed a technique that would make response contingencies very clear. This technique involved deleting, by covering with black crayon, all material which did not contribute to reaching a correct answer. For example, a lengthy exercise in a statistics program for engineering students described the determination of arithmetic combinations and permutations, but when the student was finally asked to do something with this information, the question was simply "3 x 2 x 1=__". None of the information on combinations or permutations was necessary for the answer. A contingent relationship was lacking since all of the preceding material could be covered with black crayon without affecting the student's answer. This total blacking-out of the material demonstrates the need to rewrite the material so that the student must make use of the information to obtain a correct answer. This technique permitted a quantitative measure of the degree to which the contingency principle was met. We called it the black-out technique.

On the heels of this first effort to program, our lab as well as others began turning away from programming verbal knowledge. We moved to areas and skills that traditionally have been taught poorly. Demonstrations were prepared for teaching difficult musical discriminations, and a gadget was designed to reinforce matching an auditory rhythm. Visual discrimination programs were developed to teach spatial thinking and inductive reasoning skills. Under a grant from Carnegie Corporation, the Committee on Programmed Instruction was formed to facilitate Harvard and MIT faculty efforts in programming skills in their own areas. Languages and sciences were particularly emphasized, and I enjoyed the paradox of two Chomsky students programming language teaching objectives derived from Chomsky's structural linguistics, which he felt to be a refutation of Skinner's analysis of verbal behavior.

Across the country, programming efforts had be-

come so widespread that Carl Hendershot provided a major contribution by keeping an updated compilation of programs.

But gradually, the term "programmed instruction" became less fashionable even as the influence spread more widely. Objectives in education became behavioral objectives. Books and lesson plans, whether they were touched by programmed instruction or not, at least benefited by borrowing the method of defining their teaching objectives.

Doug Porter, from the beginning a resident of Batchelder House although not administratively on the project, branched out from his early involvement to work for the Office of Education in developing a training package for The Job Corps. Faced with the immediate problem of creating a reading curriculum for Job Corps trainees, he gathered together a variety of curriculum materials from pre-reading to high-school level, including a programmed package for beginning reading. Porter then designed a graded examination for diagnosing the particular needs of the corpsmen for placement in these materials. Shortly after this, one of the leading centers in programmed instruction at the University of Pittsburgh, spearheaded by Robert Glaser who had carried out research in programmed instruction, turned to the idea of diagnosing individual needs through prescriptive testing and placement under the coined name "individually prescribed instruction." While this new emphasis focused on diagnostic procedures, the teaching material generally followed the experimental analysis of instruction.

To implement developments in individualized instruction, in 1964, Glaser and Gow formed a new organization, the Learning Research and Development Center, devoted to facilitating education through fostering an interplay between science and practice in education. The creation of the Center embodied the metaphor of a long hallway with a lab at one end, a classroom at the other end, and between the two, all the sequential stages of technological development with busy scientist-developers running back and forth through the hall. A few years later, Fred Keller extended the concepts into the Personalized System of Instruction. In his system, the wedge-shaped frame is gone, the teaching material comes in larger hunks, and students answer questions of larger scope, but still, the questions are prepared so that an answer is contingent on mastery of preceding material.

The influence of the beginning of these applications of our science was not limited to the world of education. More than an opportunity to improve education through behavior science had begun. The teaching machine was the first step in what we now call applied behavior analysis. The science was there waiting to be used to improve conditions for people. No doubt various areas of application could have emerged but one opening was made through programmed instruction. Many of the simple applications involve only reinforcing a single response already in the person's repertoire. For example, orienting toward the teacher might be reinforced. When more difficult performances are involved, however, the similarities to the techniques developed in programmed instruction are apparent. Establishing speech in an autistic child requires a slow, gradual shaping process that carefully constructs utterances of sounds, then simple single words, and later sentences.

By the end of the 20th century, even clinicians explicitly drew upon principles of programmed instruction. For example, Israel Goldiamond suggested that the therapist in producing a clinical program specify target or outcome, specify entry behaviors and beginning repertoire of the person, sequence behavior—change steps, and finally provide maintenance consequences for each step in the sequence. This clinical approach emphasizes constructing new operants by building on the current repertoire of the individual as in programmed instruction.

Programmed instruction illustrates the usefulness of basic research in leading to important applications, but the flow of influence goes the other way as well. Attempts at using basic science in dealing with real-world problems removes the tunnel vision of the basic scientist. The complexities of the applied settings may reveal oversights and gaps that exist in the theory. The practitioner, to solve his immediate problems, does the best he can by improvising to cover the deficiencies, but when basic and applied scientists are closely related, or even perhaps the same person, experience in application can open new research areas and enrich the parent theory.

One of the several serious gaps was revealed as we set out to teach discriminations errorlessly. Until this time,

laboratory research in stimulus discrimination had always proceeded by reinforcing a response to one stimulus while extinguishing it in the presence of another stimulus. Animal discrimination typically progressed slowly. They responded in the presence of what was to be the negative stimulus as well as the positive stimulus until gradually, after hundreds or even thousands of responses to the negative stimulus, extinction was complete with the animal responding only to the positive stimulus. This was the only way discriminations were formed in the laboratory, and it was assumed that it was the only way to do it. As Keller and Schoenfeld put it in their textbook, *Principles of Psychology*, "Extinction is the hallmark of discrimination."

Nevertheless, when we attempted to program discrimination learning, we worked out gradual progressions of stimuli to obtain as close to errorless performance as we could. Even relatively simple discriminations were unmanageably difficult otherwise. Children could not be kept at the task long enough to run off the necessary extinction curve. But here was a paradox. The way we were teaching discriminations in an applied context was not in agreement with the basic research. A graduate student, Herb Terrace, looking for a dissertation topic, saw this paradox, and he carried the problem into the laboratory. He established errorless discriminations in pigeons and began investigating the properties of discriminations established this way as contrasted with the classical procedure. It turned out that the two types of discrimination learning were quite different. Not only was the errorless procedure faster, but the resulting discrimination differed in ways that are important to a systematic understanding of behavior.

Terrace, and the work he stimulated, focused on the properties of discriminations after they were formed. Forming errorless discriminations in the laboratory or in practice was still an art. Not every progression worked. Here, another gap in our knowledge was revealed, and the interplay between laboratory and practice continued. Subsequently, an active area of laboratory research was the determination of the conditions for establishing control by a new stimulus dimension. This work involved a number of people, such as Paul Touchette and Judith Doran, and moved back and forth between laboratory and practice. Studies seemed to indicate that successful fading is not due to an "associative" transfer of control by pairing a controlling stimulus with the new stimulus. Instead, successful fading seems dependent upon the arrangement of conditions that ensure a response contingent relationship with the new stimulus similar to that found in response shaping. Again, we saw that a steady interplay between research and application improved both.

In sum, the analysis of behavior in instruction, from the early teaching machines to today, is an interesting case study of the interplay between basic science and a technology based on science. The effects of contingencies of reinforcement, the nature of shaping, and the analysis of psychological phenomena in behavioral terms were learned from our basic science, which now serve us as we attempt to arrange sequences of contingencies to meet behaviorally-defined educational objectives. Applications spread to the modification of behavior outside educational settings into therapy and social management situations. When practice remains true to the proven principles of the laboratory, impressive gains are made; when basic principles are neglected, the results are less impressive or even embarrassing. At the same time, practice is the ultimate test of theory, and applied behavior analysis in instruction opened new directions that continue to provide a more complete understanding of behavior. ●

reflections

# eLearning: Today's Teaching Machine

by Emaley McCulloch M.Ed. BCBA
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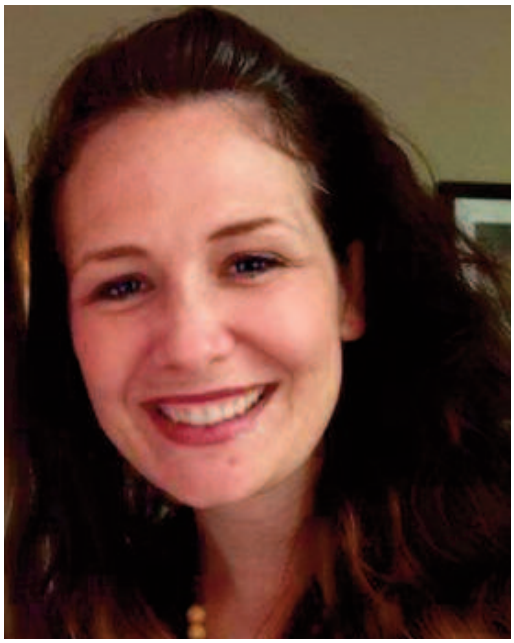
Relias Learning



*In 2008, Emaley McCulloch co-founded Autism Training Solutions, LLC and currently serves as the Director of Behavioral Products and Research at Relias Learning. Relias Learning is a leading elearning provider to the health and human services field, including senior care, ABA/autism, mental health, and intellectual and developmental disabilities. Emaley is a Board Certified Behavior Analyst and holds an M.Ed in Special Education. She has 18 years experience in the field of autism and ABA and has provided and overseen services to individuals between the ages of 18 months to 24 years in homes, schools, and clinical settings. For eight years, she served as a consultant and supervisor at agencies based in Hawaii and Japan, where she trained groups of professionals and parents. Emaley's passion is staff training, eLearning, disseminating evidenced-based interventions, film, and videography, and using technology in the fields of behavior analysis and special education.*

In the March-April 2015 issue of *Harvard Magazine*, Sophia Nguyen published the article entitled, "Computing in the Classroom: From the 'Teaching Machine' to the Promise of Twenty-First-Century Learning Technology." In this article, Skinner's work relating to the teaching machine and programmed instruction was characterized as rudimentary and robotic in comparison to the potential of today's "teaching machines." The article's message was focused on the opportunities we have with today's technology, including the Internet, to make learning engaging and exploratory for the learner. The article's misrepresentation of Skinner's ideas of the teaching machine is another reminder of the misconception that Skinner, and behavior analysis in general, reject "mental" events, such as insight, problem solving, and concept formation. Although Skinner's teaching machine and programmed instruction only began to scratch the surface of how today's teaching machines are changing the landscape of education and training industries, the principles that were used in the early wooden boxes and paper disks hold powerful technologies for learning that today's computer scientists have not fully utilized. Modern teaching machines, including the Internet, handheld devices, and video games, are very advanced. However, the science of learning that includes the power of shaping, immediate feedback, and reinforcement, is often left on the sidelines.

Skinner anticipated that learning would someday become automated and that anything that can be verbalized could be taught through a teaching machine. Today, his predictions have become a reality with the rise of eLearning, Massive Open Online Courses (MOOCs), and Learning Management Systems (LMS). Unfortunately, in the driver's seat of these advancements are computer scientists, who care more about emerging technology than the science of behavior analysis.

The global eLearning industry is expected to reach $107 billion by the end of 2015 with a 9.2% annual growth track record. Currently, 77% of companies in the U.S. use eLearning as part of their professional development program. Higher-education institutions are adopting eLearning in order to stay competitive with the needs of today's learners. MOOCs, such as Coursera and Udacity, provide free courses to thousands of learners across the globe on a variety of subjects. Within the field of behavior

analysis, there are 108 BACB-approved ABA higher-education course sequences, and 32 of them offer online courses. The once-prevailing perceptions that eLearning is inferior to classroom instruction are fading away with the understanding of the benefits of self-paced instruction and adaptive learning as well as the efficiency and convenience that eLearning offers learners and instructors.

At the same time, there is an obvious gap between the powerful modern technology and effective instructional procedures. Many applications mirror didactic, instructor-led presentations. LMS, despite its potential, often serves as mere storage for long "talking head" videos and PowerPoint presentations.

Skinner's study of programmed instruction provides a model of evidence-based teaching. The main principles of Programmed Instruction are:

**Behavioral objectives**- Lessons and programs should be designed based on objectives that are observable and measureable rather than what learners will "know" or "understand."

**Lessons are broken down into "frames"**- Lessons are broken down into small units of information and presented sequentially.

**Learners should be active and engaged**- The programs and lessons should include a constant interchange between the learning material and the student. In the programs designed in 1960s, Skinner and colleagues often required student responses every 25 words or so.

**Immediate feedback**- The program should provide immediate feedback on the accuracy of the learner's response. The feedback can also include prompts, hints, and reasons for incorrect responses, including additional examples to help struggling learners.

**Self-paced**- Learners should advance through the lessons at their own pace, which allows them to utilize the time and resources (additional tips and multi-media) that they need to master the material.

**Reinforcement**- The program should provide a form of positive feedback for every correct response.

**Assessment of mastery**- Assessments should be performed at the end of each section to determine if the concept has been mastered.

Within the world of eLearning, the phrase "behavior change" is used very generously. It is heard at eLearning conferences and seen in titles of popular eLearning articles such as, "Can You Really Change Behavior Using eLearning Design? Yes!" and "Can eLearning Influence Behavior Change?" Yet the fundamental science of behavior change, behavior analysis, is not at the center of their instructional design. It is safe to assume that if B.F. Skinner were alive today, he would be engaged in the work and science of eLearning. Behavior analysts should begin by looking at our own use of eLearning within our field. Are we truly using the principles of programmed instruction in our own online materials? Are we adding to eLearning and gaming research to include the principles of behavior analysis?

In 1989, Skinner said, "Computers are now much better teaching machines" than the devices he was able to build. But it will take much more than fancy high-tech gadgets to improve the training and education industries. The teaching machine is only as effective as the teaching methodologies it employs. Can we, as behavior analysts, bring evidence-based teaching and instruction into the new world of teaching machines? ●

science corner

# Programmed Instruction's Lessons for xMOOC Designers

by Julie S. Vargas, Ph.D.
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Every month, an increasing number of students take university-level courses over the internet. These courses, called MOOCs (Massive Open Online Courses), consist of lectures and demonstrations, quizzes and tests, and internet interactions with other students. MOOCs rely on presentation for teaching. But viewing even the most inspirational lecture does not effectively "shape" behavior. Like tutoring, shaping requires centering instruction around student activity, including its moment-to-moment progress. In the last century, B. F. Skinner designed a shaping procedure called "Programmed Instruction" (PI). Research on PI reveals features of instruction that would help MOOC designers. In particular, the studies on PI recommend adding more active responding. Centering instruction around student activity not only enhances individual achievement, but also provides data to enable internet designers to improve the effectiveness of their courses.

In 2012, the *New York Times* declared 2012 the year of the MOOC. MOOCs are generally said to originate in 2008 with a course known as CCK08: Connectivism and Connective Knowledge, a name coined by Dave Cormier. Twenty-five students at the University of Manitoba in Canada took CCK08 for credit. The course taught by engaging students in blogs and connecting individuals through social media. It also offered readings. The course was opened to the general public without charge or university credit. Over 2200 students joined the free online discussions. This course was not the first online course with large enrollments. Other "open" and free courses had existed on services such as the Kahn Academy founded in 2006, ALISON founded in 2007 to help teach job skills and MIT's OpenCourseWare that began in 2002. But it wasn't until 2012 that the most prestigious American universities began offering MOOCs. In February, a Stanford professor left academia to found Udacity. In April of that same year, two other Stanford professors launched Coursera, and in May, Harvard and MIT announced a joint venture called edX. As of 2014, new MOOC offerings show no sign of slowing down.

The university courses differed from the CCK08 "connectivity" course. Instead of asking students to learn through discussions with each other (called a "cMOOC" format), university MOOCs (called xMOOCs) are designed like typical university courses. These xMOOC offerings typically start and end on specific dates, present content through lectures or demonstrations, give exercises, and evaluate with quizzes and tests. With thousands of students enrolled, uni-

versity on-line courses do not offer personal contact with the main instructor. Most provide interaction between students through blogs, email, or other on-line discussion vehicles. Students worldwide can take xMOOC courses without charge or for a modest fee for a certificate of successful completion. A certification of successful completion from a major university's xMOOC does not earn the same credit as a course taken as a regularly-enrolled student. The rest of this article concerns university courses (xMOOCs).

Students taking internet courses from universities are expected to learn through online presentations that are intended to "prime the attendees for doing the next exercise." Presentations vary in format. Some consist of video lectures that students view the same way they would if sitting in a university lecture hall. Others present moving arrows or writing that appear as words are spoken. Diagrams or models simulate procedures or show structures of objects as they are assembled or disassembled. Videos of actual experiments or historical footage are also found in the presentations. While these "instructional" parts of courses present content in interesting and informative ways, no responding is required of viewers *during* the presentations. The learner remains in a nonparticipant role.

Designers of xMOOCs realize that presentations alone do not guarantee mastery: hence, courses include more active behavior through assignments. Assignments essentially outsource teaching to the students. Whatever they cannot yet do, they must figure out by working through assignments, or by seeking help from peers, but they don't receive individual guidance by the instructor. In most xMOOCs, students can attempt problems multiple times. Mistakes, however, reveal the failure of presentations to teach the skills required. In relying on presentation and practice exercises, xMOOCs have little instructional advantage over the average textbook. Textbooks can be accessed individually according to each student's preferred time. They provide expert content with diagrams and pictures. They provide exercises, and most give a scoring key to check answers. Using a textbook, students can interact with others when needed. As an instructional method neither books nor presentations can be counted upon to guarantee mastery.

Following assignments, most xMOOCs give quizzes or tests. Like assignments, quizzes let students assess their performance. Test results, however, do not give students feedback at the point at which it is needed. Finding out that answer number six is incorrect does not tell a student where he or she got off track.

For instructors, evaluation is used for grading. The behavior tested becomes the operational definition of a course's objectives. Even in on-campus courses, the "behavior" or "performance" objectives are worth examining as a physics professor at Harvard University found out. Eric Mazur taught a traditional on-campus lecture course on physics. He read an article that argued that while physics students could solve problems with formulas, they had no idea of what their answers meant in daily life. He reported his reaction: "Not *my* students!" But he gave a test to find out. To his alarm, large numbers of students could not select the correct answer to simple questions like identifying which of five paths an object would follow if dropped from a moving airplane. Mazur reconsidered his course objectives and redesigned his course to meet them. Although not trained behaviorally, he added more responding and feedback, part of what a behavior analyst would recommend. He divided his lectures into short segments, each followed by a multiple-choice question. Every student answered the question individually, and the answers were electronically summarized for Mazur. Then, students discussed their answers with peers before Mazur gave feedback on which option was correct and why. Interestingly, Mazur reports that not only did his new procedure teach the "understanding" that his original course had lacked, but student performance on the traditional physics exam remained high. That exam required traditional physics problem-solving and computation.

With thousands of students enrolled, most xMOOC courses employ only multiple-choice questions with fixed alternatives. The behavior required to pass these tests differs from the objectives of a college education designed to enable students to function in a variety of possible futures. Multiple-choice items do not prepare students for a career or for skills useful in daily life. Conducting an experiment, writing an article, or planning a budget require more complex behavior than selecting the best of four or five given options.

The shortcoming of multiple-choice to evaluate complex skills has not been lost on xMOOC designers. For performances, like essay writing, automated scoring programs exist. These programs assign overall grades for essays. Automated essay grading programs have been found to match well evaluations given by human scorers. They

check grammar, length of sentences and paragraphs, vocabulary, and other structural elements. Evaluation of structural elements is helpful especially for non-English writers, but automated graders cannot judge sense from nonsense, accuracy of information, nor quality of argument. An automated grading program gave Lincoln's Gettysburg Address a grade of 2 out of 6. As with assignments and quizzes, scoring programs that evaluate finished paragraphs do not help students during the composing of a paper.

In addition to scoring programs, xMOOCs may give individualized feedback for complex behavior from other students taking the same course. This feedback quality depends, of course, on the skills of the peers evaluating. Whether with automated scoring or through peer evaluation, xMOOC feedback is not given to students during the building of the skills they are to acquire. xMOOC designers extoll tutoring as the epitome of instruction, but the actual "teaching" part of xMOOCs remains the lecture-cum-exercises. Work done in the last century with Programmed Instruction provided a tutoring-like format. Experience gained with Programmed Instruction would be useful to xMOOC designers.

**Origins of Programmed Instruction**

Programmed Instruction came out of the work of B. F. Skinner. Skinner plunged into instructional design in 1953 as a result of a Father's Day visit to his younger daughter's school. Sitting on one of the fourth-grade chairs he witnessed a standard lesson. The teacher showed how to solve a simple math computation then gave out worksheets. Skinner observed some children struggling and others working quickly with looks of resignation or boredom. Suddenly, he realized that the teacher had been given an impossible task. No teacher could individually "shape" the performance of each learner in a class of 20 or more students. Shaping, like good tutoring, teaches new behavior by reinforcing the best of an individual's present behavior with each next step depending on that learner's progress. Skinner and his colleagues had spent over 20 years researching how behavior is selected through immediate reinforcement of properties of actions. The contingencies of the traditional classroom violated all of the principles he and his colleagues had discovered. Teachers needed help.

Skinner designed a machine to solve the teacher's problem. There were no microcomputers back in the late 1950s, so Skinner made a mechanical machine. His first machines provided practice on randomly presented math problems. Skinner demonstrated his machine at a conference, and when Sidney Pressey heard the talk, he sent Skinner articles about the "teaching machine" he had designed earlier. Pressey's machine had four knobs for answering randomly presented multiple-choice problems. He had found that giving immediate feedback after each answer instead of at the end of the set improved performance. Skinner's machine with sliders from 0 to 9 required "composed" responding, not multiple-choice. Pressey, equating his machine with Skinner's, also missed the primary message of Skinner's talk–that the science of behavior could be used to shape *new* behavior, not just to give practice on existing but weak skills. In his talk, Skinner described shaping procedures. He explained how you could shape moving in a figure-eight pattern by reinforcing "successive approximations" of a pigeon's turn. He talked of maintaining skills with schedules of reinforcement, the effects of which "would traditionally be assigned to the field of motivation." Randomized practice would not do. Instruction had to involve special sequencing he called Programmed Instruction (PI).

Within a couple of years of his Father's Day visit, Skinner with the help of James G. Holland programmed his own course at Harvard. They wrote sequences that introduced each new concept in a series of "frames." In size, a frame was about the size of today's cell phone or tablet screen. Every frame required student responding to the "content" presented at that step. Frames within a unit were built in a way for students to solve increasingly complex problems as they progressed. The Programmed Instruction was delivered by a mechanical machine that presented frames one at a time, gave space for writing, and with the movement of a knob, uncovered the correct terms as the student's writing moved under plexiglas where it could not be changed. Students then marked what they wrote as correct or incorrect, and the next frame appeared. Everything students wrote, frame by frame, was saved, along with their evaluations of what they wrote.

Skinner followed his own scientific principles about shaping. That is, "mistakes" were not defects in student performance, but rather defects in the sequences of in-

struction. He and Holland revised their program–frame by frame–until the sequences shaped individual responding to the proficiency desired. When no manufacturer in those days before microcomputers would produce a machine meeting Skinner's criteria, he and Holland put their program into a paper format. Unlike machine formats, the paper formats did not adhere to the contingencies of a machine: Students could peek at answers before responding. But paper versions at least made the steps available.

Book forms of Programmed Instruction exploded in the 1960s. A 1967 *Bibliography of Programs and Presentation Devices* required 123 pages to list available Programmed Instruction programs and the 116 companies and educational institutions that produced them. Programs taught entire courses in adult basic education, business, construction, foreign languages, music, science, and law. Anyone, it seemed, could write Programmed Instruction. All you needed to do was to take text, remove a few words here and there, and voila! No understanding of behavioral principles appeared to be needed. Unfortunately, behavioral expertise was required. Skinner's own design drew from his analysis of verbal behavior.

Many formats called "Programmed Instruction" existed. Most followed Skinner's format of text with blanks to fill in at each step. Educators evaluated this new teaching procedure. Some studies compared Programmed Instruction with simply reading the same material with no blanks to fill in. Results of these comparisons were contradictory. Holland and other researchers examined a programs used in comparison studies to find out why results differed. Properties investigated fell into three major categories. *Property one* involved antecedent (discriminative) control, that is the specific features of content that controlled responding at each step. *Property two* considered structural elements that determined attention patterns while viewing individual frames. *Property three* was density of active responding. Some Programmed Instruction writers added a fourth property–the degree to which the sequencing of frames adjusted to each student's moment-to-moment progress. In the last century, the procedures available lacked precision that today's internet could provide.

Part of education involves responding to the appropriate features of a problem. Everyone is aware of inappropriate antecedent control when a student cheats. In cheating, a student supplies an answer scored as "correct" or a paper graded as "A," but what controlled the student's behavior is not what the assignment intended the student to do. Copying is under different antecedent controls from solving or analyzing.

In any course, instructors need to attend to antecedent control. Even if students are answering "correctly," are they doing so for the right reasons? To examine the features of Programmed Instruction that controlled student responding, Holland invented the "blackout ratio." The premise was simple: If you could respond "correctly" with parts of "instruction" blacked out, the obscured material was not controlling your answer. The more material that was blacked out, in other words, the less that content contributed to learning. Figure 1 shows an example of a high blackout ratio: Anyone could answer this question without reading a word of the section intended to teach probability. In contrast, a low blackout ratio indicates that most of the "instructional" material exerts evocative control over responding. In looking at Programmed Instruction lessons that were no better than or equivalent to just reading the same material, Kemp and Holland found that those Programmed Instruction lessons had high blackout ratios. Like the statistics program in Figure 1, student responding failed to be controlled by the relevant properties of the topic. Students could respond "correctly" for the wrong reasons. Consider the talk of a lecturer as equivalent to the textual explanation in Figure 1, and you can imagine how difficult it would be for xMOOC designers to identify features of their explanations that exert evocative control over student performance.

Part of antecedent control involves patterns of attention. In an online course, where do students look during the presentation of a lecturer? Do their eyes follow the diagram arrows that illustrate a point, or do they focus on the lecturer's face or, worse, on their cell phones? When a screen presents textual material, what part do students view first? The latter question was possible to investigate with Programmed Instruction. Doran and Holland tracked the eye movements of students as they went through two versions of Programmed Instruction. The first, a low blackout version, consisted of material taken from the program used in Skinner's course. Students had to read most of the

words in order to correctly answer. The second version was constructed as a high blackout version. The same sentences were presented, but different words were requested. To make it unnecessary to read all the words, the high blackout version omitted words that could be filled in by reading only adjacent words. For example "reinforcement" was easy to fill into a blank following "positive" even without reading anything else. The researchers controlled for unit difficulty: Half of the students began the first unit with a *low* blackout version then received the high blackout version for the subsequent unit. The other half of the students began with the *high* blackout version then received the low blackout version for their next unit. Results showed clear differences between eye tracking with high and low blackout ratio material. With the high blackout version, the one with poor discriminative control, student eye movements flickered all over the screen. They didn't read everything. They skipped around. With the low blackout ratio, where control lay in the entire material, student eye movement showed the typical pattern of reading. This principle is still extant. A recent study of eye-tracking when viewing home pages showed a similar flicking around the page before redesign. The home page was changed to control focusing onto critical parts. According to E. Rowell, where commercial interests are concerned, home pages typically "go through many iterations, repeatedly fine-tuning certain elements of the page in order to control the user's eye movement patterns, creating a natural user experience that avoids user confusion and frustration." Similar fine-grained analyses are, to my knowledge, not conducted with xMOOCs. No one tracks where students are looking while viewing presentations.

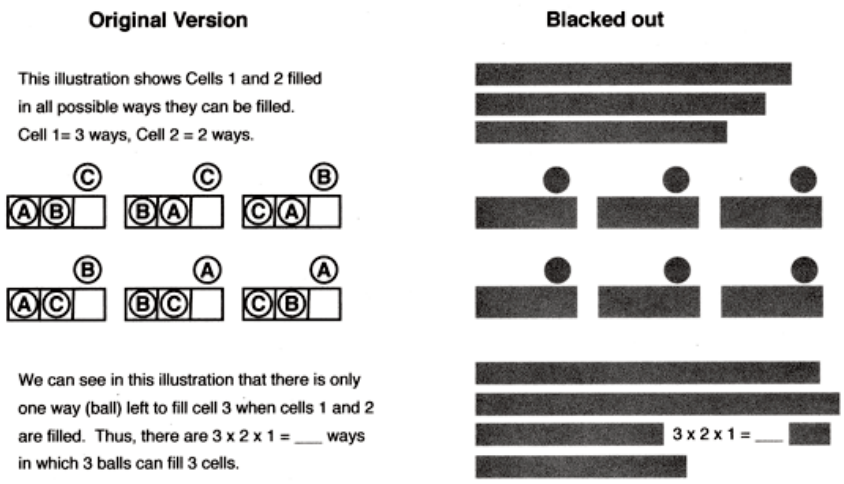


*Figure 1*

In the 1990s, with the coming of microcomputers, instructional designers adopted computer-delivered formats for Programmed Instruction. Computer formats enabled research on the role of active responding. Using a computer-delivered Programmed Instruction lesson, Kritch, & Bostow varied "student response density." They created three versions of a lesson to teach how to write code using a computer authoring language. One version required responding to content in every screen of material. A second version asked for responding in only half of the screens. A third version presented material to read with no responding. To control for time spent with each screen, each student taking the "no active responding" version was yoked to one student taking the highest-density version. The "no active responding" student thus received his or her next screen only when the yoked "high-density" student filled in an answer and moved on. Thus, whether actively responding or not, both students saw each screen of content for an equal amount of time. Not surprisingly, the more actively students responded during instruction the better they performed. Not only did they score better on the unit posttest, they also wrote better code when given a totally new computer authoring task.

Shaping requires that teaching actions continually adjust to learner behavior just as much as learner actions adjust to instructional steps. Skinner's teaching machine adjusted to missed items by bringing them back until they were completed correctly, a poor way to help the slower learner. A format called "gating" provided more adaptation to individual progress by beginning each sequence with a quiz item. If missed, the student completed items to teach that skill. If answered correctly, the next test frame appeared. Gating helped alleviate the need for repeating missed items. But even the best Programmed Instruction of

the last century did not continually adjust to each action taken by the learner the way a good tutor would. Flexibility in sequencing for each individual could, however, be done with today's internet tools.

Any instructional designer could benefit from behavior analytic principles. First, behavioral instructors state goals in terms of student behavior. Objectives like "understanding" are translated into observable actions that indicate when the inferred "understanding" has been achieved. These "behavioral objectives" define skills students should have mastered by their final evaluation. Next, shaping steps, the actions students take to achieve competence, are analyzed. As students respond, instructions adjusts to individual progress. All this requires high rates of student responding.

The need to increase active student participation has not been lost on xMOOC designers. P. Norvig in his 2013 article in *Scientific American* describes a course with lectures divided into two- to six-minute segments with student responding in between . Science courses have added more responding by adding simulated labs. Students "click," "drag," and type on a screen to virtually "perform" experiments or even to operate actual equipment located elsewhere. Many internet courses prescribe interacting with fellow students to increase activity. Without seeing what peers are saying, however, instructional designers cannot tell what or if peer interactions help teach. All of these procedures to increase active student involvement are gradually approximating Programmed Instruction's procedures. With more frequent data, like that gathered after each two- to six-minute lectures, xMOOC designers can locate "junctures" where course materials need improving. The data from Programmed Instruction would provide even more details.

xMOOC courses require a team that includes a content expert, a behavior analyst, and a data-analysis expert. Currently, instructional teams use only part of the data that could be available. They record average sign-ons and dropout rates, minutes spent on-line, educational level and nationality of enrollees, and opinions of students. These data serve marketing purposes more than improvement of instruction. One summarizing website gives data on over 150 courses, isolating completion rates by length of course (number of weeks), number of students enrolled, platform (Coursera, EdX, Futurelearn, Open2study, Udemy, and 11 others,) and type of assessment (peer grading or auto grading only). The data show higher completion rates for shorter courses and for courses with fewer students. These data, while interesting, do not help improve instruction. Cohort analyses of student gains measured in pre- to posttest along with number of attempts on homework or quizzes reveal much about the kinds of students who take a course but little about what students were doing to learn. The designer cannot tell where critical steps were missing, what steps are unnecessary, or what parts were particularly effective. Average summary data also fail to capture individual variability. They do not adjust to progress *during* the acquisition of skills, something with which a behavior analyst could help.

If instruction were broken down into Programmed Instruction-sized steps, today's computers could adjust steps as a learner goes through them. xMOOCS could record the speed with which each step is completed. Rapid performance could signal a need to a shift to more difficult steps or to a subsequent section. Boredom from repeating skills already mastered could be avoided. Conversely, slow responding could transfer a learner to a sequence of missing prerequisites or smaller steps until the learner responds more rapidly. Sequence alterations of both kinds would be seamless to the learner. He or she would not know whether the sequences taken were advanced or remedial. Such shaping would come close to tutoring by a live teacher.

The xMOOCs offered by today's universities rely on lectures and demonstrations as their primary teaching tool. Presentations put students in a passive role. Behavioral research on Programmed Instruction in the last century revealed the importance of active student responding and of subtle features of formatting that determine moment-to-moment student progress. One cannot expect xMOOC designers to abandon lectures and presentations in favor of writing the complex sequencing of steps that Programmed Instruction requires for a college-level course. But they would benefit from what behavioral science has to offer. Shaping student competence requires a lesson to adapt each learning step to the variability in individual student actions. Increasing individual responding also provides detailed information for improving lesson content and sequencing. That information, in turn, encourages more analysis of student responding, and perhaps, a realization that behavioral expertise is needed. We have a science that shows how behavioral change occurs. It is time to use it. ●

profile

# Juliet Newberry

## Behaviour Analyst

## Johannesburg, South Africa

### interview by Joanne Robbins, Ph.D.

I received my undergraduate degree from Rand Afrikaans University in Johannesburg, South Africa. I then proceeded to do online courses through the University of North Texas. Once I had completed the set, I then started my supervision with Josh Pritchard and Siri Ming in the United States. At this stage, the Internet bandwidth in South Africa was not great, which made sending videos difficult. However, I persevered and completed my hours. While doing my supervision, I enrolled in a Masters program with Cardiff University in Wales which I completed. I plan on getting my BCBA by the end of 2015.

During my supervision with Josh and Siri, I started seeing home-based clients for ABA. After a year, I opened up an ABA intervention centre in Johannesburg, called Newberry Park. My goal is to offer a good-quality ABA program at an affordable rate to parents. The only other ABA centre available is run by CARD USA, and their programs are unaffordable to the general population. I have always ensured that every child gets the best intervention available; that is the reason I got in contact with PEER International (Partnerships for Educational Excellence and Research). I was looking for a program for older children to learn in a group environment. Colleagues from PEER have mentored me in Direct Instruction and fluency. Together, we have been able to change children's learning abilities. Children who could not do basic math facts could complete difficult equations, non-readers became readers. I am incredibly proud of what we have been able to achieve in South Africa in such a short time period and pray that we get better and better over the years.

The following books have been critical to my learning: *The Morningside Model of Generative Instruction; Explicit Direct Instruction: The power of the well-crafted, well-taught lesson; Teaching struggling and at-risk readers a direct instruction Approach; Response to Intervention and Precision Teaching: Creating synergy in the classroom*, and last but definitely not least *Enhancing instructional problem solving: A efficient system for assisting struggling learners*.

Unfortunately, we don't have any learners from extreme poverty yet. My goal is to start training those families in extreme poverty who need assistance. I also plan to organize workshops once a month to support those with program work. Another goal is to provide more training to teachers in inclusive school environments, helping them with teaching efficiencies to support their students' needs.

Currently, I provide training mainly to my staff as well as parents of the children who attend our centre. All the training in Johannesburg focuses on basic needs, such as toilet training all the way to increasing verbal behavior. The goal this year is to develop three training workshops: one for professionals such as occupational therapists and speech pathologists, one for teachers, and one for parents.

***What are some of the things you find most gratifying about your work?***

We are able to help so many families with ABA therapy, which is normally available only to families who are in a high-income bracket. It is wonderful to watch how families' lives start to change for the better when their children's behavior becomes more appropriate in their home environment and social settings. There is nothing better than to teach children to communicate their needs and en-

gage in conversations with their families. The gratitude that we experience from the families we work with at the Centre is amazing.

***What drew you to behavior analysis?***

I volunteered at a government school for autism and observed teachers trying to teach children diagnosed with autism using methods that were employed in typical schools. The teachers continued to do the same thing over and over, yet the children with autism never made any progress. Some teachers did not have time to teach due to the severe problem behaviors they had to manage. At this time, I started looking into treatment methods for autism. Applied Behavior Analysis (ABA) drew me in, due to the scientific evidence as well as the analytical way of measuring each child's progress.

***How has your community responded to your success?***

The people in the community without hands-on experience have not responded well to ABA. Parents still worry that their children will turn out like robots. Doctors feel that children will not apply the skills outside of the learning environment. The people who have responded well are the people who have been involved with my Centre, such as the families, doctors, speech language pathologists, and occupational therapists. This portion of the community has witnessed firsthand the progress the children have made with ABA. As a result, they are all extremely pleased.

***How do the parents feel about the accomplishments of their children?***

Parents are thrilled at the progress and accomplishments of their children. The realization that their children can learn new skills, including language, is gratifying for them. Parents are thrilled that their children now have a voice and are better equipped for their life within their communities. They are the ones that are proactive for ABA and will sing its praises.

***How do your students respond to academic instruction and activities (Direct Instruction, building to fluency)?***

Students have responded very well to Direct Instruction and building to fluency. Using these methods have allowed children to learn and, most importantly, to enjoy what they are learning. They are able to retain and apply their skills to other places and settings. They have developed a sense of pride in their accomplishments. They have also developed a sense of competitiveness, so they work harder because they want to be better than their peers in certain activities .

***How were you able to learn these procedures given your location?***

Thankfully, the advancement of technology made learning easier than I thought it would. The support from PEER International has been amazing with Skype calls and emails. I have been able to order books on Amazon to increase my knowledge, and the availability of journal articles has been easy. I always believe that if you have the commitment to a task, you will be able to complete it! The children's progress that I witness daily has made the journey worthwhile. ●

profile

# Dr. Mickey Keenan

## Professor of Behaviour Analysis
## Ulster University, Northern Ireland

interview by Katerina Dounavi, Ph.D.

*Mickey Keenan is Professor of Behavior Analysis at Ulster University where he teaches behaviour analysis to undergraduate psychology students. He was instrumental in laying the foundations for the master's course in Applied Behavior Analysis (ABA) at the university after he established the first charity in Ireland whose mission was to promote ABA for the treatment of autism. He has campaigned tirelessly for the rights of children to have access to ABA in Ireland and throughout Europe.*

*The first part of this interview was published in Quarter 1, 2015 edition of* Operants.

When I took a course on learning as an undergraduate student, I was intrigued by the complexities involved in trying to study basic learning processes. To put things in some perspective for myself, at the time, I came up with the following image of what was being demanded by training in a scientific perspective. Imagine you had been on the science team that had beamed down from the starship *Enterprise* to explore a new world. New creatures to be investigated meant having a strategy that was not biased by any understanding of how life functions on Earth.

If you think about it for a while, creatures you may be familiar with on Earth really are the most amazing things to look at. The vision of a child seeing the world for the first time, that was to me the goal of being ready to investigate, to see things anew, and to build up a database of how mother nature worked.

Then, I had a chance to study schedules of reinforcement for my Ph.D. Thus began my love affair with my science. Schedules taught me about the multiple determination of behavior, and while most my time was spent trying to isolate variables, it was interesting to see schedules from an applied perspective: If you want to produce a particular performance, then use this particular combination of variables in this way! It's an easy step from looking at contingencies in the lab to looking at them in the real world. Skinner shared his understandings of the implications, and whilst I never had any formal training in philosophy, I saw the immense importance for understanding myself as a person and for understanding the responsibility foisted upon us by Skinner's insights.

***What are your research interests and current projects?***

My research interests have always gone hand in hand with those of my Ph.D. students. I adopted this approach as one way of casting a wide net for bringing behavior analysis to the country. Personally, I was interested in anything behavioral and enjoyed sharing my understanding of behavior analysis with students. And students eventually taught me about the issues that needed to be addressed in their area of interest. When I look back at the Ph.D.s I supervised, the broad areas covered include human schedule performance, biofeedback, stimulus equivalence, sex abuse, gerontology, precision teaching, video modelling, anger management, private events, and parent training. I have also worked closely with my wife, Karola Dillenburger, on autism and on bereavement. Throughout all this work, I have been involved in extensive advocacy work for parents

of children with autism. This is incredibly time consuming and has taken me away from basic laboratory work. Currently, though, I am rekindling an interest I have in examining what happens when multiple functions are added to equivalence classes. This interest arose from some recent intriguing findings. We established that when three functions (i.e., arbitrary drawing responses) were added to a five-member equivalence class, a range of novel drawings appeared in tests for transfer of function. On some occasions, the participants even drew the stimuli that made up the classes! These findings are unusual to say the least, and they cry out for more attention in the context of studying creativity.

***For a long time, you have championed the use of multimedia for teaching behavioral analysis. What is driving these ideas?***

We all know that the science of behavior analysis has an image problem. I am convinced though that we can address many of the problems we face by giving more attention to the resources we develop for teaching. In particular, I believe we need to give more attention to the scientific image. Consider these two quotations: one about problems faced by analysing behavior and the other about the difficulties in sharing information obtained from scientific research:

> *Behavior is a difficult subject matter, not because it is inaccessible, but because it is extremely complex. Since it is a process, rather than a thing, it cannot easily be held still for observation. It is changing, fluid, and evanescent, and for this reason it makes great technical demands upon the ingenuity and energy of the scientist. But there is nothing essentially insoluble about the problems which arise from this fact.* (B. F. Skinner, *Science and Human Behavior*)

> *The scientific mind may be characterized as the bearer of two torches: one of insatiable curiosity and the other of a will to impart understanding. Nevertheless, scientific studies are usually published in a language seemingly impenetrable by the non scientist….Images - even complex ones - can, however, impart the scientist's objectives in startlingly direct ways*. (H. Robin, *The Scientific Imag. The History Of The Art Of Science: From Cave to Computer*)

While Skinner had been talking about the scientific analysis of behavior, his comments also ring true with attempts to share the findings of a scientific analysis. These next two images show how I have approached a reinterpretation of Skinner's comments as they relate to the ingenuity and energy needed for generating scientific images. Figure 1 shows me holding a JABA article in class.

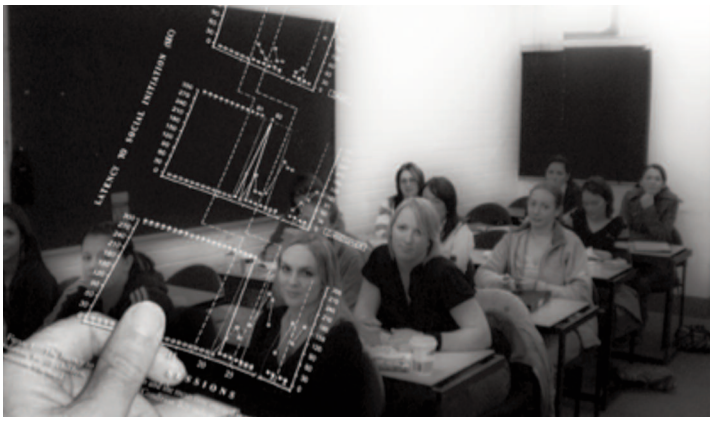

*Figure 1: Teaching with an article from JABA*

Figure 2 is a replication of Figure 1 with a major difference. It represents my vision of where we could be. In the figure, the data points are clickable buttons that reveal video clips of the behaviour responsible for the creation of the data points.

*Figure 2: Teaching with an article from JABA that has multimedia elements*

When you show the figure to the class and you want to explain what the behavior actually looks like at any point on the graph, you would click on the data point that then activates a video clip of that behavior. Not only would you have important social cues when showcasing successful treatment, but you would be able also to ensure treatment fidelity is improved when others can see what the treatment actually looked like. Now, I am guessing that most people would prefer to be taught with the setup in Figure 2. And this is possible right now just using PowerPoint or Keynote.

Unfortunately, however, most people haven't broken free from the shackles of the printing press, and the design of educational material is guided mostly by what has been possible with paper up until now. This is entirely understandable, but for a moment, think about the number of times you have shown a graph in class and then spent time trying to describe the actual behaviour represented by the data points. We don't have to do that anymore, and the software available to do things differently is getting more and more user-friendly. Here is a link to the presentation I made that explores this issue in more detail: https://dl.dropboxusercontent.com/u/1973170/The_Dot_as_an_SD/Intro.html

In terms of what is currently available, Karola Dillenburger and I have produced what I think is the first multimedia textbook in behaviour analysis that showcases how teaching our science could be different, *Behaviour Analysis: A Primer* (Keenan & Dillenburger, 2014). It is available on a Mac or iPad. I hope people take a look at it and develop the ideas further. In the book, we have designed animations of various behaviors, and we show the dynamics involved in simple schedules. There is nothing new in the material we teach, but it is how we teach it that is new.

As one example of a graphic in our iBook, we have

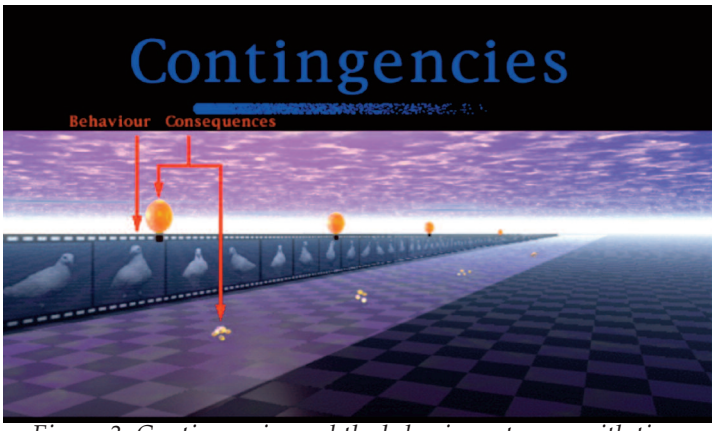


*Figure 3: Contingencies and the behaviour stream, with time moving into the horizon*

designed images with perspective (Figure 3) to show how to think about behavior streaming across time. It would be easy to add animation layer on top of it to give a more realistic representation of how behaviour changes across time. Interestingly, the inclusion of perspective in drawings is something that became more prevalent during the Renaissance period in the history of art (http://www.op-art.co.uk/history/perspective).

We live in a visual world with a huge library of resources on the web, so please let's get our science up to scratch with what is possible. A quick assessment will give you an idea of how much we have to do to catch up. Pick up any popular science magazine, and look at the supporting role played by carefully designed graphics to explain complex issues. Can you think of one, only one, image in behavior analysis that would sit comfortably in the magazines you are reading? I certainly can't! Science and art can and should work together more often. We can use art to help perfect the soft sell of a hard science. We need to address our image problem on so many different levels.

***I am convinced that we can address many of the problems we face by giving more attention to the resources we develop for teaching.***

***What can you tell practitioners about your re-***

***search? How is it applicable to their work*?**

That's a big question. I'd love to be able to say that I have a body of people working with me, and that we have a centre doing funded research on a number of topics directly relevant to real world issues. I simply don't have any resources worth talking about, apart from a few PCs. When my Ph.D. students leave, so does my work in the area they were working on. My lab work on equivalence has no funding. A charity that I set up with parents of children with autism has no statutory funding. We are on the breadline so to speak, but our passion for going forward to change things is what sustains us.

Despite these negatives, there is one way in which applied people will see my work as useful to them, and that is through my suggestions for developing multimedia resources. I have spent some time thinking outside the box of how we normally teach, and I understand why many students these days find it all rather boring. Often, students are being asked to remember answers to questions that they don't fully grasp. We need to find ways to involve students in asking those big questions that Skinner as a young man asked. If you have no passion for the questions, then how on Earth are you supposed to be excited by the answers? Sure, we can train technicians who can do basic research, but to make a rounded scientist-practitioner, that's a lot more difficult. If professionals in applied fields can make data points come alive, then young teachers who may have no applied experience, but who may be asked to teach ABA, will be able to confidently share the amazing work done in applied fields. That way, they can gather students around them.

*We need to find ways to involve students in asking those big questions that Skinner as a young man asked. If you have no passion for the questions, then how on Earth are you supposed to be excited by the answers?*

***You have taught numerous students in the last three decades at undergraduate and postgradate level. Could you identify some key aspects of teaching that increase students' interest in behavior analysis?***

Many students come to psychology with no science background, and in a sense, they go shopping in the variety store that is their undergraduate degree. What puts them off behavior analysis is the technical language and the coldness in this language when dealing with people. Also, the relative ease with which students can dish out questionnaires for their dissertations draws them away from a behavioral dissertation. To survive in this context, I have focused on a couple of strategies: One - Collect as many videos as I can which show the outcomes of applied work or which show examples of basic learning principles. Videos of applied work are really important because the caring side of the science reveals itself in the voices and faces of all involved. Two - Develop classroom exercises to engage students with philosophical issues they might not have considered before. Three - Involve PEAT in some of my teaching. PEAT is the charity organization called *Parents' Education as Autism Therapists* (www.peatni.org). This parent-lead charity has brought the benefits of ABA to well over 800 people during its lifetime. This is an organisation that visits people's homes and works directly with parents, teaching them about ABA. Involving them in my teaching allows students to hear real case studies from professionals on the front line. Four - Develop animations and 3D graphics to make the science appear contemporary in an image-rich culture. ●

reflections

# Cultural Selection - Evolution of Applied Behavior Analysis in the Public School System in Israel

by Shiri Ayvazo, Ph.D., BCBA-D
David Yellin Academic College
Matia Holon-Azur, Israel

*Shiri Ayvazo (Ph.D., BCBA-D) is a lecturer in the compound disabilities and special education programs at the David Yellin Academic College (Jerusalem, Israel) and in the School of Education at the Tel-Aviv University and Director of the Applied Behavior Analysis clinical unit in Matia Holon-Azur, Israel. She earned her MA and PhD in Teacher Education and Applied Behavior Analysis from The Ohio State University in 2007. Her research focuses on teaching expertise and promotion of academic and social skills of students at risk in school settings, especially those who have Emotional-Behavioral Disorders. Her clinical expertise is with childrn with moderate-severe behavior problems.*

Skinnerian science began in the 1930s at Harvard University in animal laboratory research. Since then, it has spread to almost every facet of human interaction from teaching and therapy to daily relationships and growth to practices of cultures and governments across the globe. Nine decades following the first seeds, the science of behavior, both experimental and applied, has grown immensely. Cutting-edge researchers continue to examine natural phenomena and environment-behavior relations; reputable academic institutions teach the science of behavior; and the number of clinical professionals in applied behavior analysis (ABA) is growing exponentially across the globe. Seeds of the science of behavior have also reached the state of Israel and have planted roots even within one of what I consider the more conservative systems in the country—the public education system. In this article, I wish to discuss the evolution of ABA services in the Israeli public school system using Skinner's conceptual framework of cultural selection and variation. I will be using evolutionary examples of growth in one of the cities in Israel considered to be highly progressive in its ABA services within public schools. The information shared may not be representative of other cities, sectors, and regions in Israel. Nonetheless, I suspect the process of cultural selection would take similar course of action in those other places as well.

The state of Israel is small (22,072 square kilometers) with a population over eight million people. Public education services are national and managed by the state (i.e., Ministry of Education). ABA services have a relatively short history in Israel and within public schools as a therapeutic profession. The first ABA academic training program was established in the late 1980s in a teachers' college. Preservice and in-service teachers began to be trained in ABA theory and technologies. The first two behavior analysts, veteran physical education teachers with special education background, were formally assigned to provide ABA services in elementary public schools in 1991 and 1995.

At that time, ABA was unknown to any school professionals, superintendents, principals, teachers, and other paraprofessionals. A culture of ABA was nonexistent. Skinner conceptualized culture as a product of contingencies arranged by other people. In the particular case of schools, there are several strata of cultures—every school in the city is a cultural unit, all schools in the city operate as another cultural

layer, the region (composed of several cities) is a larger culture, and the Ministry of Education can be conceptualized as the highest cultural stratum.

Within each of these sub-cultures are people, typically administrators and policy makers, who arrange for contingencies that may select ABA as an adequate, viable, and welcomed practice. Examples of such contingencies are allotting ABA therapy hours as part of the intervention plan for a student or class, founding appropriate infrastructure conditions that increase the probability of successful treatment, such as a therapy room and equipment, and advocating for ABA services in critical leadership meetings.

Assuredly, another option exists as well, where members of the culture arrange contingencies that select other practices and reject ABA. Educational-psychology services, principals, or other decision-makers, such as superintendents for example, may object to the delivery of ABA in schools or its provision to particular students within the school. In my experience in Israeli schools, it has been argued more than once that ABA is not the treatment of choice for students who are estimated to have emotional problems and who need talk therapies (i.e., in Israel these are termed emotional therapies). ABA, in this case, may be considered superficial treatment at best and damaging at worst. Additional reasons for rejection of ABA services may be related to the absence of a professional legal status of ABA in Israel, impeding its adoption and expansion. Lastly, the extent of layman people's acquaintance and knowledge of ABA is central and influential on its dissemination and spread.

I would like to share the example of the evolution of an ABA services culture within public schools in the city of Holon. Holon is a mid-size city (approximately 4,744 acres), housing 185,300 residents, approximately 30,000 of them are students (ages 2 to 18). There are 29 general and special education elementary schools in the city. When I was recruited as a behavioral consultant for the special education services of the city in 2011, ABA culture did not exist in the city.

Skinner explained that a culture includes *ideas*, *norms*, and *values*. In Holon, at the outset, it was an initiative of the special education superintendent deputy to try to address some of the challenges with tools that were yet to be examined in the city—ABA services. Formerly, behavioral interventions were not practiced in the city despite the urging need and prevalence of behavioral challenges from preschool to high school. The deputy promoted ABA treatment to the therapeutic table, and a culture began to emerge. More behavior analysts were recruited and hired every year, and over the span of four years of practice, the ABA clinical unit has grown from a single behavior analyst working five hours a week to 16 behavior analysts, directed by an expert behavior analyst at the doctorate level. To date, the entire unit delivers close to 250 weekly hours of ABA services to more than 50% of the schools in the city, serving more than 70 individual students or classrooms. Some of these hours come from different sources and cooperation between different organizations within the city, as described later, which illuminates the ongoing cultural evolution.

First seeds of ABA practice in the city of Holon began within special education settings. This trend was influenced, among others, by the inclusion law (1988), protecting rights of students with special needs to receive quality education. The service provision model, directed by the ABA expert, entailed a minimum of three weekly hours assigned to a case and implemented across at least two (if possible, three) days of the week. The behavioral interventions prescribed are always based on completion of functional behavior assessment. In these interventions, the behavior analyst may need to perform hands-on training with the student or classroom, instruct the teacher during and off- lesson time, or the two together. Service hours are provided along the school year or until goals are met, and fading procedures are used for optimal treatment end.

The special education ABA model resulted in extraordinary success and yielded distinguished improvement with the most challenging students and behaviors.

The achievements fostered continued support of ABA across the city. Yet, for ABA to be further selected as preferred practice in other educational sectors as well (such as preschool, for instance), *variation* needed to occur. Inspired by past achievements, the superintendent's deputy proposed to the city's educational psychology services a collaborative model of ABA support to typically developing preschool children (ages 3 to 5) who are experiencing challenging behaviors. This working model was collaboratively built by the special education service, superintendents of the Ministry of Education, and the Educational Psychology Services and superintendents of the municipality. Its unique purpose is to provide services for children who have undergone other interventions with no satisfactory improvement and who are currently at risk for first-grade special-education placement. This ABA service model includes five weekly hours of ABA provided by a behavior analyst, maintenance of a full-time aide (approximately 30 weekly hours), and psychological support for the kindergarten teacher and the child's parents. The behavior analyst prescribes and delivers the intervention and trains the aide to extend the intervention throughout the week. This working model is limited to 10 to 12 weeks of service, and fading processes begin from week six and on. Every semester, the municipal education leadership team nominates the four most challenging preschool students to receive the service. In three years of implementation, less than 25% of the referred students were placed in special education settings in first grade. Consumer satisfaction reports (i.e., kindergarten psychologist, teachers and aides, students, and their parents) are excellent.

The preschool service model represents the variation needed for ABA services to expand and to be selected for further adoption. Nevertheless, variation has not ended here. ABA practices and additional ideas continued to prosper with the success experienced.

The special education superintendent deputy proposed an ABA service model to the city general education superintendent of elementary schools. The general education service model proposal entailed the idea of recruiting a behavior analyst professional to join the school staff. The purpose of the initiative was to provide support for typically developing students (and their educational teams) in general education who have challenging behaviors and who are at risk for academic and social failure. The school principal and staff choose the students and teachers to receive the service. Similar to the special education model, each intervention is composed of three weekly service hours across at least two contact points with the consumers (i.e., student, teacher). Mentoring and supervision is provided by the behavior analysis expert.

The general education model is not mandatory. Rather, it operates on a voluntary basis. School principals are not obligated to include ABA services in their school. Instead, they need to ask for this service to be provided as one of the available therapies in school and to fund it. To incentivize principals to hire behavior analysts, the superintendent and deputy successfully advocated and landed matched funding (by the municipality) for each participating school. For example, if a school provided 4 to 5 weekly hours position, the municipality matched it with an additional 4 to 5 hours. The school then sustains 9 to 10 hours of ABA that can aid three students simultaneously. During the first year of the project, four schools participated in the initiative. On its third year, a total of 10 school principals requested the service. Demand exceeded supply, and two school positions were unfulfilled due to shortage of qualified behavior analysts.

The three ABA-infusion models detailed above are unique to the city of Holon. They are not representative of the status of ABA in schools across the state of Israel. Most other cities are presumed to be in more premature phases of this evolutionary process. Nevertheless, they arguably provide a progressive portrait of the evolution of a cultural of ABA. They illustrate evolution of growth of ideas, practices, and values. During the course of four years, the values that

have evolved are the values of appreciating and practicing ABA as a viable treatment for various students; understanding that learning is optimized when directed, planned, reinforced, and should not be left to chance; and establishing proper learning processes composed of modeling, practice, and reinforcement until achievement of mastery with any skill to be learned, be it academic (i.e., mathematical operation) or social (i.e., self-control). These are ABA *norms* that begin to be salient in the city. Objectively, they are yet to be adopted in each and every school and may not be shared by every member of the sub-cultures in the city. Nonetheless, they begin to be more widely known and embraced than unfamiliar and opposed.

It is important to note that the evolutionary process is not always linear. Skinner argued that what may be good for one culture may not be as good for another. We experience it in the differences between schools. ABA services in particular schools were selected by their principals, teachers due to reinforcing contingencies in the form of student and teacher success. Those are the schools where ABA service has thrived. In other schools (i.e., sub-culture), ABA did not flourish. Case interventions were not as successful in these settings, and the behavior analysts were not able to supply compelling evidence to gleam the merit of the service. Most challenging sub-cultures in this category are those schools whose members (i.e., teachers, principal) have negative predispositions of ABA. It is not uncommon to experience conflicts between their educational or therapeutic ideology and what the behavior analyst brings to the table. The result of these conflicts typically interferes with efficacious treatment. Cooperation with the behavior analysts is low, and sometimes, antagonism is prominent.

Looking to the future, an important question is whether the ABA culture in schools will survive and continue to thrive, or perish. Related to this question, Skinner premised that cultural contingencies are dynamic and that they change over time. Analyzing the school as a sub-culture, many changes occur over the years. Students advance through the grade levels, their physical environment is altered, classroom teachers and educational teams change, and assignment of paraprofessionals may be different. Key decision-makers also change, and fundamental shifts may occur. Superintendents, administrators, and principals change positions and others come along. In Holon, we were fortunate that the incoming municipal director of elementary schools division had just concluded a position as a principal in one of the schools in the city. During her last year, she experienced collaboration with a behavior analyst who was able to significantly aid a student with autism in an inclusive general education classroom. Success with this student was extraordinary and later left a major positive impression on the new incoming director. From her first day in the position, the director obtained funding for the hiring of behavior analysts to work in general education elementary schools. We also receive increasing calls from principals requesting behavior analyst positions in schools, just as each school has a counselor for example.

These samples suggest survival and even growth of a culture of ABA school services. Nonetheless, for the culture to endure its growth and survival, it has to continue to meet the needs of the members of the community, to help them attain what they want, and to avoid risky and dangerous situations. For example, school teachers wish for children to engage in the schooling process appropriately, continuously, and productively. Challenging behaviors, for instance, are often in the way of that process. The treatment provided by our behavior analysts is effective in promoting the desired schooling process. In other words, behavioral intervention must be efficacious for ABA to continue to be selected as a preferred service.

Inspired by Skinner's writings, this article represents my personal analysis and interpretation of how ABA culture has evolved in one of the cities in Israel. It is my assumption that other communities may share a similar evolutionary stage and experience similar struggles. Therefore, I wish to conclude with a final assumption by Skinner. A culture can begin to emerge by way of imitation of people's repertories and practices. Said another way, members of other communities (e.g., other cities, other communities around the world sharing the same evolutionary stage) who wish to establish school-setting ABA services should imitate practices enacted by those who have already established the initial evolutionary steps. Then, strive to demonstrate sustained efficacy in order to be selected by the school contingencies.●

profile

# Dennis Embry and the Good Behavior Game

by Kaitlynn Gokey, MS, BCBA
and
Josh Pritchard, Ph.D., BCBA-D

*Dennis D. Embry, Ph.D. is senior scientist at PAXIS Institute in Tucson and a co-investigator at Johns Hopkins Center for Prevention as well as co-investigator with the Promise Neighborhood Research Consortium, the University of Manitoba, University of South Carolina. Overseeing 50 major prevention projects in the US and Canada, he is a member of the SAMHSA/CSAP experts group and a nominee for the President's Advisory Council on Prevention for Health Care Reform. Current publications emphasize achieving sustainable, cost-efficient population-wide prevention effects across physical, mental, emotional, and behavioral disorders. He is an emeritus National Research Advisory Council Senior fellow of New Zealand.*

As a child, Dr. Embry was evaluated as educably mentally retarded. His rise from this to a doctorate is inspirational but may possibly be overshadowed by his phenomenal achievements in the area of maladaptive behavior prevention. Dr. Embry's early interests were in the area of safety—an interest that continues to this day through his role as a prevention scientist. This interest first focused on street-based safety. Vehicle versus pedestrian accidents are currently the third leading cause of death in the industrialized world and are an entirely preventable cause.

When Embry first began to examine this phenomenon, the primary source of data was official police reports. However, these reports proved to be misleading. The records stated that accidents occurred while the pedestrian was "crossing the street." Enter the value of science: observation. Upon observing children at play, Embry realized that a more accurate description would be 'running into the street,' often chasing balls and runaway Big Wheels. As any parent knows, this behavior is a potential concern for any child and needs only be emitted once for dire consequences to occur. What was needed, Embry noted, was a technology that every home could use, a universal precaution. Ecological evaluations identified a potential tool readily available in every home: storybooks.

Storybooks offer great potential for creating rules and modeling appropriate behavior with text descriptions and graphic depictions. The search for what makes a storybook an effective tool quickly became the subject of Embry's dissertation, and he found that the key lay in the use of pictures and dialogic presentation. Through this experience, he discovered that if they created a storybook about the child, then the behavior described in the book showed up at home. These simple pieces of behavioral technologies or ingredients of a recipe for success, designed to promote generalization, were what he and Biglan later termed "kernels." The end result? A special book in which the student was made a hero for playing safely. Following a reading of the book at school, significant improvements were seen at home with sharp decreases in street-flirting.

As promising as these gains were, they did not last. Two weeks after completing a reading, the rate of unsafe behavior

slowly began to creep back up. Upon investigation, Dr. Embry found that the consequences in place were not maintaining the behavior change created by the book. Children that engaged in attention-maintained forays into traffic did not receive attention following safe play but reliably received reprimands and spankings following a dash. Parent training, including a parent storybook for use in the home and education on how to praise safe play, was successful. This success was later replicated in several New Zealand studies, including a larger scale study that followed 100 students via direct observation and strict measurements that even included near-miss events.

With this success, Embry began to grasp the potential for population-wide change. With the help and academic protection of his advisor, Don Baer, Embry formed his own non-profit organization and secured a grant to evaluate the procedures on a large scale. None other than Sesame Street came onboard the project, loaning their characters as models in a national field test in Head Start clinics.

The framing language used in the story books was successful and quickly adopted by other programs. In 1981, G. Roy Mayer modified the Safe Play script into the Peacebuilders Project. "I am a Safe Player" turned into "I'm a peace-builder; I promise to praise people; put-downs away." It's possible to run into someone who can still recite the entire Peacebuilders pledge from their experience in the 1990s … a powerful thing to witness, but, as Embry states, "I don't care what they say; I care what they *do* in the world."

His experience with these projects allowed him to see first-hand how important the accessibility of language and materials were to effective training and consistent, correct implementation, and the development of perhaps Embry's best-known tool: The Good Behavior Game. This game is an extinction procedure, not punishment or reinforcement. The Game is designed to change, to "fix," the delivery of reinforcement from peers; to short-circuit attention delivery for inappropriate or disruptive behaviors. This is a powerful demonstration of the Matching Law; it's so powerful that Embry recommends acting out examples of the Matching Law in action to establish buy-in.

In the late 1990s and early 2000s, the Good Behavior Game was introduced to Chicago in a multiple-probe design across 14 schools. The results showed that the Good Behavior Game was effective across settings and emphasized the importance of well-written kernels for effectiveness. In 2003, the first commercialized version of the game was published with Hzelton, and now, the Game is in over 8,000 classrooms in the United States and Canada alone.

In 2001, Dr. Embry was invited to visit Stanford once a month to assist in the creation of a consensus statement regarding prevention of behavioral disorders. Embry's approach was to identify the "active ingredient" and describe the evidence behind each needed as part of the prevention plan.

Fast-forward to March 2009 and the release of the Institute of Medicine report on the prevention of disorders. The report was ground-breaking, right on page one: *Mental, emotional, and behavioral disorders are completely preventable*. Just as important, if not as surprising, were the recommendations of effective prevention strategies: almost every strategy had roots in behavior analytic literature and practice. Of the listed techniques, the Good Behavior Game was among the most cited. This isn't surprising, considering the decades of randomized trials supporting its effectiveness.

Following the Institute of Medicine report, as well as Embry's 2004 and 2008 publications, interest in the Good Behavior Game and a behavioral approach to prevention exploded. The public interest could not have come at a better time as several states had developed a crushing problem of under-age sales of tobacco. The ineffective strategies in place (incarceration) were replaced with the Reward and Remind system, which focuses on putting a positive spin on changing behavior and emphasizes the use of reinforcement. The results were drastic. Initial work in Wyoming reduced the selling of cigarettes to minors from 55% of the time to 10% with similar results in the larger magnitude replication in Wisconsin and Kansas. Not only was this approach successful, it remained the only evidence-based approach to tobacco reduction.

It wasn't long before the government funded 20 more sites to use the behavioral kernel framework and Good Behavior Game to prevent maladaptive behavior. At the time, Dr. Embry had founded the organization Paxis, which was tapped to supervise 18 of those 20 sites. Paxis, dedicated to delivering consultation and training in positive behavior supports, such as the Good Behavior Game and the Reward and Remind system, achieved major re-

ductions in maladaptive behavior across all 18 of their sites, which proved to be a sustainable change. The remaining two sites did not fare as well with differences in implementation that may not have accounted for the functions of behavior or use in a school rather than clinical setting.

Once again, Dr. Embry was asked to expand his program's use. In 2012, he was tasked with rapid implementation of the program across several counties. He agreed with the stipulation that they create a high-grade documentary about the program in the process. This program was introduced to first-grade teachers and PAX partners and resulted in an over 80% reduction in problem behavior. The dramatic, speedy results were an early win for participants, a reinforcer for implementers and stakeholders alike. Even better, the early improvements had an effect reminiscent of *When Harry Met Sally*: outsiders witnessing the improvement begin clamoring for the program themselves.

Currently, a randomized trial of the Good Behavior Game is underway with first graders in Manitoba. This study easily dwarfs its predecessors in both scale and scope. Not only is the sample size a massive 7,000 students, but will include longitudinal components, tracking education, social services, juvenile justice, birth history, and other factors through the age of 18. In the United States, Ohio is moving towards state-wide implementation of the Good Behavior Game with over 150 schools already involved. To turn the Good Behavior Game into a true toolbox of knowledge and skills, community-based training—-using evidence-based kernels—-in addition to pre-service training specifically for teachers is underway.

The success of the Good Behavior Game lies not just in the kernels involved, but also in its robust effects. Redundancies and contingency plans are built into the design as insurance for significant, early gains. Data collection systems are simplified, and reliability is not over-emphasized. As the Good Behavior Game causes enormous improvements, an especially rigorous reliability score is not critical.

But perhaps the biggest component to its success and rapid adoption is its accessibility. Embry made this clear: "We've made such a mistake in insisting that our language is the only language. Dr. Skinner set out to make this a tool that everyone in the world could use. The same is true of Wolf, Risley, and Baer. Along the way, it got hijacked into being a special club that only certain people could be initiated."

The Good Behavior Game and the Reward and Remind programs present the science of behavior in a way that is approachable and understandable to those outside the field of behavior analysis. Embry has "translated" the literature in ways that re-brand the entire field and transform the way implementers see themselves. In other words, Embry creates "everyday scientists." This isn't such a radical idea: children display natural tendencies towards scientific exploration. Being an "everyday scientist" is a potent concept, one that strikes a chord with nearly everyone involved with the program.

When asked why he thinks his approach has been so effective at garnering support when other forays by behavior analysts have not, Embry suggests that: "People get that this is a powerful thing. We should capitalize on the utopian vision and then lay bare the theory undergirding this." When asked why he does what he does: "I make myself better and my world better. Completely consistent with [the] Skinnerian view on this."●

**Wikipedia:** The Good Behavior Game was first used in 1967 in Baldwin City, Kansas by Muriel Saunders, who was a new teacher in a fourth-grade classroom. Muriel Saunders, Harriet Barrish (then graduate student), and professor at the University of Kansas Montrose Wolfe, co-created the Good Behavior Game in 1969. Today, this study is among the most cited behavior change studies in the world.

Because of the name of the strategy, many assume the game reinforces "good behavior." That is technically not correct; the Game actually reinforces voluntary control over attention and reduces the susceptibility to accidental negative reinforcement from peers in the classroom. The Game has been scientifically proven to work for preschool-age children all the way through 12th grade students.

The Game works by positive peer pressure of 2-to-5 classroom teams, who work together to reduce inattentive, disturbing, disruptive, and destructive behaviors that interfere with learning and success. When the teams succeed, all the "winners" earn brief intrinsic activity rewards. While the teacher can define the behaviors to be reduced, the game can be just as effective when students define the behaviors to be reduced to make a better learning environment. Students teams win the game by having very low rates of disturbing, disruptive, destructive, or inattentive behaviors. The teacher must respond to such problematic behaviors neutrally and unemotionally, and the person who committed the breach is not called out or given "consequences." Rather, the team has a point against it, not the individual. The game is used during normal instruction—such as during lectures, seat-work, cooperative leaning, and even during transitions.

# TAGteach for Autism: The What and Why

techniques

By Martha Gabler M.A.
Silver Springs, MD

I am the mother of a nonverbal teenage boy with severe autism. I'd like to tell you a little bit about my family's journey with autism and a lot about the wonderful method known as Teaching with Acoustical Guidance (TAGteach). I will describe how TAGteach meets the three essential conditions for effective teaching (as delineated by B. F. Skinner), why this simple method is so effective for learners with autism, and how it can be a boon for autism families and autism professionals. At the end, I hope you will be inspired to try TAGteach for yourself!

**Our autism journey**

I love ABA (Applied Behavior Analysis) now but came to it by chance, not choice. The day my son was diagnosed with autism was the day that the world turned upside-down for us. It also ended up being the day that eventually brought us to ABA. After that fateful day, we had to deal with a devastating diagnosis, try to get services, find out that the best services (ABA) were out of reach, and then, figure out a way to move forward. We moved forward first with ABA and Verbal Behavior and eventually learned about Direct Instruction and Precision Teaching. Each of these made a huge contribution to my son's progress. I was amazed by these effective scientific methods for teaching and was astounded then (and still am) that they remain unfamiliar, under-utilized, and often inaccessible for most families.

A huge stroke of luck came when I stumbled onto Teaching with Acoustical Guidance (TAGteach). My son had many difficult behaviors; as soon as I read about combining an event marker with positive reinforcement, I realized I had found a way to teach him helpful skills. This turned out to be the case.

*Martha Gabler is the mother of a non-verbal teenager with severe autism. Martha lives in Silver Spring, Maryland with her husband and two sons. Her older son is at university pursuing a degree in mathematics. Martha runs a tutoring center called Kids Learning Workshop and is the author of two books for autism parents:* Chaos to Calm: Discovering Solutions to the Everyday Problems of living with Autism *and* Behavior Basics: A Primer for Autism Parents. *Martha writes articles to help other autism parents solve or prevent behavior problems at her blog:* www.AutismChaosToCalm.com.

**What Is TAGteach?**

TAGteach stands for Teaching with Acoustical Guidance. TAGteach is a teaching and communication method based on the scientific principles of ABA.

TAGteach enables extremely precise positive reinforcement of behavior by using an acoustical signal to "mark" a behavior at the precise moment the child performs the behavior! The acoustical signal is a short, sharp click sound made by a handheld device (the "tagger.") When the child performs the correct action, the parent/instructor immediately presses the button on the tagger and hands over a treat (candy, treat, token, praise, social recognition, or money) as a reinforcer.

**The Tag is a Conditioned Reinforcer**

After a few experiences of hearing the tag and re-

ceiving a reinforcer, the child quickly learns that the tag means good things are coming. He starts to look out for the sound, and more importantly, starts figuring out what caused this nice event to happen. The child then relies on the tag to tell him to do that good action again. At this point, it is possible to shape new behaviors in the child quickly and efficiently. TAGteach is so reliable because it meets the three essential conditions for effective teaching, as described below.

**The Three Essential Conditions for an Effective Teaching Program**

Over fifty years ago, B. F. Skinner described the three essential conditions of an effective teaching program. They are:

Immediate feedback
Moving at the child's pace
Learning in many small steps

Let's see how TAGteach meets each of these requirements.

**Immediate Feedback**


When learning a skill, immediate feedback on whether your response is correct or incorrect is essential to effective learning. Why? Because when you know instantly that you did something right, you feel success! You will do that good thing again, and you will be willing to try the next step because you have a history of success.

In contrast, delays in feedback lead to delays in learning. If feel uncertain, you won't know which action was correct. You won't feel confident when another task is presented. The delay results in confusion and dismay, which negatively affect learning.

**How does TAGteach deliver immediate feedback?**

With the "tag," the acoustical signal marks the correct action at the exact moment the child performs it!

In a TAGteach setting, the child (perhaps a child with autism or another disability) performs an action. If the child performs a desired action (for example, putting a puzzle piece in place, saying his name at an appropriate vocal level, or rolling a ball), the parent/instructor immediately "tags" the action with a tagger (the key acoustical signal in TAGteach) and follows up with a reinforcer (a treat or re-

ward to the child's liking).

Since the child receives the acoustical feedback (the "tag") at the split second she performs the action, she knows exactly what she did that is right! This is exhilarating for any child but especially a child with autism. The "tag" signals success! "Yes, you did it!" She feels happy, confident, ready to repeat that great action, and emotionally ready for the next step.

Thus, the tag provides immediate feedback to the learner, and TAGteach delivers on the first of these three essential conditions.

**Moving at the Child's Pace**

Dr. Skinner emphasized the need for students to learn at their own pace. Learning at her own pace is crucial for a child with autism. These children have so many sensory and emotional issues that the teaching process must respect their need for time to respond to and understand new stimuli.

Since children with autism often have problems with pre-cursor learning skills such as eye contact and imitation skills, it is important to teach these. Yet, eye contact, for example, can be a difficult task for a child with autism for a variety of reasons.

How does TAGteach allow the child to learn at her own pace?

By observing the child and waiting for her to act.

In a TAGteach environment, the focus is on observing the child and waiting for her to perform the desired action. In the teaching goal discussed above, the solution is not to force eye contact but to reinforce it whenever the child performs it. Eye contact, by its very nature, is a fleeting behavior. It is often just a flash and then it disappears.

TAGteach, with the quick "tag," captures each flicker of eye contact whenever the child chooses to perform it. If the child performs it only once a day or once a week, it will be reinforced at that rate. As the child gains comfort and performs the skill more often, it will be reinforced more often. TAGteach respects the child's ability to perform this behavior, and allows the child to build it at her own pace.

The TAGteach practice of observing and waiting for the child ensures that the child learns at her own pace, the second of Dr. Skinner's essential conditions.

**Learning in Small Steps**

The third essential condition for effective learning

is a carefully constructed program where the skill is taught in many small steps. The reason for this is to ensure that the child experiences success in the learning progression. Many successful small steps result in a confident, motivated learner.

How does TAGteach deliver learning in small steps?

With the "tag point" process.

The tag point describes the exact physical movement which will earn the "tag" and reinforcement. The tag

point must meet four criteria:

What I Want
One Criterion
Observable
Five Words or Less

Also, the first tag point must be set at the "point of success." This means that you start reinforcing a child for performing a behavior she can already do.

Let's go back to the example of teaching eye contact. We tend to think of eye contact as two people locking their eyes in a mutual gaze. Yet, this child may not be able to do that; in fact, she may keep her head turned away from people. The first tag point would not be "Looks at me," but may be, "Head turns one-quarter to front." So, every time she moves her head slightly towards her mother or an instructor, she earns the "tag" and reinforcement.

With time, practice, and patience, she will regularly turn one-quarter to the front, then slightly more until she is comfortable facing people directly. Once she is comfortable facing people, the tag points can be set for a progression such as "Eyes on my neck/chin," "Eyes on my cheek/nose," "Eyes on my eyes." After she is comfortable with the "Eyes on my eyes" tag point, you can work on duration until she is comfortable with maintaining eye contact. These many small steps take a child from avoiding eye contact to being comfortable with appropriate eye contact thus mastering an important learning readiness skill.

With the tag point process, any parent or instructor can start teaching a child a new skill. Start out with something the child can already do. When that is mastered, add one very tiny step to the process and reinforce that until the child is comfortable. Keep building from there.

TAGteach with the acoustical signal from the "tag" delivers on all three of the essential conditions outlined by Dr. Skinner. This is the reason for the success of TAGteach.

In summary, with TAGteach, it is easy to reinforce behaviors precisely and quickly. The immediate, accurate feedback and positive reinforcement result in the child performing the correct action more often and for longer periods of time. With immediate feedback and learning tasks broken down into small steps, children can learn many new skills with TAGteach at their own pace.

**Why Is TAGteach Ideal for Children with Autism?**

The acoustical signal gets around the common problems of sensory processing and speech processing in children with autism and offers precise, instantaneous reinforcement in place of slower, traditional verbal reinforcement.

**TAGteach gets around Sensory and Speech Pro cessing Problems**

TAGteach is ideal for children with autism because it gets around the sensory problems commonly associated with autism. Recent research tells us that children with autism perceive physical actions as happening faster than they do in reality and process speech sounds much more slowly. This places high sensory demands on the child because he has to try to coordinate fast movement with slow words—quite an obstacle to learning.

TAGteach cuts through the confusion. TAGteach uses one consistent sound (the "tag") to deliver one consistent message, "Yes! You are correct. Now, you are getting a reward." This clear and simple information makes a huge impact. The child quickly learns that the sound means reinforcement is on the way! He learns to look out for it and pay attention to what causes the reinforcement. When he is engaged with his environment and looking for reinforcement, you can start shaping behaviors.

**TAGteach Lets You Deliver Reinforcement on Time**

Slow, late reinforcement causes delays in learning. With TAGteach, you can mark a behavior instantaneously and reinforce it promptly. This speeds up the learning process.

Karen Pryor, author of *Don't Shoot the Dog*, has a beautiful description of why an audible sound is much better at "marking" a behavior than our spoken words:

> "…please note that the human voice is a very poor marker signal… too long, too slow, too variable, carrying too many confounding messages (your sex, your age, your mood, your health, etc.) and it also almost always late. Furthermore, you can't distinguish when you are a

mini-second late with your voice, but you CAN tell at once, without experience, when your click is late. (Karen Pryor, Penn State Listserve System, Standard Celeration Society, 18 May 2005).

For these reasons, TAGteach is effective in increasing skills in children with autism.

**TAGteach Has Great Potential to Help Autism Families**

To teach a child with autism, it is imperative to know about the use of positive reinforcement to build skills and the use of reinforcement schedules to maintain skills.

The beauty of the TAGteach method is that it takes this body of scientific knowledge and simplifies the teaching protocols to the point where non-experts can implement them, including grieving, overwhelmed, exhausted autism parents. TAGteach gives parents a way to put their keen observational skills to good use and to help their children learn functional skills. Everyone wins.

**TAGteach Has Great Potential to Help Autism Professionals**

There is so much potential to teach so many things with this beautiful method. TAGteach can be a wonderful complement to ABA and VB programs: Every time the child makes the desired response, tag and reinforce. The accuracy and clarity of reinforcement can speed up the learning process.

TAGteach is outstanding for working in the natural environment. As the child walks around, it is easy to mark and reinforce even the tiniest muscle flinch of touch, play, eye contact, or vocalization behaviors.

For teaching social skills, there is tremendous potential, especially with the "peer tagging" approach. In peer tagging, each participant in a small group is given taggers


to mark and reinforce the target behaviors of that particular session. As they observe and reinforce each other for the desired behaviors, they learn them faster and have a good time doing it.

I could go on but will stop here. I hope you share my vision of how TAGteach can help children, parents, instructors, aides, and professionals in the autism community.

There are so many creative applications possible; I've listed only a few here. We are limited only by our imaginations, so let's unleash them and get going! ●

**More Information About TAGteach**

TAGteach International website: www.tagteach.com.

techniques

# PECS: Picture Exchange Communication System

by Andy Bondy, Ph.D.
Newark, DE

*Dr. Bondy is an innovative leader in the field of autism and applied behavior analysis. He directed a statewide public school system for students with autism for 14 years. He is co-author of the PECS Training Manual. He also wrote the Pyramid Approach to Education, a training manual that offers an integrated orientation to developing effective educational environments blending applied behavior analysis with functional activities and create communication strategies. Dr. Bondy received his MA and Ph.D. from the UNC Greensboro and completed his clinical internship in 1976 at the University of Kansas Medical Center. Dr. Bondy has presented numerous papers, lectures, and workshops in regional, national, and international conferences and conventions on behavior analysis, PECS, and the Pyramid Approach to Education. He has remained active in research and writing and continues to develop new and innovative methods of helping children with autism and related developmental disorders.*

The Picture Exchange Communication System (PECS) was developed by Lori Frost, a speech/language pathologist, and me, a behavior analyst, in the late 1980s within a statewide public school system serving students with autism. The first publications in 1993 and 1994 provided descriptive information about the content of PECS and outcome data for children in the USA and Peru. Thus, from the very start, PECS was applied internationally. Currently, there are over 150 publications from over 15 countries providing a wealth of information about its application and effectiveness. There have been a number of reviews that have noted the evidence-basis for PECS. These reviews include one published by a panel of autism experts in 2012 in the journal *Pediatrics* that noted the following, "They agreed that applied behavioral analysis, integrated behavioral/developmental programs, the Picture Exchange Communication System, and various social skills interventions have shown efficacy."

While it is significant that PECS is viewed as effective, many people read this statement and conclude that PECS is separate or distinct from applied behavior analysis. The confusion has been enhanced in some countries that provide funding for staff and parent training for both ABA and PECS. Furthermore, because PECS focuses on communication, many speech/language therapists and special education professionals want training in how to implement the program with fidelity. Lori and I created an international company (with offices in 14 countries) to provide training and consultation report around the world, and we are approved to provide both BACB and ASHA CEUs for most of our workshops.

Obviously, PECS involves the use of pictures to foster the acquisition and expansion of verbal behavior. However, the key is the explicit use of teaching strategies developed within the field of applied behavior analysis to gradually build up a set of communication skills. The sequence of the six Phases of PECS was designed to reflect Skinner's analysis of the fundamental verbal operants. We published with Matt Tincani a detailed article describing multiply-controlled verbal operants within the PECS protocol in *The Behavior Analyst*. We believe that a key factor in the successful application of the PECS protocol around the globe is the availability of The PECS Training Manual (currently translated into 11 languages,) which guides readers through the systematic application of a variety of behavioral teaching strategies, including a section regarding Skinner's analysis of verbal behavior.

The PECS protocol is unique and has been used to teach other forms of verbal behavior, including sign language and the use of electronic devices. One crucial aspect of all verbal behavior is that the form of the behavior must

be controlled by the presence of another person. Doing something to a picture is not the key; doing something to another person who in turn provides reinforcement is the central feature of each verbal operant. Thus, the first Phase of PECS seeks to teach the learner to exchange a single picture of something known (by past behavior) to be rewarding. The exchange guarantees an interaction. Pointing to or even tapping on a picture does *not* guarantee an interaction with someone else. Once this skill is demonstrated, the second Phase seeks to promote generalization across people, environments, and reinforcers. The third Phase introduces discrimination, often beginning by pairing a picture of a reinforcer with a picture (and item) that is non-preferred. A variety of discrimination strategies and error-correction strategies are suggested. Then, discrimination between equally reinforcing items is taught, using a correspondence check so that the learner selects items that correspond to pictures offered.

The next Phase involves beginning to teach a sequential lesson involving two icons: one that relates to an item and one connected with how the other picture functions. In other words, a picture of a cat may be used to request/mand or to comment/tact. Therefore, a PECS user will eventually use "I want" when requesting versus "I see/hear/etc." when commenting. Before we can teach the discrimination between sentence starters (in English grammar), we begin with this simpler lesson on sentence structure for the request. Once the PECS user has demonstrated the construction and exchange of the "sentence strip" their communicative partners may use a delayed prompt strategy (between tapping on the two icons) to promote vocalization. Several publications have noted that for those children who begin (or expand) speech after starting on PECS, it occurs most frequently within this phase.

After the development of this simple sentence format, the PECS protocol suggests working on a variety of attributes that help specify features of reinforcers that are most important to the learner. For example, some children may pick out all the red candies from a tray. At this point in the protocol, we would help the child learn to construct, "I want red candy." This lesson is typically more for motivating to learners than ones such as "Touch the red card" because these lessons usually result in less preferred social outcomes (e.g., "Good girl!"). Next, users are taught to respond to simple questions, such as, "What do you want?" Finally, the PECS protocol suggests working on responsive and then spontaneous comments (i.e., intraverbal-tacts prior to pure tacts).

In terms of Skinner's analysis of verbal operants, the changes from one Phase to another in the PECS protocol involve modifications of either an aspect of stimulus control or reinforcement and never require changing two things at once. Without an understanding of the role of reinforcement, no one would effectively teach the PECS protocol. Without the use of systematic teaching derived from the field of behavior analysis, effective development of PECS skills is unlikely. We believe that the field of behavior analysis can help all professionals and parents improve the likelihood of achieving the educational/behavioral goals they set.

Over my years of guiding the provision of educational services for all students with ASD within one statewide program in America, I designed the *Pyramid Approach to Education* as a way to organize how to create effective educational environments. Every PECS workshop begins with a review of the key elements that reflect broad spectrum and functionally-oriented applied behavior analysis. The *PECS Training Manual* depends upon the systematic application of the Pyramid Approach. Therefore, everyone who reads the PECS manual is provided with a clear perspective on the importance of applied behavior analysis and how the work of Skinner is the underlying basis of the PECS protocol. ●

profile

# George Sugai, Ph.D.
# University of Connecticut

interview by Sheila Habarad

*Professor George Sugai received his M.Ed. in 1974 and Ph.D. in 1980 at the University of Washington. His primary areas of interests are positive behavior support (PBS), systems change, personnel preparation, behavioral disorders, social skills instruction, behavioral consultation, behavioral assessment procedures, applied behavior analysis (ABA), and strategies for effective school-wide, classroom, and individual behavior management. Currently at the University of Connecticut, Dr. Sugai is Carole J. Neag Endowed Chair in Behavior Disorders and professor with tenure. He has taught graduate-level special-education courses in applied behavior analysis, emotional or behavioral disorders, behavioral consultation, social skills instruction, and classroom/behavior management. He is Director of the Center for Behavioral Education and Research in the Neag School of Education, which focuses on research and outreach activities related to promoting effective academic and social behavior supports. Dr. Sugai has presented at numerous local, national, and international conferences and professional meetings and has served as advisor to the U.S. Departments of Education, Justice, and Health and Human Services. His international work includes projects in Jamaica, New Zealand, Australia, Spain, and Canada, and invitations to present in Japan, England, Netherlands, and Denmark.*

*As Project Director or Co-Director of major training or research grants totaling over $60 million, Dr. Sugai has ample experience in the implementation, operation, and supervision of grant-related projects. Dr. Sugai has a noteworthy publication record in refereed journals. He has published over 140 peer-reviewed articles, numerous monographs, and five college textbooks on effective teaching practices and ABA. Dr. Sugai's research emphasizes effective applications of ABA principles and PBS procedures to problems experienced in educational contexts. The subject populations include students with severe challenging behavior, students with at-risk behaviors, and students described as having severely challenging behaviors. His recent work has focused on school-wide student populations related to school climate, culture, and leadership.*

*Dr. Sugai is currently co-director (with Rob Horner at the University of Oregon and Tim Lewis at the University of Missouri) of the National Center on Positive Behavioral Interventions and Supports. The Center has been established by the Office of Special Education Programs, U.S. Department of Education to give schools capacity-building information and technical assistance for identifying, adapting, and sustaining effective school-wide disciplinary practices. The Center has two foci: (a) broad dissemination to schools, families, and communities about a technology of school-wide positive behavioral support exists and (b) demonstrations at the level of individual students, schools, districts, and states of effective and feasible implementation of school-wide positive behavioral support.*

*He also co-directs (with Mary Beth Bruder) the OSEP Early Childhood Personnel Center (www.ecpcta.org). This Center facilitates the implementation of integrated and comprehensive early childhood systems of personnel development (CSPD) for all disciplines serving infants and young children with disabilities.*

My undergraduate degree is in botany from the University of California Santa Barbara. In the 60s, I was heavily influenced by the war protests, environmentalism, and "hippy" movement, and I had visions of doing good things for our environment. In the summers of 1971 and 1972, I took an Easter Seal camp counselor job in large part because the camp was located in the beautiful redwoods of the Santa Cruz Mountains. I knew nothing about kids and adults with muscular dystrophy, cerebral palsy, polio, and Down Syndrome and with whom I would be responsible for six days a week for 24 hours per day. It was one of those wonderful "life-changing experiences," and I decided to work with kids with disabilities … instead of trees. Immediately after finishing my degree in botany, I received my Masters in Special Education in 1974 at the University of Washington (UW) where Rick Neel introduced me to educating students with behavior disorders. With special education teaching certificate in hand and the new special education law (94-142) in place, I accepted a new special education position in Aurora, Colorado, where I and a group of brand new special educators developed the first Behavior Disorder resource room programs in the public schools. We wrote some of the first ever Individualized Education Programs (IEPs) for students with behavior disorders. I can't say that these IEPs were very good or that we knew what we were doing with them. However, we learned a lot, and my training from the UW kept me afloat. I taught for four years and then went back to Washington to get my doctorate, where I had the privilege of learning from Rick Neel, Owen White, Gene Edger, Norris Haring, Joe Jenkins, Felix Billingsley, Kathleen Liberty, and Tom Lovitt … all Precision Teaching (PT) folks.

Don Bailey and Mark Wolery were in my doctoral cohort and were responsible for shaping my understanding and skills in behavior analysis. Although they were far more fluent behavior analysts, Mark and Don invited me to co-author a book in 1988, *Effective Teaching: Principles and Procedures of Applied Behavior Analysis with Exceptional Students,* which was our attempt to merge PT and ABA for applications in school environments. This book and working with Don and Mark were highlights of my early career. Unfortunately, the book wasn't widely adopted in general education because it may have been a bit too behavioral for that time, especially PT and ABA together.

***Do you feel that you've been influenced by Skinner's work, and if so, in what ways?***

Absolutely. As I mentioned, I was a botanist, and as a botanist, I was immersed in the scientific method and became quantitatively oriented. To complete my degree, I was required to take an introduction to psychology course for which I read *Walden Two* and *Science of Human Behavior.* These books fit so well in the 1960s counter-culture movement of the time and with my science training. Skinner's studies were perfect applications of the scientific method. So, when I went to University of Washington, I got to study with behavior analysts who were directly and indirectly mentored by Skinner and who continued that emphasis on data-driven decision-making. Together, we read Skinner's writings, which left a great impact on me and continues to influence my work.

***In his book* Upon Further Reflection *Skinner takes into account the main differences between behavior science and cognitive science which, in those days at the beginning of the 80s, positioned itself as the "revolution" supposedly "overthrowing behaviorism." Taking into account behavioral science and cognitive science, what is your position towards cognitive science as a behaviorist?***

First, I view myself as a staunch behavior analyst. However, I have experienced difficulty communicating the concepts and practices of PT and ABA within public school environments. That is, the ABA terminology seems to slow practice acquisition. Fortunately, I learned about what might be possible from works such as *Behavior Analysis for Effective Teaching* (Vargas, 2013, 2009) and *Behavioral Psychology for Teachers* (Vargas, 1977), which

seemed to get us closer to the general education community. I know that I have dipped into cognitive language, which has helped me gain access to non-behaviorally oriented individuals; however, I have not done an adequate job of teaching the behavioral practices to high enough levels of fluency to avoid the acquisition of behavioral misrules, and criticism is expected.

To some degree, I acknowledge some cognitive behavioral therapy (CBT) practices, especially those derived from clinical behavioral applications. Doing so has allowed us to work with teams whose members are not behaviorist. However, I remain grounded in the ABA perspective of verbal behavior in my analysis and implementation of CBT. I do not view myself as a cognitive behavioral therapist at all, but I sometimes like to "cheat" and say that I am because conversations are occasioned that we might otherwise not have. Some CBT therapies seem to have some legs, that is, supporting data are available. However, I think we can still describe and analyze with ABA; so, I am okay with it if educational or therapeutic benefits are achieved, and we hold ourselves responsible for learning failures.

***... although we did not overtly use ABA language, we developed the PBIS logic and framework using ABA principles.***

***How do you relate Positive Behavioral Interventions and Support (PBIS) to a behavioral science rather than a cognitive science? Do you try to make a distinction between PBIS being a behavioral science versus a cognitive science?***

PBIS was first coined with the reauthorization of the Individuals with Disabilities Education Act (IDEA) in 1996. In that law, funding was designated for a technical assistance center, referenced in IDEA as the Center for Positive Behavior Interventions and Support (PBIS). When Rob Horner and I at the University of Oregon were fortunate to get the grant, we actually suggested changing the name of the Center because PBIS did not exist before this law. However, PBIS was in IDEA, and the name was used.

The Center was charged with providing technical assistance to schools, districts, and states to enhance the educational and behavioral outcomes for kids with disabilities and with behavior difficulties. Within the first three years, we quickly learned that working with individual students required working more with the adults in classrooms and schools. Within and regardless of the PBIS terminology, we were agreed amongst our Center partners and collaborators that we would stick with our behavior analytic roots. Therefore, although we did not overtly use ABA language, we developed the PBIS logic and framework using ABA principles.

During the first 10 years of the center, we developed a school-wide PBIS framework based on a multi-tiered system of behavioral practices and supports. The core practices within and across tiers reflected our ABA traditions and technologies. For example, social skills training logic is based on the development and transfer of stimulus control and firmly grounded in Direct Instruction and PT. When we encourage school staff to use positive reinforcement, we ask them to say what the student has done when and where and provide a positive acknowledgement. PBIS has been characterized as a watering down of ABA; however, we suggest that PBIS is among the best examples of scaling up ABA in the general public schools. Using ABA to support individuals with autism is another good example. The PBIS Center has documented implementation efforts with more than 21,000 schools, many of which don't realize they have embraced behavior analytic practices.

So, I'm pretty comfortable with the PBIS vocabulary and concepts because it has allowed us to move the behavioral technology into general education settings more quickly than if we taught about teaching stimulus control and using positive reinforcement. We gave and taught educators the practices and reinforced their use of those practices when they got certain kinds of outcomes. In addition, an important focus has been on fidelity or accuracy/fluency of implementation. We have found that the more accurate and fluent the implementation by educators, the better

the outcomes for students, which is experienced as a positive reinforcer by educators, hopefully maintaining the use of those practices.

Despite the relative success and benefits associated with implementation of the PBIS framework, questions and criticism still occur because we don't use ABA language overtly. In fact, just a month ago, I was asked if promoting PBIS is watering down ABA. My response is that as long as the people are implementing with fidelity, monitoring student outcomes continuously, establishing systems that support and maintain its use, and benefiting students, I am satisfied. Admittedly, one challenge that continues is the modification of the practices and systems of PBIS beyond our ABA technology.

***In spite of the deep differences that characterize the two sciences, behavior analysis and cognitivism, we are witnessing a growing upsurge of a combination or linkage of the terms, particularly in professional areas concerning social work and psychotherapy. In fact, it is now common to see in advertisements, post-graduate courses, psychiatrist wards, and institutions for disabled that the "cognitive-behavioral approach" is applied. The layman may overlook this apparent incongruence, which nevertheless deserves some clarification. Can you tell us some more about it?***

I have had less experience with the cognitive behavioral "approach" per se … or maybe, I've chosen to ignore it. As I mentioned earlier, I have more experience with school and clinical psychologists who have emphasized empirically validated cognitive behavioral therapies or practices, especially when grounded in our understanding and analysis of verbal behavior.

***Those of us who belong to the behaviorist community know that there are difficulties in understanding or, worse, accepting the concepts and implications of radical behaviorism. Parts of them are due to technical reasons, such as operant conditioning, schedules of reinforcement, and the like, but part are due to more complex social reasons linked to our cultural conceptions and practices. There are language uses that seem to bring us inexorably back to an inner agent, to free will, to information processes, and ideas forming—all concepts we should go "beyond" as Skinner suggests. Religion and law institutions appear to be particularly impervious to any possible shift in view and practice. Are there more effective approaches to face this problem that have not been exploited enough?***

I'd like to give you some examples first. Partners within the PBIS Center started off by focusing on kids in special education, classroom management, and school discipline. Due to our accomplishments with that work, the federal government asked us to work in other areas, such as school climate, bullying, school safety, social and emotional learning, character education, and racial disproportionality. To facilitate these requests, we applied an ABA perspective. For example, many school climate surveys focus on students, staff, and family perceptions (verbal report) of safety, belonging, etc. We thought it might be useful to identify what kids and adults do in environments that are labeled as negative or positive school climate. Then, we ask what schools might do to promote and/or maintain those student and staff actions related to positive climate. We then ask, "What will it take to change the environment?" so that those skills/behaviors can be occasioned, taught, and strengthened.

Two everyday examples should be mentioned. The first is a Dairy Queen drive-in marquee that reads, "Scream until your dad stops the car." We use this example to illustrate what maintains a negative school climate. When a kid screams, daddy gives ice cream, and the screaming stops (positive and negative reinforcement). This is the equivalent of the situation in which a student says, "I don't want to do the work," the teacher sends the student out, and the complaining stops. Using these kinds of examples facilitates the adoption of behavioral solutions.

The second example comes from a book called *The Power of Habits* by Charles Duhigg. He talks about good and bad habits that people have as being explained, understood, and changed by similar mechanisms. The part that I like is that he describes a habit as consisting of a cue, a habit (behavior), and a reward – our basic three-term contingency (antecedent, behavior, consequence). Using the habit analogy helps teachers and administrators to under-

stand how behavioral science can explain behavioral difficulties in either kids or adults and that assessments and interventions must consider antecedent and consequence conditions.

We approached school climate, bullying, and nonattendance, for example, from a three-term contingency perspective, and conduct functional assessments, operationally describe behaviors, and develop behavioral intervention plans. Our approach has always been to present the analysis in a way that is understandable to the general community and then create an intervention that seems feasible based on that interpretation. Again, it's not teaching behavioral concepts directly, but rather modeling the approach.

***Administrators and students in education leadership also need to learn about ... behavior analytic procedures and the systems that are required to support their accurate, fluent, and sustained uses.***

***While in some fields it looks there have been significant progress, education and schooling in general appear to have been relatively left out. Some important steps have been taken, such as that of Julie Vargas with her recent book,* Behavior Analysis for Effective Teaching, *addressed to teachers. Still the terrific potential of programmed instruction has not been developed and valued enough. Public schools are reluctant to adopt the methodology, but are there private institutions where the practice is used with success?***

I think our demonstrations and documentations of what is possible have increased the acceptability of the behavioral sciences in education. However, we have a ways to go to suggest that we have a viable and sustainable approach to taking ABA to scale. The amount of prompting and the schedules of reinforcement that we have had to provide to maintain implementation is above what we'd consider sustainable and generalizable. Our trainers have touched more than 21,000 schools; however, there are more than 100,000 schools in the U.S. We're happy with the behavioral spread of PBIS, which is probably better than other approaches, but we'd like to go farther.

I think we're struggling because we don't train preservice personnel very well, such as general educators, counseling psychologists, social workers, school administrators, etc. In some programs, we do a reasonable job with special educators and school psychologists. Both preservice, in-service, and on-going professional development will need to adopt a behavioral sciences perspective. Similarly, national associations, accreditation agencies, federal policy makers, etc. will need to emphasize a more behavioral perspective.

***What do you think we would need to do to spread behavioral science in education throughout the country? We cannot forget what Skinner straightforwardly called "the shame of American education."***

Teacher and other personnel preparation programs need to be better grounded in our behavioral sciences, and teachers need to have opportunities to increase their teaching competence (academic and behavior) to high levels of fluency that are resistant to extinction. If we are going to spread our behavioral technology, we have to become more involved in general education teaching and leadership training. Those two areas may have the biggest effects on shaping what happens in classrooms and schools.

In addition, new teachers and administrators must move into schools that model best practices. When a new teacher leaves college, they quickly adopt whatever practices and behaviors are being used in the school regardless of their training, especially with respect to classroom behavior management. I think Morningside is a great example of what we'd love schools to look like. Why can't more schools look like Morningside? Where every minute is dedicated to teaching and learning, where Direct Instruction is emphasized, where social skills are being taught more explicitly and reinforced continuously. Where students receive more positive feedback than negative. In our public

schools, it's just not happening right now at the level and intensity required. When I was at University of Oregon, we taught the classroom management course for teachers and for administrators. We were able to teach about token economies, positive reinforcement, data decision making, function-based intervention development, and contingency management systems. Administrators and students in education leadership also need to learn about these behavior analytic procedures and the systems that are required to support their accurate, fluent, and sustained uses.

***Skinner often speaks of behavior science and the philosophy of that science (*About Behaviorism *was an example of the treatment of that philosophy); hoping that there would follow a conspicuous increase in research in amplitude and complexity. We wonder if there has not been instead a reverse of the desirable situation with a preoccupying shortage of laboratory work. Can you give us a picture of the current situation in this sense?***

I'm an applied researcher and probably have not been as appreciative of the experimental research as I should. Although I don't always understand the details, I like studying experimental research because it informs my theory and occasions applications in the classroom. From my perspective, classrooms are rich places that present endless applied situations and problems to be studied.

***As the famous metaphor goes, we have climbed upon the giant's shoulders and should be in the position to have an ampler and clearer view of the field. Our beloved giant, drawing a conclusion at the end of a book that collects a number of commentaries to his works writes (I quote from* The Selection of Behavior: The Operant Behaviorism of B.F. Skinner, Comments and Consequences, *A.C. Catania& S. Harnad, 1988): "Why have I not been more readily understood?" – and continues – "The central position, however, is not traditional, and that may be the problem…To move from an inner determination of behavior to an environmental determination is a difficult step." Now, I ask you, are we more equipped to overcome this difficulty? Have we better chances of interacting with other sciences and disciplines such as economics and politics in order to make them more effective and socially helping?***

I have spent a big chunk of my career working with kids and studying how we can improve their educational outcomes, and clearly, that is where the action is. However, our work at the National Center has pushed us to enhance systems that occasion and reinforce the actions and practices of teachers, school psychologists, administrators, etc. We find ourselves at the state and federal levels shaping policy, legislation, evaluation, and implementation. In that work, we have tried to apply our same behavioral sciences and technologies to the behaviors and actions of policymakers. Again, I don't think our focus has been to convert them to behaviorism but rather to increase their understanding of how we analyze a situation or an issue and how we use that information to arrive at a solution. We try to model those two things. If we are going to influence those who make policy and legislate them, we model, demonstrate, and document what is possible. That is a long way of saying that my attempts to persuade someone to move from an inner to environmental deterministic tradition have not been positively or negatively reinforcing and that we may be more successful by modeling what is possible.

I'm lucky because my early training was in botany where the experimental method and tradition were emphasized. Not only did this preparation ease my entry into my special education experience at the University of Washington, it also facilitated the acquisition of PT, ABA, and Direct Instruction. If I ever had to run a teacher training college, I would make every student become a biologist, physicist, chemist, or some type of physical scientist because the scientific method gets people to give priority to functional relationships, teaches them about measurement, gets them into experiments with systematic manipulations and replications, and demands an explanation and confirmation of the mechanisms. These same competencies have important generalizable applications to the world of teaching and learning and model what we do in our behavioral sciences. ●

profile

# Natália de Mesquita Matheus, Ph.D.

## Brazilian Association of Psychology and Behavioral Medicine (ABPMC) First Secretary of the Board

### interview by Bruna Colombo dos Santos

*Natália de Mesquita Matheus has a degree in Psychology by Pontifical Catholic University of Sao Paulo (PUC-SP). She earned both her Masters and Ph.D. from PUC-SP. Her Masters degree was obtained in Program of Graduated Studies in Experimental Psychology: Behavior Analysis. She earned her doctorate degree in Program of Education: Educational Psychology. Currently, she is an instructional design consultant in the group of Education Technology Management of Carlos Alberto Vanzolini Foundation. Natálie teaches at the Paradigm Center of Behavioral Sciences. Her research interest is in behavior analysis and education with an emphasis in educational politics. Natália serves on the board of the Brazilian Association of Psychology and Behavioral Medicine (ABPMC) as First Secretary.*

*Natália de Mesquita Matheus possui graduação em Psicologia pela Pontifícia Universidade Católica de São Paulo (PUC-SP). Cursou mestrado e doutorado na PUC-SP, sendo o mestrado no Programa de Estudos Pós-Graduados em Psicologia Experimental: Análise do Comportamento e o doutorado no Programa de Educação: Psicologia da Educação. Altualmente, é consultora em design instrucional no grupo de Gestão de Tecnologias Educacionais da Fundação Carlos Alberto Vanzolini e professora no Centro Paradigma de Ciências do Comportamento. Seu interesse de pesquisa é voltado para Análise do Comportamento e Educação, com ênfase em Políticas Educacionais. Desde janeiro de 2015, Natália faz parte da diretoria da Associação Brasileira de Psicologia e Medicina Comportamental (ABPMC), como Primeira Secretária.*

**Tell us a little bit of your academic history in psychology. How and when did you become interested in behavior analysis?**

My degree in psychology at Pontifícia Universidade Católica de São Paulo (PUC-SP) is very democratic regarding theoretical approaches. We studied many disciplines in the first year of the program. Since the beginning, in the first semester, I thought that the experimental approach to explaining the phenomena that are treated as psychological is very interesting. I confess that I also felt myself attracted to other approaches, but it was more curiosity than interest in using them professionally. I was confident in my preference with behavior analysis during my third year at the Psychology College after I had studied other theoretical disciplines.

I took a course on parental styles, where we studied the short- and long-term consequences of parents' behaviors in children's behaviors. This approach was inline with the educational theme from the very beginning.

**Inicialmente, gostaria que você contasse um pouco sobre sua trajetória acadêmica dentro da Psicologia. Como e quando você se interessou por Análise do Comportamento?**

A graduação em Psicologia na PUC-SP é bastante democrática em relação às abordagens teóricas, temos muitas disciplinas de diferentes abordagens nos primeiros anos. Desde o início, logo no primeiro semestre, eu achei muito interessante a abordagem experimental para a explicação dos fenômenos ditos psicológicos. Confesso que eu também me atraía por outras abordagens, mas era mais curiosidade do que interesse em utiliza-las profissionalmente. Foi no terceiro ano da graduação, quando já tinham acabado as disciplinas teóricas obrigatórias e podíamos escolher eletivas que eu acabei tendo certeza da minha preferência (ou identificação) com a Analise do Comportamento.

Fiz uma disciplina de estilos parentais, onde estudávamos as consequências a curto e longo prazo que os comportamentos dos pais produziam nos comportamentos dos

**Inside behavior analysis, you have demonstrated a special interest in education. Tell us how this interest developed.**

I can say that before my entry into Psychology College, I considered a degree in Pedagogy, but I gave it up. I attended a discipline of licentiate about Education Philosophy that was very provocative. But if I had to choose a point of my formation, I would also give credit to the curriculum of PUC. I had an obligatory internship during my fourth year. The internship focused on four areas: education, health, organization, and clinic. The education internship with supervision in behavior analysis was an amazing experience. I learned a lot about the approach of applying the science of behavior analysis to teaching. I witnessed the results of an individualized teaching program that changed the lives of two children in an educational socio-nucleus (a place to assist children of public municipal school during the period in which there were no classes). Inspired by the principles of the science and the results that occurred, I decided that I wanted to work with teaching and education.

**Your research in both your Masters and PH.D. coursework were about education, more specifically about Brazilian educational politics. What were the main objectives and contributions of these researches?**

In my Masters I had a unique objective as a researcher: to verify whether or not what Skinner said during his life about education was compatible with Brazilian political proposals. I chose a federal decree and the proposal was the analysis of compatibilities in a theoretical study. The major contribution showed that Skinner's proposals for education, which he began to write in the 1940s and continued until the 1980s, are compatible with what is recommended in the Federal decree analyzed.

The research I conducted during my doctorate differed. First, I analyzed the decree. The decree prescribed an enormous group of actions to improve national education. The initial proposal included taking an almost experimental approach to identify what actions (or group of actions) appeared that systematically correlated with improvements in educational results (specifically in IDEB, the Development Index of Basic Education, an indicator developed by the Education Ministry to measure the qual-

filhos. Foi uma aproximação pela tangente do tema educacional desde o início...

**Dentro da Análise do Comportamento, você tem demonstrado especial interesse pela interface desta Ciência com a Educação. Conte-nos um pouco sobre como se deu este interesse especifico.**

Posso dizer que antes de entrar na faculdade de Psicologia eu cheguei a cogitar a graduação em Pedagogia, mas acabei desistindo. Fiz um disciplina de licenciatura, de Filosofia da Educação, que foi muito provocativa... Mas se fosse para escolher um ponto da minha formação, também devo dar crédito ao currículo da graduação da PUC. No quarto ano fazemos estágio obrigatório em quatro áreas: educação, saúde, organizacional e clínica. O estágio da educação com supervisão em análise do comportamento foi uma experiência incrível... aprendi muito sobre a abordagem, sobre a proposta da Análise do Comportamento para o ensino e consegui ver (e promover) resultados de um planejamento de ensino individualizado, inspirado por estes princípios, que mudaram a vida de duas crianças em um núcleo sócio educativo (um local para atender no contraturno crianças da escola pública municipal). Naquele momento eu decidi que queria trabalhar com ensino e educação.

**As pesquisas que você realizou no mestrado e no doutorado foram voltadas para Educação, mais especificamente sobre políticas educacionais Brasileiras. Quais foram os principais objetivos e contribuições destas pesquisas?**

No mestrado eu tinha um único objetivo como pesquisadora: verificar se o que o Skinner tinha dito ao longo da vida sobre educação era ou não compatível com as propostas políticas Brasileiras em vigor. Escolhi um decreto federal e a proposta foi de análise de compatibilidades, num estudo teórico. A contribuição maior é mostrar que podemos dizer, com segurança, que as propostas do Skinner para a educação – que ele começou a escrever na década de 1940 e continuou até os anos 1980 – são compatíveis com o que é recomendado no decreto analisado.

Já no doutorado foi um pouco diferente ... depois de ter analisado o decreto, que prescrevia um conjunto enorme de ações, visado melhorar a educação nacional, a proposta inicial era a de investigar o que estava sendo efetivamente realizado. A ideia era se aproximar de uma abordagem quase

ity of education in the country). However, between the plan and reality, there is a distance, isn't there? The data available were not enough to complete the analysis. Therefore, I fell into a methodological study using a statistical analysis to identify correlations between a group of variables and the results of IDEB. Since it is an exploratory study, no result can be considered conclusive; however, one of the major contributions, in my opinion, indicates criteria to research municipalities with lineages of good educational results and municipalities with bad results.

**You mentioned two parts that seem to have been important in your researches: a Brazilian Federal Decree and the Education and the Development Index of Basic Education (IDEB). Could you talk more specifically about each one of them?**

The decree was approved in 2007. Its number is 6.094 (www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/decreto/d6094.htm). The Brazilian Federal Decree is a plan that mobilizes the union, states, municipalities, and the civilian society with the aim to improve education quality in Brazil. The plan includes guidelines, or parameters of actions, with a goal that in a period of 14 years, the students in Brazil's education system will reach educational results similar to those of first world countries. For example, all children under eight years old will know their alphabet. This account enters the IDEB, an index that was adopted as an indicator of education quality. The IDEB considers either the results of the students in standardized tests or school flow (evasion data, school failure, and school achievement).

**How do you think behavior analysis can contribute to educational politics in Brazil?**

Well, I can say that Brazilian educational politics have made decisions based on scientific evidence. Behavior analysis is an approach built upon evidence-based practices. The practice is also very much geared toward evaluation. We have a very soecific approach to task analysis, description of repertoire, and skills that can be very useful. But is also worthy to say that our entry into educational politics is certainly not simple. There is a dispute for space in educational politics between many scientific approaches, and each one claims to be able to contribute within its own specilaty.

experimental e identificar quais ações (ou conjunto de ações) apareciam sistematicamente correlacionadas com melhorias nos resultados educacionais (especificamente no IDEB, o índice de desenvolvimento da educação básica, um indicador desenvolvido pelo Ministerio da Educacao para aferir a qualidade da educação no país). Mas aí entre o plano e a realidade tem uma distância, né? Os dados disponíveis não eram suficientes ou adequados para esta análise, então acabei caindo num estudo metodológico usando uma análise estatística identificando correlações entre um conjunto de variáveis e os resultados do IDEB. Como foi um estudo exploratório, nenhum resultado pode ser considerado conclusivo, mas uma das maiores contribuições, na minha opinião, é a indicação de critérios para uma linha de investigação de municípios com linhagens de bons resultados educacionais e de municípios com resultados ruins.

**Você mencionou duas partes que parecem ter sido importantes nas suas pesquisas: um decreto federal Brasileiro que propõe diretrizes para Educação e o Indice de Desenvolvimento da Educação Básica (IDEB). Você poderia falar mais especificamente sobre cada um deles?**

O decreto foi aprovado em 2007, seu número é 6.094 (www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/decreto/d6094.htm). Basicamente é um plano que mobiliza a união, estados, municípios e a sociedade civil com o objetivo de melhorar a qualidade da educação brasileira. No Plano são relacionadas diretrizes – ações ou parâmetros de ações – para que num período de 14 anos o Brasil alcance resultados educacionais semelhantes aos de países do primeiro mundo. Por exemplo, alfabetizar todas as crianças até os 8 anos de idade. E é nessa conta que entra o IDEB, um índice que foi adotado como indicador da qualidade da educação e considera tanto os resultados (ou desempenho) dos alunos em testes padronizados quanto o fluxo escolar (dados de evasão, reprovação e aproveitamento).

**Como você avalia que a Análise do Comportamento pode contribuir com as políticas educacionais no Brasil?**

Bom, eu posso dizer que a política educacional Brasileira tem procurado tomar decisões com base em evidências e a Analise do Comportamento é uma abordagem que pode contribuir muito com produção de evidências. A política também está muito voltada para avaliação e nós temos um olhar muito particular para análise de tarefas, descrição de habilidades e repertórios, que podem ser muito úteis. Mas tam-

**In your opinion, what is the situation of the research geared toward the interface behavior analysis and Education in Brazil? Are there themes that need further research?**

In my opinion, educational research is dominated by politics, lacking in the analysis of educational methods and lacking in the development of assessment instruments for repertoires and academic performance. We still need to investigate and develop technology for pedagogy—how to teach a teacher. In situations of collective teaching, the variety of repertories that a teacher has to deal with in the classroom must be considered. And, of course, I could not fail to mention the reason that made me work with it. I think that we should follow the transformations that society encounters and produce research about distance learning. Further, research should investigate emerging technologies to effectively advance educational services. These areas have some expression in international research, but in Brazilian behavior analysis, we still have a long way to go. ●

bém vale dizer que nossa "entrada", apesar de totalmente pertinente do meu ponto de vista, certamente não é simples. Há uma disputa por espaço na política educacional entre muitas abordagens científicas e cada uma se diz capaz de contribuir dentro de sua especificidade.

**Em sua opinião qual a situação das pesquisas voltadas para interface Análise do Comportamento e Educação no Brasil? Existem temáticas que você julga que precisam de mais pesquisas?**

Na minha opinião a Educação é carente de pesquisa em muitos temas. Para além da política – produção de evidências e análise de métodos educacionais, desenvolvimento de instrumentos de avaliação de repertório e de desempenho acadêmicos – vejo que nós ainda precisamos investigar e desenvolver tecnologia para formação de professores, por exemplo – como ensinar a ensinar, em situações de ensino coletivo e considerando a heterogeneidade dos repertórios que um professor tem em sala de aula. E, claro, eu não poderia deixar de mencionar porque trabalho com isso... penso que também devemos acompanhar as transformações que nossa sociedade vive e produzir pesquisas sobre ensino a distância e nos aproximar de áreas que estão surgindo para criar experiências efetivas de uso da tecnologia com fins educativos. Estas áreas até têm alguma expressão em pesquisas internacionais, mas na Análise do Comportamento Brasileira, ainda temos muito a percorrer. ●

## About the Interviewer:

*Bruna Colombo dos Santos has a degree in Psychology from State University of Londrina (UEL) in Brazil. During her degree, she worked with applied research in behavior analysis, focusing on children who presented oppositional defiant disorder and their relationships with parents or caregivers. Because of the contact with parental practices and their effects on children's behavior, she became interested in aversive control and started to study theoretical aspects of punishment. She has a Masters degree from the Program of Graduate Studies in Experimental Psychology: Behavior Analysis at Pontifical Catholic University of Sao Paulo (PUC-SP), where she conducted a historical-conceptual research study about the aversive control in Brazil, using theses and dissertations produced by Brazilian researches. In this period, she also worked with children with autism spectrum disorder. Currently, she is a Ph.D. candidate in the Graduate Program in Theory and Research of Behavior (PPGTPC) at Federal University of Para (UFPA), where she is studying the concept of punishment in B. F. Skinner's work.*

profile

# New Zealand: ABA Lives within Universities' Educational Departments


## Larah van der Meer, Ph.D., Amarie Carnett

interviewed by Anne Macaskill, Ph.D.

Victoria University of Wellington, New Zealand


*Dr. Larah van der Meer (left) and Amarie Carnett*

*A group of academic researchers and graduate students conduct applied behavior analytic reasearch and run behavioral treatment programmes at The Educational Psychology Clinic at Victoria University of Wellington in Wellington, New Zealand. The group works to develop communication skills in children with developmental disabilities taking a verbal-behavior-based approach. Dr. van Der Meer conducts research focused on using new technologies, such as iPads, to enhance the social and communicative functioning of children with developmental disabilities.*

*Amarie Carnett, a Ph.D. candidate at the clinic, is currently working on a thesis entitled:* Teaching Advanced Manding Skills to Children with Autism Spectrum Disorder Using Systematic Instruction, Speech-Generating Devices, and Skinner's Analysis of Verbal Behavior. *Amarie met with Dr. van der Meer to discuss her work and its impact on education in New Zealand.*

*For more information about behavior analysis in New Zealand, visit nzaba.org.*

**Please describe your current research and interests in the area of education**

I am currently working on teaching advanced manding skills (e.g., manding for actions and manding for information) to children with autism who communicate using iPad-based speech-generating devices. Additionally, my research interests fall mainly under verbal behavior topics and motivating operations. Within the current resarch I am conducting, I'm evaluating the use of behavior chain interruption (i.e., CEO-T and CEO-R) to teach these advanced manding skills.

**How is your research influenced by Skinner's work and radical behaviorism?**

My research is very much influenced by Skinnner. He described the term "verbal behavior" to account for behavior related to communication and defined it as behavior that is reinforced through the mediation of another person's behavior. Specifically, he broke down this concept into functional units known as "operants". My research involves investigating one of these units of analysis, the "mand." Simply stated, Skinner defines a mand as a request for a desired event or stimulus or to terminate an undesirable event or stimulus. A mand can be a simple request for something like a drink or a more sophisticated request like manding for information (i.e., question asking). What makes manding for information particularly challenging for some individuals with autism is the lack of social motivation they may have to ask questions. With that said, the research I do involves a great amount of attention to a child's motivation (i.e., motivating operation), which is an internal state. I think it is fair to say that I would not be conducting the research I work on today had it not been for Skinner's work and radical behaviorism.

**You are somewhat unusually placed in a school of education rather than psychology. What challenges and opportunities does that afford you?**

Being in the applied area of behavioral research, I get the unique oportunity to work with colleagues from various fields. I think it is becoming more common to see

ABA within educational departments. For example, when I studied for my Masters in ABA it was through a School of Education. I can understand that it might create challenges due to misconceptions about ABA, but I think sometimes these types of things are more related to the terminology we use rather than the actual interventions. It has been my experience working with educators, parents, and the like that there is generally a common goal of wanting a child to learn and be happy. Since most of the work I do is within the applied scope of special education, collaboration with all of the stakeholders is key. With that said, I think it is also valuable to collaborate with researchers who are working in more of the experimental topics of behavioral research.

**What do you see as the key points of difference between your approach and your colleagues who also work in education but do not take a behavior analytic approach?**

It's an issue of form over function. I think it is key to look at behavior in regards to function. When doing so, it cuts out a lot of the guessing. We may see when someone is trying to explain what a child's behavior means, but why it is occuring is unclear. Even when looking at prelinguistic behavior, there is always function. When we can evaluate the function of behavior, we can create meaningful interventions that can change the quality of someone's life.

**What do you see as the most promising and important future directions for behavior analytic research in the schooling or education context?**

I think we are at a great place within applied research. I am seeing some nice extentions of research topics like parent/teacher/caregiver training in subjects ranging from challenging behavior to verbal behavior. In terms of future reseach, I would be excited to see more research that extends past basic manding skills and investigates other operants for nonverbal children who use augmentative and alternative communication systems (e.g., speech-generating devices). ●

*Panorama taken from the 5th floor of the Cotton building of the Victoria University of Wellington. Photo: Dean S. Pemberton, 2005.*

history corner

# T.C. Barnes and B.F. Skinner: A Brief Collaboration

by Todd L. McKerchar, Ph.D.
Jacksonville State University, and
Edward K. Morris, Ph.D.
University of Kansas

B. F. Skinner began his graduate studies at Harvard University in the fall of 1928 in the Department of Philosophy and Psychology. E. G. Boring was the director of its Psychological Laboratory, where students primarily addressed questions on psychophysics and in the Titchenerian style. Although Skinner later noted he was "not entirely untouched by [the] introspective predilection," he found his scientific interests better served in the Department of General Physiology, which was under the direction of William J. Crozier. Crozier had just hired his own recent graduate, Hudson Hoagland, as faculty member in the department. Skinner enrolled in one of Hoagland's courses (Physiology 5: Behavior) his first semester. He was thrilled to be reading about the work of Pavlov, Magnus, and Sherrington, and he was assigned what was to be his first research project—measurement of a conditioned reflex in frogs. He soon discovered, however, that the reflex to be measured turned out to be an instance of "lowered threshold." The project was halted.

**The Barnes and Skinner Collaboration**

In spring 1929, Skinner took a research course taught by Crozier in the Department of General Physiology (Physiology 20a: Dynamics of Vital Phenomena). It was in this course that Skinner carried out a research project with Thomas Cunliffe Barnes. Although Barnes and Skinner were both young scientists, Barnes was senior to Skinner. He had received his Doctor of Science the previous year from Harvard's Bussey Institute for Applied Biology. Barnes's (1928) dissertation was titled, *A Biological Study of the White-Pine Weevil with Especial Reference to Anatomy, Flight, Phenology, Parasitism, Behaviour, and Injuries to Young Tree*. His committee had included William Morton Wheeler. At the time of his collaboration with Skinner, Barnes was an Assistant in Physiology and according to Skinner, was "an eccentric young Canadian who came to his office in wing collar and cravat."

Barnes put Skinner to work on geotropisms in ants—tropisms being a favorite topic of Crozier's. Under dim red lighting, Skinner placed an ant (*Aphaenogaster fulva*) at the center of a yellow square of paper. The path of the ant was closely followed and traced with a pencil, creating a path of which various segments were relatively straight. Skinner measured the slope of the straight segments of the paths (see Figure 1). Over numerous trials and

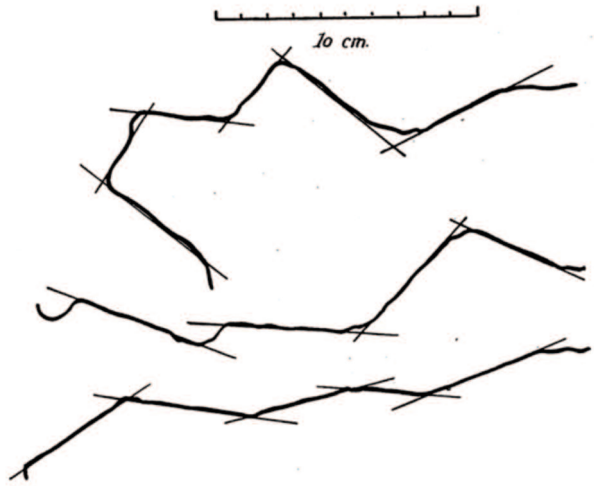


*Figure 1. Samples of an ant's path on a paper surface under dim red illumination (from Barnes & Skinner, 1930). The paths were traced by Skinner and the slope of the straight segments were measured as a function of various angles of the surface.*

days, the angle of the yellow surface was carefully measured and varied. As the tilt of the surface increased so did the slope of an ant's "geotropic orientations." Barnes and Skinner also found that when they kept the angle constant at 50º, the slope of the orientations increased across successive trials. To investigate whether this was due to "learning," they allowed an ant to crawl on a horizontal surface for three consecutive days. On the fourth day, the angle was again increased to 50º and remained so for three additional days. A "progressive increase" in geotropic orientation also occurred on days four to seven, suggesting that learning (perhaps a history of crawling) was not the important fac-

tor. Through additional experiments in which they systematically evaluated the effects of (a) removing an ant's stomach, (b) adding weight to the ant (by placing pupa in it mandibles), and (c) removing its antennae, they concluded that the changes in geotropic orientations were a function of "muscle tension." Barnes had pursued a "muscle tension theory" of geotropisms in earlier publications.

Barnes and Skinner submitted a report of their research to the *Journal of General Psychology*. It was received for publication on June 18, 1929. Published in the fourth volume of the journal, it was titled *The Progressive Increase in the Geotropic Response of the Ant* Aphaenogaster (1930). Although this was not Skinner's first publication—he had already written *A Digest of Decisions of the Anthracite Board of Conciliation* (1928,) with his father as coauthor "for prestige"—it was his first journal article and scientific publication, and, thus it formally marks the beginning of an extraordinary career. Skinner, of course, did not pursue tropisms much further. He soon moved on to the systematic study of operant behavior, and Barnes moved on to other topics at Yale and elsewhere (see biography below). Nevertheless, their collaboration and publication initiated for Skinner the beginning of a lifelong search for order in behavior, whether in research, application, or his own behavior.

**Who was T.C. Barnes?**

Thomas Cunliffe Barnes was born on June 4, 1904 in Montreal, Quebec, Canada. He received an A.B. from Cornell in 1926 and a Sc.D. from Harvard in 1928 and was an assistant in Crozier's Laboratory of General Physiology at Harvard from 1927 to 1929. Barnes went on to serve as an instructor (1930-1935) and assistant professor (1935 to 1940) in Yale's Department of Biology, where he published many papers on the effects of "heavy water" in various physiological processes. During this time, he also authored a *Textbook of General Physiology* (1937) and a *Laboratory Manual of General Physiology* (1937). Barnes later moved to Hahnemann Medical College and Hospital in Pennsylvania, first as a research associate in pharmacology (1940 to 1942), then as an associate professor of physiology (1943-1947) and pharmacology (1947 to 1959). At Hahnemann, Barnes began a research program in the then-cutting edge area of electroencephalography (EEG). For the rest of his career, his research was primarily concerned with the effects of various psychological and physiological factors on EEG readings. The date of his death is unknown. He is listed in the 12th edition of *American Men and Women of Science* (1971) as a research associate at Philadelphia State Hospital; his last publication was in 1972. The 13th edition of *American Men and Women of Science* (1976) lists him as deceased; therefore, he likely died between 1972 and 1976. Some of the professional societies to which Barnes belonged included the American Physiological Society, American Psychological Association, American Society for Pharmacology and Experimental Therapeutics, Society for Experimental Biology and Medicine, and the Society of General Physiology. The International Society of Behaviorology (ISB) has an award in Barnes's honor. The award is a large black plastic ant given to a student who presents the most "creative and curious shaped animal behavior." ●

**This article is the first in a series *Brief Biographies of a Selection of Skinner's Coauthors.***

As the authors noted in Quarter I, 2015 issue of *Operants*, "We should point out, ... that for many of these coauthors our biographical records are incomplete. Because they were not well known in behavior analysis and psychology, they were unlikely to have extensive or widely published obituaries. We have done our best to conduct thorough searches, but in some cases we have exhausted the resources available to us. Accordingly, we encourage anyone who has biographical information on Skinner's lesser-known coauthors to please contact us." You can forward any information to operants@bfskinner.org.

*Of course, teaching and learning occur not only in the classroom. B. F. Skinner teaches his grandaughter, Justine, how to use tools in the shop (above), and learns how to work with dolphins in Sea Life Park in Oahu, Hawaii (below). From the family archives.*

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*As always, the editors welcome your feedback. Suggestions and news items are very welcome. Feel free to contact any of us by emailing operants@bfskinner.org.*

**from the archives**

*It has been said that an education is what survives when a man has forgotten all he has been taught. Certainly few students could pass their final examinations even a year or two after leaving school or college. What has been learned of permanent value must therefore not be the facts and principles covered by examinations but certain other kinds of behavior often ascribed to special abilities. Far from neglecting these kinds of behavior, careful programming reveals the need to teach them as explicit educational objectives. For example, two programs prepared with the help of the Committee on Programmed Instruction at Harvard—a program in crystallography constructed by Chalmers, Holland, Williamson, and Jackson and in neuroanatomy by Murray and Richard Sidman—both reveal the importance of special skills in three-dimensional thinking. As measured by available tests, these skills vary enormously even among scientists who presumably make special use of them. They can be taught with separate programs or as part of crystallography or neuroanatomy when specifically recognized as relevant skills. It is possible that education will eventually concentrate on those forms of behavior which "survive when all one has learned has been forgotten."*

B. F. Skinner. The Technology of Teaching, pp. 89-90.

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