reinventing

the wheel
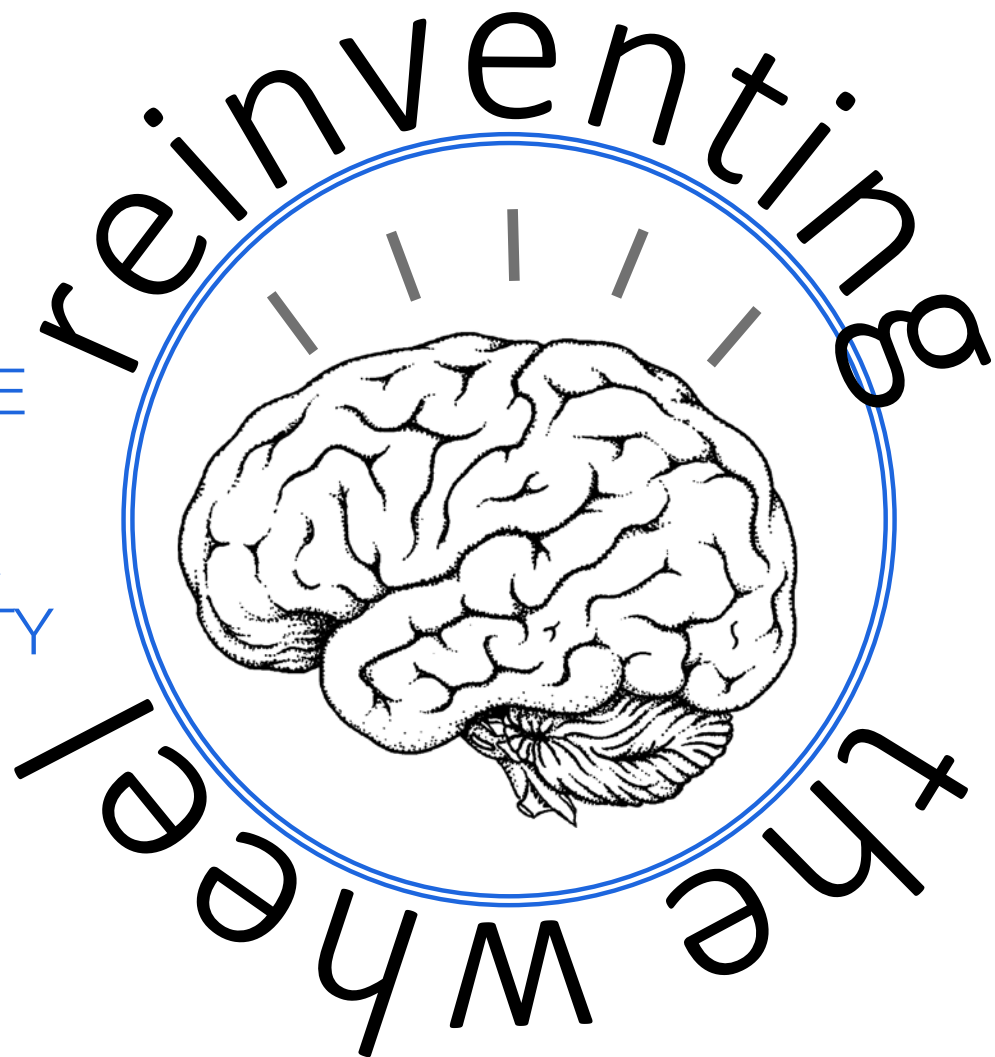
NEUROSCIENCE
"DISCOVERS"
WHAT SKINNER
SHOWED EIGHTY
YEARS AGO

REFLECTING ON JACQUES LOEB
AND HIS LEGACY

Aboston newspaper recently printed an article about education. It began with a teacher scolding her students because they scored only 30 points on a 100 point test. Looking at the situation differently, you might as well scold the teacher for her poor teaching. Of course, behavior analysts do not blame either the teacher or her students. The teacher's methods and her students' studying routines are a function of the contingencies over their behavior. Few educators are taught shaping. To improve education, society must provide teachers with behavioral techniques. Then, teachers will experience the joy of teaching: their students' success.

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

Chinese Translated by Karena Lee

波士頓報紙最近刊登了一篇關於教育的文章。一開始的內容是關於一位老師因為學生在測驗中獲得30分/100分而責罵他們。以不同的方式看待這個情況，你也可能會責怪老師的教學方式。當然，行為分析師在這個情況下並不會責怪老師或她的學生。教師的方法和學生的學習模式是有關聯性的。現在很少教育工作者有學過怎麼塑造行為。為了改善教育質素，社會必須為教師提供管理行為的訓練。這樣，教師將會體驗到教學的樂趣：學生的成功。

Dutch Translated by Frans van Haaren

Recentelijk publiceerde een krant in Boston een artikel over onderwijs. Het begon met een beschrijving van een onderwijzeres die haar leerlingen een uitbrander geeft omdat zij maar 30 punten gescoord hadden , terwijl zij 100 punten hadden kunnen verdienen. Aan de andere kant, we zouden ook de onderwijzeres gewoon een uitbrander kunnen geven omdat ze slecht onderwijs moet hebben gegeven. Goede gedragsanalytici zullen, natuurlijk, noch de onderwijzeres noch haar leerlingen de schuld geven omdat de onderwijsmethodes van de onderwijzeres alsook het studiegedrag van haar leerlingen gewoon een functie zijn van de contingenties die zowel het gedrag van de onderwijzeres als het gedrag van haar leerlingen bepalen. Er zijn maar heel weinig onderwijsdeskundigen die iets van 'shaping' afweten. Om onderwijs echt te verbeteren moet de gemeenschap onderwijzers voorzien van technieken gebaseerd op gedragsanalytische principes. Pas dan zullen onderwijzers echt plezier krijgen in lesgeven: gebaseerd op het success van hun leerlingen.

French Translated by MarieCéline Clemenceau

Un journal de Boston a récemment publié un article sur l'éducation. Cela a commencé avec un enseignant qui gronde ses élèves parce qu'ils n'ont obtenu que 30 points sur un test de 100 points. En regardant la situation différemment, vous pourriez aussi bien gronder l'enseignant pour son enseignement médiocre. Bien entendu, les analystes du comportement ne blâment ni l'enseignant ni ses élèves. Les méthodes de l'enseignant et les routines d'étude de ses élèves sont le produit des contingences qu'ils expérimentent. Peu d'éducateurs apprennent à façonner. Pour améliorer l'éducation, la société doit fournir aux enseignants des techniques comportementales. Ensuite, les enseignants connaîtront la joie d'enseigner: la réussite de leurs élèves.

Hebrew Translated by Shiri Ayvazo

עיתון בבוסטון הוציא לאחרונה כתבה על חינוך. הכתבה נפתחה בסיפור על מורה שגערה בתלמידיה כיוון שהגיעו רק ל 30 נקודות מתוך מבחן של 100 נקודות. בהסתכלות אחרת על המצב, אפשר באותה המידה לגער במורה על ההוראה החלשה שלה. כמובן, מנתחי התנהגות אינם מאשימים לא את המורה ולא את תלמידיה. שיטות ההוראה של המורה ושגרות הלמידה של התלמידים הם פונקציה של התליויות השולטות בהתנהגותם. מורים מעטים מאוד לומדים עיצוב. כדי לשפר חינוך, החברה חייבת לספק למורים טכניקות התנהגותיות. אז, מורים יתנסו בחוויות ההוראה: ההצלחה של תלמידיהם.

Hellenic (Greek) Translated by Katerina Dounavi

Μια εφημερίδα της Βοστώνης δημοσίευσε πρόσφατα ένα άρθρο για την εκπαίδευση. Ξεκίνησε με μια δασκάλα που μάλωσε τους μαθητές της επειδή πήραν μόνο 30 πόντους σε μια δοκιμασία με άριστα το 100. Κοιτώντας διαφορετικά την κατάσταση, μπορούμε επίσης να μαλώσουμε τη δασκάλα που δεν δίδαξε σωστά τους μαθητές. Φυσικά, οι αναλυτές συμπεριφοράς δεν κατηγορούν ούτε τη δασκάλα ούτε τους μαθητές της. Οι μέθοδοι της δασκάλας και οι συνήθειες μελέτης των μαθητών της είναι λειτουργία των συναρτήσεων που δρουν στη συμπεριφορά τους. Λίγοι παιδαγωγοί μαθαίνουν πώς να διαμορφώνουν μια δράση. Για τη βελτίωση της εκπαίδευσης, η κοινωνία πρέπει να παρέχει στους δασκάλους συμπεριφορικές τεχνικές. Τότε, οι δάσκαλοι θα νιώσουν τη χαρά του να διδάσκεις: την επιτυχία των μαθητών τους.

Icelandic Translated by Kristjan Gudmundsson

Dagblað í Boston birti nýlega grein um menntun. Hún byrjaði á því að kennari skammaði nemendur sína vegna þess að þeir náðu á prófi aðeins 30 stigum af 100. Séð frá öðru sjónarhorni þá má allt eins skamma kennarann fyrir lélega kennslu. Auðvitað ásaka atferlisgreinendur hvorki kennarann né nemendur. Kennsluaðferðir kennarans og námsaðferðir nemenda eru afleiðing af skilyrðingaskilyrðum hegðunar þeirra. Fæstu menntafólki er kennd hegðunarmótun. Til að bæta menntun, þá verður samfélagið að vopna kennara með tækni atferlisfræðinnar. Þá munu kennarar upplifa ánægju af kennslu: sem er árangur nemendanna.

Italian Translated by Anna Luzi

Un giornale di Boston ha recentemente pubblicato un articolo sull'educazione. Parlava di un'insegnante che aveva rimproverato i suoi studenti perché avevano totalizzato solo 30 punti su un test di 100 punti. Cambiando il punto di vista si sarebbe potuto invece rimproverare l'insegnante per la sua scarsa efficacia nell'insegnamento.
Ovviamente gli analisti comportamentali non vogliono attribuire colpe né all'insegnante né ai suoi studenti. Sia i metodi utilizzati dall'insegnante, sia le routine di studio dei suoi studenti sono funzione delle contingenze che intervengono sul loro comportamento. Pochi educatori vengono formati alle metodologie di shaping. Per migliorare l'istruzione, la società deve fornire agli insegnanti tecniche di insegnamento di tipo comportamentale. Solo così gli insegnanti proveranno ciò che dà la più grande soddisfazione nell'insegnare: il successo dei loro studenti nell'apprendere.

Japanese Translated by Naoki Yamagishi

ボストンのある新聞社が最近、教育についてのある記事を書きました。生徒は100点満点中30点しか取れず、その生徒を教師がしかるという話から始まっています。異なる見方をすると、指導力のない教師をしかるかもしれません。行動分析家はもちろん教師も生徒も非難しません。教師の指導法と生徒の日々の学習は、彼らの行動にかかわる随伴性の関数なのです。ほとんどの教師はシェイピングを教わりません。教育を改善するには、社会が教師に行動的な（教育）技術を提供しなければなりません。そうすることで、教師は教育の喜び、すなわち生徒の成功を経験するようになるのです。

Korean Translated by Theresa Yunhee Shin

보스턴 신문에서 최근 교육에 대한 기사를 실었습니다. 한 교사가 학생들에게 소리를 지르는 것부터 시작합니다. 그 이유는 학생들이 100점 만점에 30점을 맞았기 때문입니다. 이러한 상황을 달리보면, 우리도 어쩌면 형편없는 교수를 하고 있는 그 교사에게 역시 소리를 지를지도 모릅니다. 그 교사의 방법과 그 학생들의 학습 루틴은 행동에 있어 유관적인 기능을 가지고 있습니다. 몇몇의 교육가들은 행동형성을 가르칩니다. 교육을 증진하기위해서 우리는 교사들에게 행동적 기법을 알려주어야 합니다.. 그래야 교사들은 가르치는 즐거움을 경험할 수 있고, 학생들은 성공을 경험할 수 있습니다.

Norwegian Translated by Karoline Giæver Helgesen

En avis i Boston trykket nylig en artikkel om utdanning. Den begynte med en lærer som ga sine studenter en reprimande etter kun å ha oppnådd 30 av 100 mulige poeng en test. Sett i et annet lys kunne læreren like godt få en reprimande for sin dårlige undervisning. Atferdsanalytikere ville selvsagt hverken klandre læreren eller studentene. Lærerens metoder og studentenes studievaner er begge funksjoner av atferdenes kontingenser. Få undervisere læres opp i shaping. For å forbedre utdanningsløpene må samfunnet utstyre lærere med kunnskap om og teknikker for å endre atferd. Slik vil lærere få erfaring med undervisningsglede: Deres studenters suksess.

Polish Translated by Monika Suchowierska-Stephany

Jedna z bostońskich gazet opublikowała ostatnio artykuł na temat edukacji. Publikacja rozpoczyna się od opisu zdarzenia, podczas którego nauczycielka gani uczniów za uzyskanie tylko 30 punktów w 100-punktowym teście. Inaczej patrząc na tę samą sytuację, można byłoby skrytykować nauczycielkę za mało efektywne nauczanie. Oczywiście, analitycy zachowania nie winią ani nauczyciela, ani ucznia za brak postępów. Metody nauczania oraz zachowania związanie z uczeniem się są wynikiem zależności pomiędzy środowiskiem a kształtowanym przez nas zachowaniem. Niewielu nauczycieli wie, jak efektywnie wykorzystywać kształtowanie zachowań. Aby poprawić proces edukacji, system szkolnictwa powinien zapewnić nauczycielom możliwość poznania technik behawioralnych. Wtedy nauczyciele będą mogli cieszyć się wynikami swoich działań: postępami uczniów.

Portuguese Translated by Bruna Colombo dos Santos

Um jornal de Boston publicou recentemente um artigo sobre educação. O artigo começou com uma professora repreendendo seus alunos porque eles haviam atingido apenas 30 pontos em um teste de 100 pontos. Olhando para a situação de maneira diferente, você poderia repreender a professora pelo seu ensino pobre. É claro que analistas do comportamento não culpam nem a professora e nem os estudantes. Os métodos da professora e as rotinas de estudo de seus alunos são função das contingências sobre seus comportamentos. Poucos educadores são ensinados sobre modelagem. Para melhorar a educação, a sociedade precisa munir os professores com técnicas comportamentais. Então, os professores irão experimentar a alegria de ensinar: o sucesso de seus estudantes.

Russian Translated by Alexander Fedorov

Недавно одна бостонская газета напечатала статью об образовании. Она начиналась с учительницы, ругающей своих учеников за то, что они набрали в тесте только 30 баллов из 100 возможных. Посмотрев на ситуацию с другой стороны, вы могли бы поругать учительницу за то, что она так плохо учит. Несомненно, поведенческие аналитики не возлагают вину ни на учительницу, ни на ее учеников. И методы учительницы, и сформировавшиеся у ее учеников модели обучения зависят от контингенций, связанных с их поведением. Лишь немногие педагоги обучаются шейпингу (процедуре формирования поведения). Чтобы улучшить образование, общество должно сделать так, чтобы учителя владели поведенческими техниками. И тогда учителя познают радость преподавания: успех своих учеников.

Spanish Translated by Kenneth Madrigal and Gonzalo Fernández

Recientemente un periódico de Boston publicó un artículo sobre educación. El artículo comenzaba describiendo cómo una profesora regañaba a sus estudiantes por haber obtenido 30 puntos, sobre un total de 100, en un examen. Viendo la situación desde otra perspectiva, en todo caso, uno podría regañar a la profesora por sus pobres métodos de enseñanza. Desde luego, los analistas de la conducta no culpamos ni a los profesores ni a los estudiantes. Los métodos de los profesores y las rutinas de estudio de los estudiantes son función de las contingencias que actúan sobre su comportamiento. Son muy pocos los educadores a los cuales se les enseña la técnica de moldeamiento. Para mejorar la educación, la sociedad debería de proveer a los profesores con técnicas de modificación conductual; entonces, los profesores experimentarían el placer de enseñar: el éxito de sus estudiantes.

Swedish Translated by Dag Strömberg

En Bostontidning publicerade nyligen en artikel om utbildning. Den började med en lärare som skällde på sina elever för att de bara fick 30 av 100 poäng på ett prov. Med en annan syn på situationen skulle man lika gärna kunna skälla på läraren för hennes dåliga undervisning. Givetvis skyller beteendeanalytiker varken på läraren eller hennes elever. Lärarens metoder och elevernas studievanor är en funktion av kontingenserna över deras beteende. Få lärare undervisas i formning. För att förbättra utbildningen måste samhället förse lärare med beteendetekniker. Sedan kommer lärare att erfara undervisningens glädje: deras elevs framgångar.

Thai Translated by Sirima Na Nakorn

หนังสือพิมพ์ในบอสตันฉบับหนึ่งลงบทความเกี่ยวกับการศึกษา โดยเริ่มเรื่องว่า คุณครูดุเด็กนักเรียนว่า สอบได้คะแนน 30 คะแนนจากคะแนนเต็ม 100 คะแนน ในทางกลับกันเราอาจมองว่า เป็นเพราะครูสอนไม่ดี เด็กจึงสอบได้คะแนนน้อย แต่บรรดานักวิเคราะห์พฤติกรรม จะไม่โทษทั้ง ครูและนักเรียน เราจะมองว่า วิธีการ สอนของครูและรูปแบบการเรียนรู้ของนักเรียน เป็นตัวแปรทำ ๆ ให้ กิดผลดังกล่าว ดังนั้น การทจะ ะปรับปรุงการเรียนการสอนได้ เราควรจะให้คุณครูทราบการใช้เทคนิค ดัำ นพฤติกรรมในการสอนเด็กๆ เพื่ คุณครูจะได้สัมผัสความสุขในการสอนเด็ก … นี้ นก็คือการประสบความสำเร็จในการเรียนของพวกเขา

Turkish Translated by Yeşim Güleç-Aslan

Bir Boston gazetesi kısa bir süre önce eğitim ile ilgili bir makale yayımladı. Haber bir öğretmenin, 100 puanlık testten sadece 30 puan aldığı için öğrencisini azarladığı ile başlıyordu. Duruma farklı bir şekilde baktığınızda, öğretmeni, onun zayıf, yetersiz öğretimi için de azarlayabilirsiniz. Tabii ki davranış analistleri öğrenciyi de öğretmeni de suçlamazlar. Öğretmenin yöntemleri ve öğrencinin çalışma alışkanlıkları onların davranışları üzerinde izlerliklerin bir işlevidir. Çok az eğitimciye şekil verme öğretilir. Eğitimi geliştirmek için, toplum öğretmenlere davranışsal teknikleri sağlamalıdır. Ardından, öğretmenler öğretmenin keyfini, neşesini yaşayacaklardır: Öğrencilerinin başarısı.

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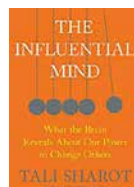**Associate Editor, History of Science:**
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We would like to thank all contributors to this issue.
Operants preserves the intellectual tradition of Skinner's writings — of interest to the field, but also written without heavy use of citations and references.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

TABLE OF CONTENTS

On Terminology: Differential Reinforcement to Decrease Behavior

Darlene E. Crone-Todd, PhD
Salem State University

Dr. Darlene Crone-Todd is a professor of psychology at Salem State University. She serves as the coordinator for behavior analysis graduate programs, and as co-coordinator of the Theoretical, Philosophical, and Conceptual Issues area for the Association for Behavior Analysis International (ABAI).

When teaching the use of differential reinforcement schedules to reduce or eliminate behavior, students often struggle with the concepts. At first, I could not figure out why this was, as it seemed obvious that either reinforcing an incompatible or alternative behavior while concurrently placing a behavior to be reduced on extinction, would work. After all, as Skinner pointed out in *Science and Human Behavior*, differential reinforcement occurs naturally to select and to reinforce adaptive behaviors over maladaptive behaviors in sports, skills, and crafts. This also applies (whether intentionally or not) at the cultural level, and in educational control over various types of behavior.

Over the years teaching these concepts, I began scoring the complexity of the principles, concepts, and procedures taught in our courses. As I completed this work on the various textbooks used at the undergraduate and graduate levels (e.g., *Behavior Modification: What it is and How to Do It*, by Garry Martin and Joseph Pear at the University of Manitoba, and *Applied Behavior Analysis* by John Cooper, Timothy Heron, and William Heward at the Ohio State University), I began teaching these concepts only after teaching what I now consider to be the prerequisite principles and procedures: Defining behavior, methods for recording/tracking behavior, functional assessment, reinforcement, extinction, schedules of reinforcement to increase behavior, stimulus control, discrimination, generalization, shaping, fading, and chaining. After rearranging the chapters in a way that seemed to flow better to understand what is involved in applied behavior analysis, students began to score better on exams when it came to the more complex chapters. For this reason, I now teach differential reinforcement procedures after these prerequisite chapters. It is reassuring to see that the 10th edition of the Martin and Pear text now has the differential reinforcement chapter later in the first half of the textbook, which is also consistent with the order in which Cooper, Heron and Heward organize their textbook.

Students also struggle with understanding the various forms of the Differential Reinforcement of Low Rates (DR+L) schedules that reduce, but not necessarily eliminate, behavior. These schedules are targeted either within *full sessions* (DR+LF) or in *intervals* as either "spaced responding" (DR+LS) or "limited responding" (DR+LL). In DR+LF schedules, a criterion is set for the maximum number of responses to be emitted, and reinforcement occurs if the behavior is at, or below, that maximum number. However, as will be discussed below, that might be very difficult to achieve, so full sessions are typically divided into equal intervals of time, and then one can use either DR+LL or DR+LS schedules. If the DR+LL procedure is used, then a maximum number of responses is specified as the criterion for each interval, and reinforcement is presented if the behavior is at, or below, that criterion. If the DR+LS

procedure is implemented, then a minimum amount of time (or interval) is specified between each response that must elapse. So, reinforcement is presented if the behavior occurs after the minimum amount of time following the previous response.

The choice of which DRL schedule to use is both an art and a science. For example, one might choose a DRL limited responding for a student who contributes far too often in a classroom setting. In such cases, the student might be limited to no more than *n* instances (a question or a contribution/answer) within a given interval. Alternatively, one might incorporate spaced responding by specifying that the student can speak out in these appropriate ways once every *t* amount of time.

In my undergraduate courses, students often select behavioral excesses that they wish to decrease, and almost every semester two of the most popular are "procrastination" with respect to studying, and smoking cigarettes. For the students who identify "procrastination" as their behavior to reduce, we spend time identifying what, exactly, procrastination is in behavioral terms. As the students discover, this general summary term is actually rather vague, and may include engaging in off-task behavior (concurrent schedules of reinforcement), latency to respond to assignments, proportion of assignments completed on time, and so forth. In fact, the students soon learn that the behaviors involved in "procrastination" need to undergo differential reinforcement: There needs to be more reinforcement available for behavioral deficits such as for engaging in appropriate academic behaviors, starting assignments sooner, and getting them completed at, or before, the deadline.

When it comes to quitting smoking, students often struggle with this behavior. As per Mark Twain's famous quote, "Giving up smoking is easy… I've done it hundreds of times", such addictive behavior is difficult to stop. However, students typically make several mistakes in their self-modification procedures, despite data available to current students from previous years on these same projects by former students. Following baseline, students will often select "full session" DRL (DR+LF) to initially try to reduce smoking. They usually specify a maximum number of cigarettes to smoke per day (i.e., the full session). Over the course of about two weeks, they systematically create a plan to reduce the number of cigarettes by 1-2 per day, every 2-3 days. The students initially show great excitement when sharing their data in class, as they can observe and record the reduction in the number of cigarettes smoked per day. However, by the time their smoking is reduced by about 25%, it is typical to see a resurgence. As we discuss the results, it is almost inevitable that by specifying a DR+LF schedule, they smoke all of their cigarettes early on, and are out of cigarettes by some time in the afternoon. This leads to withdrawal symptoms, and a return to baseline smoking levels. At this point, there are two strategies that one could use here to initially reduce the number of cigarettes smoked, both of which involve smaller intervals of time across the day. The first would be to use limited responding (DR+LL), in which they specify that no more than X cigarettes be smoked per hour, and use reinforcement if they smoke that number, or fewer, per hour. Then, over time they systematically reduce the number of cigarettes smoked per unit of time, and increase the unit of time until they meet their goal of reducing smoking before quitting altogether. The second strategy, which is typically more effective, is to simply use the spaced responding DRL procedure (DR+LS), in which they successively increase the time between each cigarette smoked. In this way, someone who smokes 16-20 cigarettes per day might smoke one per 50 minutes. Such an individual might start with 45 minutes between each cigarette for 2-3 days. If they successfully meet this criterion, they shape the interval between cigarettes by adding 5 or 10 minutes to the inter-cigarette interval, such that 50-55 minutes elapses between cigarettes. The actual amount by which one shapes the DR+LS interval will depend on the successful mastery of the criterion: If it is successful, then continue adding that amount of time to the interval every 2-3 days. If it is not successful, then add shorter durations to the interval, or return to a previously successful level for a few days and start shaping the interval again. Whichever method is chosen, the individual then moves onto a schedule of reinforcement to completely eliminate the smoking behavior. This typically occurs when they are at, or below, 1-2 cigarettes smoked per day.

It seems obvious that with the DRO, DRI, and DRA procedures that we either reinforce the absence of smoking alone (DRO), or simultaneously suppress smoking while reinforcing an incompatible (DRI) or an alternative (DRA) behavior. What is missing from the literature on DRL procedures, but is imperative is this: It is important to determine whether what is being reinforced differentially is some unspecified "other" behavior, an incompatible behavior, or an alternative behavior, *during the DRL procedures.* In fact, a review of the literature on DRL schedules reveals no known instances that while trying to reduce a behavior to acceptable lower limits, that there is any mention of specifying alternative or incompatible behaviors when one is not supposed to be engaging in the behavior to be reduced. Yet, by specifying an alternative or incompatible behavior, behavior analysts can make use of rule-governed behavior or at least shift to a higher proportion of desirable behavior in which to be engaged. After all, it is easier to engage in self-controlled behavior if there is a desirable behavior to reinforce in place of the behavior to be reduced or eliminated. For example, specifying work to be completed, or other appropriate forms of behavior to engage in instead of asking too many questions or otherwise contributing too often in class makes it more likely for a student to successfully meet the criterion in their program, and develop appropriate alternative behaviors. Similarly, using deep breathing exercises, drinking water, increasing

physical activity, finding appropriate objects to manipulate as possible replacement behaviors for smoking can be helpful (e.g., small squeeze balls, or "worry stones", which typically are smooth, round or oval polished stones with a concave thumb-sized indent).

Of course, the question regarding which set of replacement behaviors to choose as alternative or incompatible behaviors is best determined by the initial functional assessment. It is important to gain an understanding of the antecedents and consequences for the behaviors of interest. For example, the student who asks many questions or otherwise contributes in class may be doing so because this leads to more attention from the teacher or other students, may be more likely to occur after long periods of work at a desk without moving (activity deprivation), or other possible reasons. If the function of the behavior is attention-maintained, then strategies might involve providing attention on some initially rich schedule of reinforcement when the student is working on academic tasks and still meeting the lower-rate criterion for speaking out in class. However, if the behavior also seems directly related to the amount of physical activity, then planning periods of movement throughout the day might be used instead of, or in addition to, the other procedures. A complete assessment of antecedents (including motivating operations), behavior, and consequences is important.

Similarly, with smoking behavior, someone who is labeled as being addicted to nicotine likely is under the influence of several causal factors. One is the dissipation of nicotine in the system, which has a half-life of about two hours. As the nicotine levels decrease, there is often an increase in heart rate variability which dissipates the longer one can refrain from smoking. However, this initial increase in heart rate variability and other physiological effects may result in an aversive feeling that is temporarily reduced by smoking another cigarette. Thus, negative reinforcement is evident in the sense that the smoking may be maintained by continuing to escape or avoid the variability in heart rate or other unpleasant side effects. There may be other functions of the behavior, such as social reinforcement from other smokers, pairing smoking with beverages such as alcohol or caffeine, and other such operant and respondent conditioning situations. As one student mentioned, in his experience in his army unit, the only way one was able to request a break was if it they expressed that they wanted to take a cigarette break. Thus, the contingencies actually promoted starting smoking as the only way in which one could request a break from the drudgery of the work.

Given that it is possible and even preferable to specify whether a DRL schedule in use is also reinforcing zero other instances, or an incompatible/alternative set of behaviors, it seems logical to start specifying this more clearly in our writing and teaching. Doing so would provide a more conceptually systematic way to describe procedures in our field. During the past two years, teaching differential reinforcement in the following sequence has resulted in higher grades that reflect a better verbal behavior repertoire among students taking my courses. Here is the sequence, and the notation, I use to teach the course.

- DR+ Schedules to Eliminate Behavior:
    - Differential Reinforcement of Other (or zero) Behavior: DR+O
    - Differential Reinforcement of Alternative Behavior: DR+A
    - Differential Reinforcement of Incompatible Behavior: DR+I
- Comparing and Contrasting Reinforcing O, A, or I:
    - The Unspecified "Other" Behavior: May result in unanticipated undesirable behavior being reinforced.
    - Alternative Behavior: A replacement behavior to strengthen instead of the behavior to decrease
    - Incompatible Behavior (as a Special Case of an Alternative Behavior): A replacement behavior to reinforce which is physically impossible to engage in at the same time as the behavior targeted for reduction
- DR+ Schedules to Reduce Behavior:
    - Differential Reinforcement of Low Rates of Behavior (DR+L):
        - Full Session Limited Responding (DR+LF)
        - Intervals:
            - Limited Responding (DR+LL)
            - Spaced Responding (DR+LS)
    - Incorporating O, A, or I into DRL Schedules
        - DR+LFO; DR+LFA, and DR+LFI
        - DR+LLO; DR+LLA, and DR+LLI
        - DR+LSO; DR+LSA, and DR+LSI

In conclusion, although this sequence and approach adds a few more abbreviations, doing so is worth it for consistency and comprehensiveness in understanding and applying our science of behavior in a technological manner. ▬▬

Prof. Dr. Binyamin Birkan, Biruni University, Turkey

Interview by Yeşim Güleç-Aslan, PhD

Please tell us a little about yourself, as well as your current interests in the field of autism and applied behavior analysis.

I graduated from Gazi University Department of Special Education in 1993. After graduation, I worked as a special education teacher for a year. In the following years, I worked for eleven and a half years as a research assistant first and as an academic member following earning my PhD at Anadolu University Research Institute for Individuals with Disabilities. Afterwards, I received a year of training in applied behavior analysis (ABA) and research practices at Princeton Child Development Institute (PCDI) in the USA with a grant from Tohum Türkiye Otizm Erken Tanı ve Eğitim Vakfı (TOHUM Autism Foundation, Turkey). At PCDI, I was asked to make use of the information and experiences I gained there back in Turkey in the TOHUM Autism Foundation Special Education School. When I returned to Turkey, I implemented ABA in a preschool setting and in after-school programs at TOHUM Autism Foundation special education institutions. I went to PCDI once every six months to attend accreditation meetings there.

The services we provided were being inspected and evaluated each year. The results were compared with other schools. This program has been going on for 11 years in TOHUM Foundation special education institutions. Initially it was thought that people would not be interested in ABA-based education. However, the demand was incredible. There was even interest from other countries such as Azerbaijan, Iran, and Macedonia. We carried out various projects to make ABA common, including attempts to popularize it in Turkey via book translations, projects, voluntary works, and scientific studies, and by holding both national and international seminars, conferences, and workshops on ABA. We worked hard to promote ABA. Meanwhile, we trained staff with high professional qualifications in ABA. We have been lecturing in both undergraduate and graduate courses and supervising ABA-focused theses. Currently, we have a master's degree program in the Special Education Department at Biruni University, where I teach five courses on early childhood, ABA, research-based methods, and errorless teaching. We are excited to have finalized our negotiations to start ABA certificate programs (BCBA). Currently, I work as an academic coordinator in various autism foundations (SOBE, Konya, Anadolu Autism Foundation, Izmir) to make ABA programs more prevalent at the national level. Moreover, I give both national — e.g. Gaziantep, Antalya, and Izmir are the most recent places I have been to — and international seminars. We trained a TOHUM Foundation education director, who opened an ABA school in Iran. We also offer supervision services in Iran and Azerbaijan. We will be providing training and support to

Professor Binyamin Birkan is Director of Education Programs of the SOBE (Selcuklu Autism Foundation) in Turkey. Professor Birkan developed the first applied behavior analysis intervention program for children with autism in Turkey. He holds academic appointments at Biruni University. He has conducted research on behavioral intervention, staff training and monitoring and program evaluation. He has also conducted national and international studies on behavioral intervention program development, personnel training and monitoring, evaluation, development and dissemination of intervention programs. He teaches at various universities on autism and intervention programs and keynote addresses at the International conferences. Professor Birkan has published many research articles and books, book chapters, and three book translations into Turkish in the field of autism and other developmental disabilities.

a new center to be opened in Kosovo. There are also similar projects with Lebanon.

How did you develop an interest in applied behavior analysis?

My supervisor Prof. Dr. Mehmet Ozyurek received his education in the USA on behaviorist methods and ABA. He educated me with his profound knowledge and support. After I graduated from the special education department, I gave ABA-services to an individual with autism. My student had severe behavior problems, which became milder or eliminated with ABA-based procedures. I was really excited by the fact that these methods yielded such positive results. I, then, began my journey in ABA and behaviorism. I decided to improve myself in this field and the rest is history.

What do you think about the current state of behaviorism and ABA in Turkey?

I am afraid there is still a long way to go. It is not well-known yet. There is misinformation. For example, some say that ABA is only for individuals with autism or be practiced in one-to-one trainings. The problem is with fidelity in the implementation of ABA-based procedures. We need both experts who have professional qualifications and educators who possess the experience of practice. We need proper practices. We need experienced practitioners. Even if the current situation is better than before, there is still a long way to go. The issues that are criticized in Turkey are all about problems or obstacles of the practitioners while implementing ABA. People say that ABA is a cold and distant method, which does not involve establishing relationships. However, it is not ABA but poorly implemented practices that are "cold and distant." When ABA is not practiced properly, the results are not as desired; so, people have a wrong idea about it. We need to recognize behavior analysts as professionals of an occupation. We need ABA certification programs. However, I am excited about Turkey because we have made such attempts. We need to work hard.

You used many behavior analytic techniques in your interventions. What are your thoughts about application of these techniques? Challenges, advantages?

I believe that, with experience and proper practice, ABA techniques are eventually easy to implement. As ABA is a very broad area, one has to know the techniques well, have experience, and personalize them depending on the child and the child's significant others.

What do you think was the most important contribution of Skinner to the fields of applied behavior analysis and autism spectrum disorders?

I think that his greatest contribution is his emphasis on the fact that human behavior can be taught. It is very important for the field of ASD.

Prof. Birkan and Yeşim Güleç-Aslan during the interview

Finally, what would you like tell to Operants readers?

Sometimes I come across certain posts on ABA on social networking sites and I really like them. I say we should support ABA for a better, more livable world full of love and peace. ▬

Dr. Güleç-Aslan received her PhD in 2008 from the Faculty of Special Education At Anadolu University, in Turkey. She has worked at the Special Education Department, Educational Science Faculty, Istanbul Medeniyet University, Turkey. Dr. Güleç-Aslan has also worked as a professional with ASD children and their parents. Her lectures and research focus on autism spectrum disorders, applied behavioral analysis, discrete trial teaching, early intensive behavioral intervention, incidental teaching, and especially qualitative research methods.
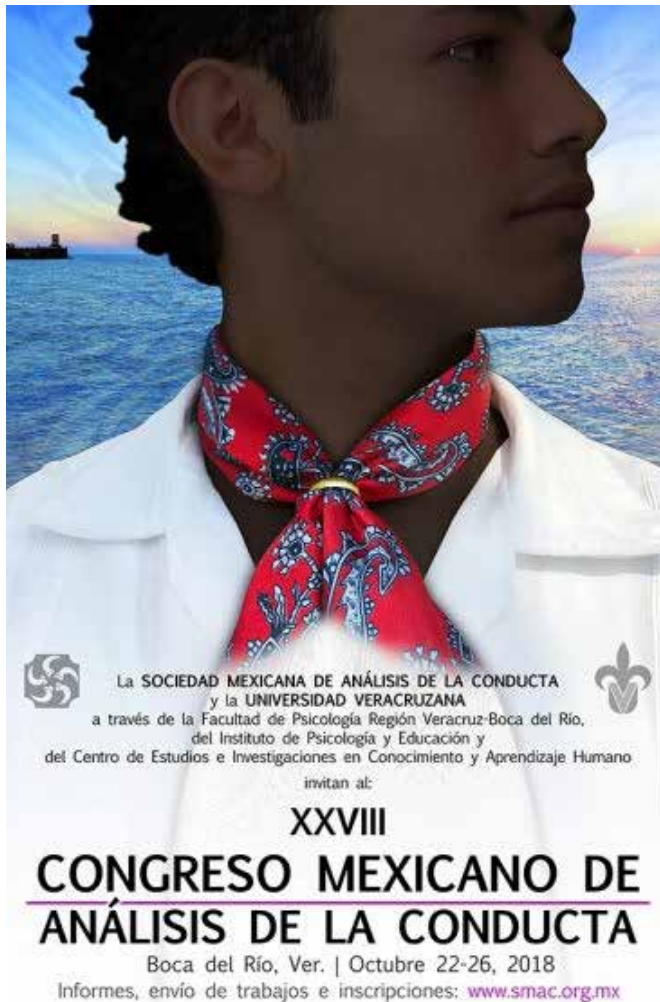
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Review of Jacques Loeb's
Forced Movements, Tropisms, and Animal Conduct

Ernest A. Vargas, PhD

Dr. Ernest A. Vargas is a behaviorologist and a retired director of the B. F. Skinner Foundation. His primary interests are in the history of science and in behavioral theory.

I

"The slow growth of a scientific doctrine was reassuring for two reasons: I could more easily imagine being a successful scientist if great ideas were not needed, and, since early steps in a discovery were simpler, they were easier to interpret as . . . behavior, traceable to circumstances in the life of the discoverer rather than to some mysterious, creative process in the mind." It is this observation of Skinner's in the second of his autobiographies that provides significance to Jacques Loeb's book, *Forced Movements, Tropisms, and Animal Conduct*. In itself the book is not that notable. The experiments reported are sometimes tedious (but also sometimes fascinating) to read, the physiology to which they refer may at times now be suspect, and the writing on occasions pedestrian—though more than once it soars and its frame of reference still applies. But primarily the book is significant for constituting part of an intellectual current that carried a number of scientists to new shores. One of these was B. F. Skinner.

What, specifically, was the training of B. F. Skinner? He went to Harvard and into psychology by accident. As he says, "I was confirmed in my choice of psychology not so much by what I was learning as by the machine shop in Emerson Hall." His graduate course work in psychology was indifferent and minimal; just enough to get by to complete his degree. He took only four classes in psychology. In his comprehensive examinations, his best grade of A+ in Comparative resulted from his work with W. S. Hunter—who preferred the term "anthroponomy" rather than "psychology" for his research on animal behavior; and with W. J. Crozier—a physiologist who emphasized the control of behavior in order to understand it. Skinner's other psychology grades were: B - in Theory, B- in History, and B and C in Experimental Psychology (!). About the exclamation point: Non-academics may not know that a C in a graduate course is equivalent to a Mafia kiss to the graduate student's record. Skinner accurately sums up his la-di-da through the required psychology courses: "Nor was I ever to learn much more psychology at Harvard."

A different story emerges with the course taken with Hudson Hoagland, who was a student of Crozier. Along with Crozier, Hoagland advocated Loeb's position; a position that argued against studying an organism primarily through its physiological parts. In Skinner's first semester at Harvard, in the Fall of 1928, he took Hoagland's course. Titled "General Physiology 5", it was a course that primarily dealt with topics on experimental matters in biology. Skinner states that "It was exactly the course I was looking for". He engaged in laboratory work, and from this work came his first publication. It was a study of tropisms in the ant Aphaenogaster. He had earlier as an undergraduate read

Loeb's *Physiology of the Brain and Comparative Psychology* and *The Organism as a Whole* and he was as he says "impressed by the concept of tropism or forced movement". Despite this second encounter Skinner never again concerned himself with tropisms, much less with ants. But in these early years of exposure to scientific method and thinking, the concepts learned were not irrelevant. Not only did they emphasize the analysis of the movement of the entire organism, but also emphasized a directed action that was not teleological. Loeb and Crozier were anti-Aristotelian. Organisms did not engage in behavior to achieve a future state of affairs. Behavior was not intentional. Outcomes were instead due to, or a result of, past actions.

A second important course mentioned in his second autobiography was one taken with Crozier in the fall of 1929—*The Analysis of Conduct*. As Skinner mentions, Crozier used the word "conduct" because Crozier thought the psychologists had "sullied" the word "behavior". Along with Hoagland's course, Crozier's course engaged Skinner in the examination of eating behavior. But much more important from a "framework of reference" outlook was that Crozier pointed him to Mach. And, just as Mach had analyzed "force", Skinner attempted to analyze "reflex". He searched for a basic unit of analysis on which to pivot all later work. He found it, of course, in the "operant".

Skinner's effort to obtain the basic underpinnings of a behavioral science were well underway when he received a fellowship from the National Research Council appointing him a Research Fellow in *General Physiology*. [Emphasis mine.] Crozier's abundant praise no doubt had an effect on the bestowing of this fellowship. As Crozier stated in a supporting letter to the Board of National Research Council Fellowships in the Biological Sciences to Skinner's application for a fellowship "I am happy to be able to indicate some of the reasons leading me to hold a very high opinion of Mr. Skinner's promise of development and of the exceptional character and of the ability which he has already demonstrated. . . . of the pre doctorate graduate students in the group which I best know he is emphatically the individual of outstanding ability, originality of thought, and fertility in the devising of experimental procedure." Crozier was a "biggie" at the time, so any word from him would be enough to convince a funding committee of the merit of its support. The work Skinner completed under the tutelage of Crozier in his lab led to the material in *The Behavior of Organisms*.

While few read *The Behavior of Organisms* today, it should be read. Almost a century since its publication in 1938, it has weathered the years well. The experimental work in it laid the foundations for our various branches of the field today: For what some call behavioral psychology or operant psychology; for much of what goes under the name of behavior analysis though certainly not all behavior analysis; and for the new science discipline designated as behaviorology. Various designations for more or less the same science effort is not unusual. It took a while for "natural philosophy" to settle into the term "physics". The various tribes of Skinnerians will eventually work out a common *nomen*.

As important as the specifics of the experimental work in *The Behavior of Organisms*, was the driving assumption behind the work. It emphasized the study of the whole organism as it behaves. "Behavior" is the central object of study—not "mind" or even "matter", in the sense of physiological matter. "Behavior" becomes understandable in its *own dimensional discourse*. It is not reducible to the physiology of the nervous system or the physiology of the hormonal system. And it is not merely a handmaiden by which to study an inferred mental apparatus. Descriptively, behavioral phenomena are a subject matter to be directly contacted. Causally, for those behavioral phenomena, the events responsible for them must rest on the foundations of experimental analysis. Control of the conditions under which behavior occurs explains why actions occur as they do. Such analysis substantiates inference.

II

Many of those driving assumptions echoed the biology of Jacques Loeb. Perhaps more accurately, what echoed was the framework of biological analysis of Jacques Loeb. But who was Jacques Loeb?

It is interesting to ask such a question today. In his time, at the beginning of the twentieth century, Jacques Loeb was probably the most famous biologist in America and throughout the scientific world. He was featured in Sunday supplement stories. He was nominated for the Nobel Prize. He was portrayed fictionally as the scientist Gottlieb by Sinclair Lewis in his novel *Arrowsmith*. Loeb's most famous line of work was in artificial parthenogenesis. It was the study of new organisms through what may roughly be called "self-fertilization". His efforts exemplified his ideals for biology. Which were: control the conditions under which you study an organism; and, study the entire organism especially in relation to its surroundings.

Loeb promoted his biology through a prolific production of articles and books. The range of his work can be provided with a few representative titles of books: *Comparative Physiology of the Brain and Comparative Psychology* (1900), *Studies in General Physiology* (1905), *The Dynamics of Living Matter* (1905), *The Mechanistic Conception of Life* (1913), *The Organism As A Whole* (1916). One in particular concerns us here: *Forced Movements, Tropisms, and Animal Conduct* (1918).

III

In writing about *Forced Movements, Tropisms, and Animal Conduct*, I write of a book that few have heard of, and fewer have read; and after reading about the book it

is doubtful whether there shall be a rush to the second hand bookstalls to seek and to buy it. So, what's the book about? In a word—tropisms. The book describes experiment after experiment to investigate different types of tropisms in all kinds of organisms.

The range and kind of organisms described is enormous. Examples include: shark, dog, dragon fly, frog, crustaceans, salamanders, shrimp, paramecia, volvox, caterpillars, barnacle larvae, winged plant lice, blowfly larvae, water scorpion, house fly, robber fly, sessile animals, hydroids, tube worms, unicellular algae, bees, drosophila, star fish, lizard, butterflies, worms, sea urchin, fish, and daphnia. Loeb's labor over the movements of life forms extends across plants and animals, and spans both vertebrates and invertebrates.

The work reported with this organic life is ingenious and captivating. On page 136, for example:

> "The importance of stereotropism in animals was first pointed out by the experiments of Dewitt on the spermatozoa of the cockroach. He noticed that when a drop of salt solution containing the spermatozoa was put under a cover glass resting on low supports on a slide, the spermatozoa collect at the solid surfaces of the slide and cover glass, while the liquid between remains free from spermatozoa. When a small glass bead is put into the liquid the spermatozoa will also swim on the surface of the bead, never leaving it again. Dewitt is of the opinion that this stereotropism is of assistance in securing the entrance of a spermatozoon into the egg. The egg of the cockroach is rather large and the spermatozoon can enter it only through a micropyle. When the egg is laid it passes by the duct of the seminal pouch in which the female keeps the sperm after copulation. On passing the duct some spermatozoa reach the egg. Dewitz points out that these cannot leave the surface of the egg any more but are compelled to move incessantly on the surface of the egg until one of the spermatozoa by chance gets into the micropyle."

The types of tropisms described by Loeb vary greatly, and include: heliotropism, galvanotropism, geotropism, anemotropism, stereotropism, chemotropism, and theromtropism. In the definition and investigation of these types lies the significance of Loeb's book. It is a theoretical treatise on tropisms, exemplified through experiments. But what is a tropism?

In its broadest sense a tropism is an animal movement brought about by something that pulls it forward.

To paraphrase Loeb, it is a forced orientation of an animal by an outside source of energy. The significant point here is that even though the event that occurs is antecedent to the animal's actions, it *pulls it forward*. (Emphasis mine.) It does not *push* from behind as is metaphorically implied by the antecedent event called "stimulus". Loeb's analysis of the forward action of an organism is important for it addresses what is usually explained teleologically with terms such as goals, purpose, and intention. Loeb makes it quite clear that he has no truck with teleological explanations, and that his theory of tropisms, with its supporting array of experimental data, refutes teleological speculation. As he quite firmly states "Science began when Galileo overthrew this Aristotelian mode of thought and introduced the method of quantitative experiments . . . "

He casts the thesis of his book as an antithesis to teleological analysis, especially as exemplified by Aristotelian thinking, in the analysis of animal behavior. What Loeb states will sound familiar to those who encounter the promotion of the controlling mind of the agent within. Loeb summarizes that opposite view trenchantly: "the Aristotelian viewpoint still prevails to some extent in biology, namely, that an animal moves only for a purpose, either to seek food or to seek its mate or to undertake something else connected with the preservation of the individual or the race." Furthermore he emphasizes that the analysis of such seemingly purposive conduct must submit to a functional analysis of the relations between independent and dependent variables, that is, to quantitative laws and physicalistic events. "In many cases the problem of animal conduct in terms of 'trial and error', of vague 'psychological states' may serve as examples. None of these attempts have led or can lead to any exact quantitative experiments . . . The analysis of animal conduct only becomes scientific in so far as it drops the question of purpose and reduces the reactions of animals to quantitative laws."

The significance of this quantitative analysis (in our terms, functional) is demonstrated in the words "forced movements". By "movements" Loeb gave special importance to an analysis of animal behavior that could be directly observed and that would be carried out within the dimensional system of the physical world. By "forced" Loeb advances his philosophical orientation, or frame of reference, that actions lack purpose. It was an unfortunate selection of a term by Loeb; by "forced" he does not mean coerced. He means that actions, of plants and of animals, occur through the *necessity* of environmental circumstance and biological history. Actions are non-voluntary. No agency lurks inside by which and with which an organism makes decisions. If under certain conditions, the organism conducts itself a certain way, it has to behave that way in those conditions. Loeb's term "forced" underlines the inevitability of its movement, its actions, its behavior, given the conditions the organism encounters. As Loeb wryly puts it, the animal goes "where carried by its legs". Within certain physical and chemical circumstances, these inevitable movements

by the whole organism, plants and animals, were "tropisms".

So far, so good; and if Loeb wants to describe such forward-forced movements as "tropisms" that is a perfectly proper term to provide, such as one provides the term "operant" for consequence-governed actions. Loeb, however, stumbled. He wanted to explain, even further, why they occurred. Like others who do not realize an explanation has been given if the independent variable has been provided, he attempted to provide one through the underlying mechanisms of the body. So despite his concern with the external conditions governing behavior, his investigations drifted into physiology. He concerned himself with describing the physiological pathways and the biochemistry underlying tropisms. His "muscle tension theory" underlying tropisms was a point of controversy with biologists and others concerned with animal behavior, such as H. S. Jennings. The disagreements over his muscle tension theory and over the physiology underlying tropistic behavior might have obscured the contributions Loeb did make to the analysis of conduct, especially his contributions in methodology and focus of analysis. Such a side swipe from a fuss would not be the first time.

The significance of *Forced Movements, Tropisms, and Animal Conduct* goes beyond the descriptions of the prolific experiments with animals and plants. Though he slipped a tad, Loeb emphasized an explanatory independence from general physiology, especially the physiology of animal parts, later echoed quite firmly in Crozier's writings. As Crozier stated in an article on tropisms: "A quantitative treatment of tropistic behavior is essential if the understanding of conduct is to be furthered . . . the term 'quantitative' has significance in the light of functional interrelationships . . ." The echo resonated Loeb's voice.

But now the voice barely sounds above a whisper. From a household word, Loeb's name drifted to a name only heard in the cloister of the history of science.

Mention Loeb to any behavioral scientist and you will get only a puzzled look, though perhaps the occasional biologist may chirp up. The calendar pages flutter too closely to the immediate dates of his contributions to judge those well. Perhaps those contributions were large, perhaps small. But then, who knows what exactly the smallest brick contributes to the edifice of science? Each small stone of support undergirds the common effort. There is, however, no doubt of what he helped to build. Loeb left behind him a cornerstone in the foundation of behavioral science in his influence on Skinner.

IV

Skinner drifted to the psychology department, seduced primarily by its available and handy workshop. As noted earlier, the courses in psychology were irrelevant to his concerns. Immersed in the science and even philosophical frame of reference of Loeb and Crozier, Skinner thought, even stated, in the joyful enthusiasm of the young entrepreneurial scientist that he would make over psychology. In order, as he stated in *The Shaping of A Behaviorist*, "to suit myself". He never succeeded.

The customs and beliefs and practices in psychology were simply too alien to his quest. The traditions from literature and philosophy that emphasized understanding of the mind and of its purposive goal-seeking conduct rejected any tendency to do away with the agent within. How could there be a mind without an agent to provide its manners? Even stating that an organism does this or that provides an agent, and therefore an explanation, though circular, for its conduct. The frame of reference of agency assumes an epistemological dimension separate from one whose focus of concern is that of the properties of behavior. Proof lies on what is inferred *from* behavior about its *controlling mind* rather than from the direct observation *of* behavior under *controlling conditions.* Instead of inferences from behavior about the "mind" and why the "mind" does what it does, the direct observation of controlled actions provides an explanation based on manipulable variables responsible for the immediately linked behavioral properties. For Skinner, as for Crozier and Loeb earlier on, the control of actions explains them.
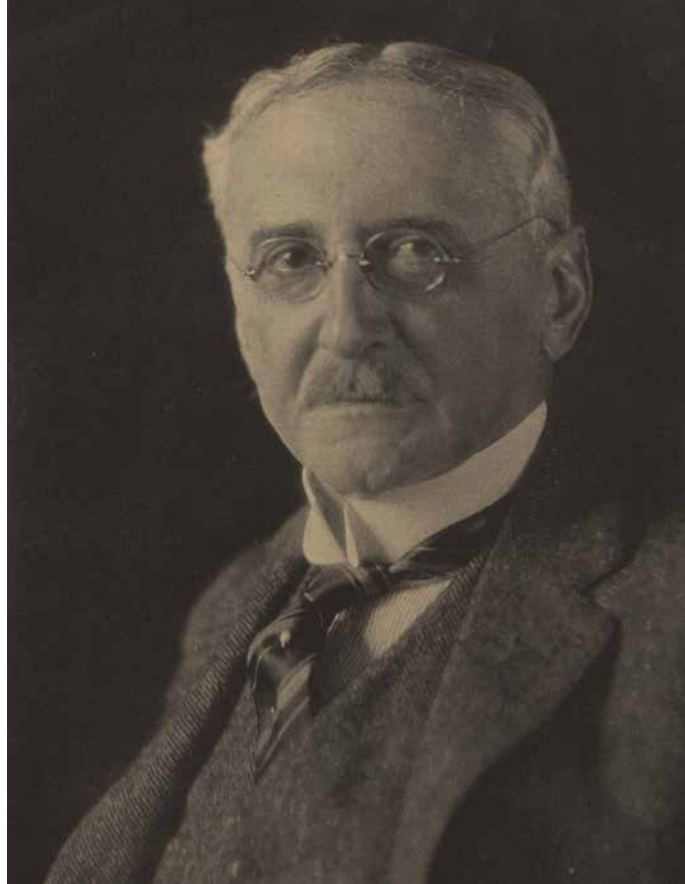
Jacques Loeb, 1923

The significance of the influence of Loeb and Crozier on Skinner shows itself quite clearly through its impact on the sciences of behavior. The origins of behavior analysis (the behavior analysis of the Skinnerian variety) and of behaviorology (the Skinnerian science of the properties of behavior) stem from biology rather than from literature or philosophy or psychology. Skinner learned his science in Crozier's lab. There was no truck there with implied Aristotelian entities. Skinner transported this anti-Aristotelian position to the behavioral sciences. Skinner's subsequent impact on the analysis of behavior led to the effective practices of behavior analysts and to the definition of *behaviorology* as the *science of contingent relations between actions and other events*.

A behaviorological analysis posits a non-reductionistic approach to the analysis of behavior; not reducing its principles to that of any other discipline defines and supports its independent disciplinary status. The position is typical in the maturing of a science. Ernst Mayr argues strongly that biology is not a branch of any of the physical sciences—physics, chemistry, or what have you—as biology's principles derive from an independent dimensional frame. Life is not merely the whirling orbits of atoms and electrons. In that same sense, the study of an organism's conduct also occurs within an independent dimensional frame: The behavior of an organism is not merely a matter of the interactions of physiological events. As with physical and chemical substrates, the physiological substrate can be taken for granted. Rather than to speculate or to unravel the neuronal activity involved in reading behavior, it is far easier to say that a person reads a grocery list written in Spanish because he has been taught Spanish. Of course, there is nothing wrong in neuronal examination or even speculation for those for whom it is their business.

And what is the business of behavioral scientists? Well, what their name denotes of course. They are scientists of behavior, and that clearly means the study of the organism's behavioral interchanges with its worlds, internal and external; and how it changes those worlds; and in return, how the changes in those worlds change it. Such complex reciprocity is as dynamic and puzzling as encountered in any science. Moreover, an additional arcaneness adds to the puzzle. The interaction continues to be obscured by the ideological lenses by which behavior is viewed by groups with agendas to pursue and for others to adopt. Thus, we have moral man, political man, economic man, and even genderless man, and any other favorite defining attribute. To those concerns, behavioral scientists can offer no more, and that is quite a lot, than the neutrality of their subject matter and of its analysis with no assumption of a dictating agent, mind, or will. As Loeb put it in the very first sentence of his book, "The analysis of the mechanism of voluntary and instinctive actions of animals . . . is based on the assumption that all these motions are determined by internal or external forces." "Forces " is his term for the conditions that dictate actions.

What Loeb wrote in *Forced Movements, Tropisms, and Animal Conduct* indicates some of the links between Loeb and Skinner. How Loeb and Skinner connect is displayed in temper, in tone, and in approach. They shared the same frame of reference in looking at the organism as a whole as it behaved within a defined set of circumstances. Loeb addressed the specific actions of the whole organism within an ambient environment, such as a sea shore. Skinner examined properties of behavior from intact organisms in a constructed environment such as an operant chamber. They both rejected any aspect of agency. They both dispensed with purpose, intent, or will. In their descriptions of the behavior of organisms, they both expunged any remnant of Aristotelian ambiance.

This review started with a quote from Skinner. It seems only proper to end with a quote from Loeb. In these last words from the last two pages of his book, Loeb expresses uncompromisingly the reality of the determinate forces over behavior. Loeb clearly points to why so many indulge in so much illusion over agency and its presumed free will.

". . . higher animals and human beings seem to possess freedom of will, although all movements are of the nature of forced movements . . . the number of possible reactions so great that prediction becomes impossible and it is this impossibility chiefly which gives rise to the doctrine of free will. . . . We have shown that an organism goes where its legs carry it and the direction of the motion is forced upon the organism. When the orienting force is obvious to us, the motion appears as being willed or instinctive; the latter generally when all individuals act alike, machine fashion, the former when different individuals act differently. When a swarm of Daphnia is sensitized with CO_2 they all rush to the source of light. This is a machine-like action, and many will be willing to admit that it is a forced movement or an instinctive reaction. After the CO_2 has evaporated the animals become indifferent to light, and while formerly they had only one degree of freedom of motion they now can move in any direction. In this case the motions appear to be spontaneous or free, since we are not in a position to state why *Daphnia a* moves to the right and *Daphnia b* to the left, etc. As a matter of fact, the motion of each individual is again determined by something but we do not know what it is. . . . Our conception of the existence of "free will" in human beings rests on the fact that our knowledge is often not sufficiently complete." ▬

A Note on Prizes and Honorific Awards

Per Holth, PhD
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I don't believe in prizes for grown-ups or for children
B. F. Skinner

The practice of awarding individuals for important achievements is widespread in our culture. There are highly ranked international prizes for different areas of achievement, such as those awarded by the Nobel committees in Sweden and Norway. Governments give different medals and other awards, professional organizations, like APA in the US and similar organizations in other countries, universities, colleges, and schools give them. And, of course, ABAI does it, and even the B. F. Skinner Foundation.

Certain contingencies must have produced and selected such practices. In colloquial terms, it is easy to come up with some nice things to say about prizes and awards. We often talk about candidates "deserving" the award, and we are likely to applaud when awards go to someone whose work we admire. The individual who receives the award may be helped by it in different ways. It may bring more attention to the person's work, the award can be listed on the CV, and it may even increase the chances of getting grants, promotions, more prestigious positions, and so on.

Basically, individual awards make good sense from the traditional view of an individual as responsible, at least in part, for his or her actions. An individual responsible for great achievements may be deserving of a reward. In a behavior-analytic perspective, where the causes of behavior in principle are traced to the environment, the idea of individuals deserving an award makes less sense. Certainly, awarding a person is by itself an environmental event that may reinforce behavior. However, we know little about what is reinforced by such an event, and we know no more about other effects it may have.

The effects of individual honorific awards are seldom, if ever, analyzed in more detail, and may be rather complex and problematic. I will just raise a couple of issues here, specifically related to the practice of giving individual awards. No doubt, the practice of giving individual awards is well meant, but the focus here is not on what an award is meant to achieve, but rather on what the potential and likely effects are. Generally, an individual award has the potential to affect the behavior of many people, including other potential candidates, who do not receive the award. When individual awards are announced, it is simultaneously an announcement of no-award for all others, and the implicit potential effect of awards as aversive stimuli is seldom made explicit in our "equation" of pros and cons with respect to a specific awardee.

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Dr. Holth is a member of the B. F. Skinner Foundation's Board of Directors.

Consistent with the idea that the causes of behavior lie in the environment, our focus should be on strengthening those features of the environment that contribute to good research. So, how can we do that? "Reinforcing" the environment by awarding it does not really make very good sense. If we consider the behavior of other researchers as an important part of any researcher's environment, an approximation to strengthening environments that produce good research may be to give awards to groups of researchers. While individual awards may encourage self-promoting behavior, group awards may be more likely to encourage collaborative efforts. Also, more collaboration across research groups may often be more useful than efforts to distinguish the work of one group and, accordingly, the awarding of concurrent or joint efforts of different contributors to a specific research area may be particularly useful.

When Skinner had been awarded the National Medal of Science for his "basic and imaginative contributions to the study of behavior which had profound influence upon all psychology and many related areas," Bill Estes wrote him a letter with congratulations on the medal. Skinner replied that," it was good of you to send the note about the medal. I don't believe in prizes for grown-ups or for children - - but it was an interesting occasion." Skinner elaborated his point of view in a letter to Sherman Ross in the American Psychological Association at the time:

> "I am in favor of supporting good research, but I have grave doubts about the value of honorific awards. The contingencies of reinforcement are far from satisfactory. I would be in favor of bringing all activities of the APA which appear to evaluate personal achievement to an end."

Still, as suggested in the introduction, individual awards may occasionally have important functions. For example, although Skinner (in a note from 1967) wrote that "I am convinced that my effects on the world will be greatest (and there's my reinforcement!) if I minimize all personal blandishments", he did make use of his own honorific awards on occasion, for example, when criticized by "a group of individuals" at Massachusetts Institute of Technology (MIT) following the publication of *About Behaviorism* in 1974. He wrote to the editor of Harvard Magazine and complained that the book had been sent to one of these persons for review. Skinner emphasized that, "For the experimental work I have done at Harvard I received the National Medal of Science and many other honors and research stemming from it is now carried on in hundreds of laboratories throughout the world. In what sense it can be 'totally vacuous' I am not prepared to say, nor is its object the training of animals."

In any case, the practice of giving honorific awards may profit from more careful contingency analyses. The fact that our current awarding practices must have been selected does not mean that there is no room for improvement by explicit design. Making awards typically available not just to single individuals, but jointly to individuals within or across research groups, seems worthwhile. ▬▬

From *Walden Two*:

"Fame is also won at the expense of others. Even the well-deserved honors of the scientist or man of learning are unfair to many persons of equal achievement who get none. When one man gets a place in the sun, others are put in a denser shade. From the point of view of the whole group there's no gain whatsoever, and perhaps a loss."

"But is there anything wrong with admiring exceptional achievements, or being pleased to receive recognition?" I said.

"Yes," said Frazier flatly. "If it points up the unexceptional achievements of others, it's wrong. We are opposed to personal competition. We don't encourage competitive games, for example, with the exception of tennis or chess, where the exercise of skill is as important as the outcome of the game; and we never have tournaments, even so. We never mark any member for special approbation. There must be some other source of satisfaction in one's work or play, or we regard an achievement as quite trivial. A triumph over another man is never a laudable act. Our decision to eliminate personal aggrandizement arose quite naturally from the fact that we were thinking about the whole group. We could not see how the group could gain from individual glory."

"But do you exclude simple personal gratitude?" asked Castle. "Suppose one of your doctors worked out a system of sanitation or medication so that none of you ever had colds. Wouldn't you want to honor him, and wouldn't he want to be honored?"

"We don't need to talk about hypothetical cases," said Frazier. "Our people are constantly making contributions to the health, leisure, happiness, comfort, and amusement of the community. That's where your young friend with the industrial process would find himself. But to single anyone out for citations would be to neglect all the others. Gratitude itself isn't wrong, it's the ingratitude or lack of gratitude which it involves." (pp. 156-157)

A Continued Discussion of Skinner's Analysis of Generic Classes

David Roth, MA

The 2018 first quarterly issue of *Operants* magazine introduced a call for discussion within the field of behavior analysis about the foundational principles of our field and how they can be plausibly extended to our explanations of complex behavior. Recently re-published on the B. F. Skinner Foundation's website Skinner's 1935 paper, *On the Generic Nature of the Concepts of Stimulus and Response*, serves as a central focus for the present discussion. Since the published works of David C. Palmer show how these principles can be extrapolated to interpretations of complex behavior, we are including excerpts from his publications that illustrate the importance of Skinner's original experimental discoveries.

So far Palmer and I have outlined three different lever-pressing response classes that emerged from tightly controlled experimental conditions. The first generic class was one in which some topographical variation of the rat's paws presses a lever that, in the past, has reliably produced reinforcing consequences. A *subclass* of lever-presses was derived by illuminating only one corner of the lever and restricting reinforcement to responses on only that corner. Finally, a third class of responses (tail-lever-presses), which independently emerged from the experimental conditions, was one that, although it produced the same reinforcing consequences as the two classes above, cannot be included as a member of the operant classes described since it is controlled by entirely different antecedent controlling variables from the previously established stimulus classes and does not rise and fall in probability with the other classes of response.

Topographically Different Members of an Operant

At least one more important class of behaviors relevant to our discussion of the operant is one that may be functionally equivalent to the previously established class of behaviors with respect to its antecedent and postcedent controlling variables. Its topography, however, bears no resemblance to the previously established lever-pressing class. Imagine that after a prolonged history within our hypothetical experimental conditions, our rat, when reaching toward the lever with its paws, fails to make contact with the lever and adventitiously operates the lever with its snout. The reinforcing consequence may now select a new range of behaviors that are topographically bounded by variations of snout-lever-presses, yet, unlike tail-lever-presses, this class is controlled by the same antecedent (and postcedent) variables as the existing class of paw-lever-pressing behaviors.

The first instance (as well as any subsequent variations) of the new behavior cannot be considered a member of the established lever-pressing class since it did not emerge as a product of response in-

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duction, nor would we classify this single response as a member of the lever-pressing *operant* since the response was not a product of a history of reinforcement for its emission within that context (or a physically similar one). From the perspective of a historical science, only subsequent variations of the response can be considered members of the operant class for lever-pressing. For example, if the rat incidentally operated the lever by sneezing on it, we would likely not observe subsequent manifestations of that topography in any orderly way within that context, since sneezing is maintained by a unique and entirely separate history of contingencies. With respect to the snout-lever-presses, however, we may observe an emergence of this new range of topographies, but we cannot presume that snout-press responses and paw-press responses would be members of the same response class unless they were somehow observed to be mutually replaceable with each other. According to Donahoe and Palmer, this would be improbable since the mediating muscle fibers and neurons for each of the two classes are largely separate from each other, and any influence a contingency change on one class might have on another would inevitably be an indirect one mediated by other variables.

Palmer on Topographically Different Classes within an Operant

In the recent article for this discussion, we presented a passage from Palmer's review of a book on the "post-Skinnerian" approach to complex behavior, in which Palmer very briefly summed up Skinner's 1935 paper as being the "definitive discussion of this topic," and he evidently saw no reason at the time to elaborate any further on Skinner's account. However, in a published response to the authors' reply to his review, Palmer provided for the reader what appears to me to function as an invaluable tutorial of Skinner's foundational 1935 paper. With respect to the emergence of a topographically unique range of behaviors within an operant (e.g. "snout-lever-pressing"), Palmer says the following in his response to the authors:

> There are no a priori grounds for predicting general-ization from one form to the other. But a prolonged reinforcement contingency might capture a variety of topographies of different origins, so long as the contingency has been satisfied in each case. That is, [snout-lever-pressing] appears more or less inter-changeably with pressing the lever in the terminal performance only because it has frequently been reinforced. Thus an operant might embrace responses of conspicuously different topographies, but only if they all share a history of reinforcement in the same context. From this perspective, an operant does not include every imaginable topography that will close a microswitch (i.e., every form that is functional-ly equivalent); it includes only those that share a history of reinforcement in the same context or in similar contexts. The concept of functionally defined

response classes is not infinitely elastic.

Although our lever-pressing operant includes at least two topographically distinct response classes that both come to varying degrees of strength within the same context, this does not imply that our operant is somehow defined independently of its physical dimensions. According to Skinner, the properties of our subject matter "must be specified, in physical terms, if we are to remain within the framework of an empirical science." So long as there is observed orderliness in our data, for all practical purposes, the definition of our lever-pressing operant includes each topographically constrained response class that has been selected and maintained by the same controlling variables. However, as will be discussed below, the scientist must reserve a healthy amount of skepticism with the possible assumption that the different forms of response are truly equivalent when investigating multiply controlled instances outside the laboratory.

Skinner on Topographically Different Classes within a *Verbal* Operant

In a traditional account of language, two topo-graphically distinct, yet functionally equivalent response forms, are classified as *synonyms*. Skinner made the claim in his behavioral account of language that "there is no true synonymy in the sense of a choice of different forms. When all the features of the thing described have been taken into account and when the audience has been spec-ified, the form of response is determined." Despite this assumption, Skinner continued to acknowledge the be-havioral reality of synonyms; within *Verbal Behavior* the term "synonym" was used 45 times in various discus-sions of response equivalence and momentarily selected response forms. In the publication of his personal notes, Skinner described twelve casual observations of "select-ed synonyms" in which he provided plausible interpre-tations for the determination of the emitted form. For example:

> I had been writing about an experiment by a student, Larry Fain. A few moments later I started to make a note about simulating affection as a reinforcer. I could not get the word simulate *and found myself writing* feign. I examined the word intensively as I wrote it and then saw that it was a homophone of Fain.

Casual speculation about this incident might suggest that the response "feign" was merely selected by Skin-ner among other available synonymous forms, such as "replicate," "mimic," or "simulate." However, Skinner remarked that, although "simulate" was perhaps a more appropriate response for the context of his current task at the time, additional variables (i.e. the echoic strength-ening brought about by his student's name within that context), contributed heavily to the ease of the eventually

emitted form, "feign."

Just like our rat that demonstrated two different forms of lever-pressing response classes within the same context, Skinner's repertoire apparently had at least two different forms of response within a context related to the mimicry of experimental variables (*simulate* and *feign*). Since there is no prior history of reinforcement for the response "feign" controlled by the context of this particular student's work, we should not interpret its emitted form as a member of an operant class controlled by those specific antecedent variables; rather, it is an example of a response under the multiple control of a unique confluence of variables. Perhaps with the development of more refined experimental technology we will discover similar distinctions between the topographically different response classes within our experimentally discovered operants (e.g. the moment-to-moment variables that control snout-lever-presses over paw-lever-presses).

Concluding Comments

Between the present essay and the previously published introduction to the series, I hope to have covered, from a Skinnerian approach to a behavioral science, the range of topographical members within a single response class, as well as the various response classes that may be included within a single operant unit. As argued by Skinner and Michael, Palmer, and Sundberg, the relatively simple operants discovered under laboratory conditions are rare in the control of our everyday behavior; however, they play the most fundamental role in the determination of our ubiquitously multiply controlled behavior. When a novel arrangement of established controlling variables leads to a seemingly fluid emission of an environmentally effective response, our scientific account cannot plausibly classify it as a member of a single operant controlled by those conditions since no operant with those physical dimensions exists within the history of the individual. Instead, we interpret the novel response as being controlled by a convergence of the unique arrangement of variables within the current context. Only the orderliness of our data over time can tell us if similar arrangements of those variables in the future will continue to maintain the behavior, thus demonstrating a newly selected operant within the repertoire of the individual.■

brevis

Recently, *Operants* magazine hosted a reception for contributors, correspondents, and translators. Below are some of the photos from the event taken by Jeremy Greenberg.
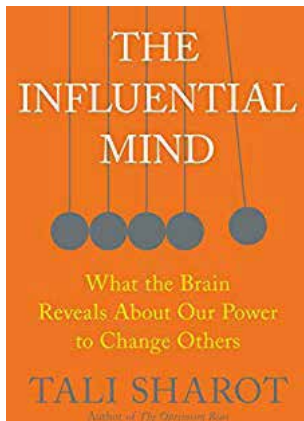
The Influential Repertoire

David Roth
Associate Editor, *Operants*

A little while ago, The Harvard Business Review summarized a book whose title, *The Influential Mind*, may have readers of *Operants* rolling their eyes. However, its mentalistic title is partially redeemed by the subsequent issues addressed in the book. Tali Sharot, the book's author, is a cognitive neuroscientist who has discovered the power that immediate consequences have on the behaviors they follow. Interestingly, considering that B. F. Skinner is not cited once throughout the book, it appears that Sharot's discovery was made independently of the facts that Skinner experimentally demonstrated over 80 years ago.

The term *reinforce* shows up in the text only twice, and its meaning merely implies one's supporting of an idea or an opinion. The term *reward*, however, appears over 60 times, and its use seems to be more closely aligned with our field's basic principle of reinforcement having a focus on its effect as a consequence of behavior. The article in the Harvard Review summarizes a study in which hospital staff demonstrated a significant increase in hand sanitizing behavior when the behaviors were immediately followed by social praise. These measurements greatly outweighed the frequency of hand sanitizing behaviors following threats of disease. Although the data collected in the study are empirical, much of the attempts to explain the effectiveness of such consequences are done so with a mixture of neuroscientific data and mentalistic speculations. This is not surprising, however, considering the author's thesis asserted in the prologue that "the underlying assumption of this book is that your brain makes you who you are."

In his 1974 text, Skinner explained that the field of cognitive psychology during that time established "a current practice of avoiding dualism by substituting 'brain' for 'mind.' The brain is said to use data, make hypotheses, make choices, and so on, as the mind was once said to have done. In a behavioristic account it is the person who does these things." Sharot's book was published over 40 years after Skinner's description of the cognitive field's attempts at avoiding dualism, yet to take an example from her text it appears that not much has changed in the cognitive domain today, "As it turns out, while we adore data, the currency by which our brains assess said data and make decisions is very different from the currency many of us believe our brains should use." Following Skinner's model, we can de-mystify statements like these by replacing each instance of "our brains" with "we"; applying this practice places readers safely back onto behavioral terrain.

There are various examples throughout *The Influential Mind* in which we can substitute mentalistic terms with behaviorally "synonymous" forms. This results in a more accurate understanding of the author's actual subject matter. Examples include replacing the words "brain" or "mind" with "person" or "behavior" when contextually appropriate. Despite its lacking behavior analytic framework, *The Influential Mind* may be an important book for behavior analysts to read. Communicating to readers with a vocabulary that is perhaps easily accessible to the average lay person, Sharot's book points to an understanding of behavior from a selection-by-consequences perspective, and that is certainly worth celebrating.

Operants has invited two experts from within their respective behavioral sub-fields to contribute to the main themes of the reviewed book. Dr. Barbara Bucklin discusses, from an Organizational Behavior Management (OBM) position, the important roles that immediate consequences and their corresponding antecedent variables play in the development of effective employee behavior. Dr. Daniele Ortu explores the popular topic of "consciousness" from a neuro-operant analysis, and he illustrates Skinner's prediction about how such physiological discoveries of behavior "will make the picture of human action more nearly complete."

Harvard Business Review article link:

https://hbr.org/2017/09/what-motivates-employees-more-rewards-or-punishments

Reinforcement and Punishment in the Workplace: A Reaction

Barbara Bucklin, PhD

In her recent book called *The Influential Mind*, the author Tali Sharot devotes an entire chapter to incentives, titled *Should You Scare People into Action?* with many examples involving individuals within workplace programs to "move with pleasure or freeze with fear." While her book is interesting, and aligns somewhat with a behavioral analysis applied to business, she doesn't cite a single behavioral research study to support her points. As may be obvious, *moving with pleasure* could mean positively reinforced behavior, while *freezing with fear* sounds a lot like behavior suppressed by punishment.

As her book's subtitle suggests (i.e., *What the Brain Reveals About Our Power to Change Others*), she discusses these principles under the guise of 'brain science' rather than the behavior science principles we've studied for decades. Some of the other chapters reveal promising forays into brain science research and results, but not this chapter on incentives. I do encourage readers to explore the book. It's an interesting read and it does us all good to learn about similar research from other fields, especially when it's cited in popular books.

So, what *do* we know as behavior analysts about the effects of positive reinforcement and punishment in the workplace? A lot!

Research and practice informing this question come from Organizational Behavior Management (OBM), a sub-field of behavior analysis applied to business and industry. And, as with most of the behavior analysis sub-fields, OBM can point to Skinner. In Alyce Dickinson's detailed history of OBM, she noted that back in 1953 in *Science and Human Behavior*, Skinner provided an astute analysis of work behavior and economics with topics such as reinforcing behavior with money, wage schedules, differential reinforcement of quality of work, and the economic value of labor. Since that time, the field of OBM has grown with its own Journal of Organizational Behavior Management, started in 1977, and has been devoted to studying behavior analysis in businesses.

Employees Must Wash Their Hands!

At the beginning of the book chapter referenced earlier, Sharot cited a CDC study that showed that only 38% of restaurant employees wash their hands before returning to work after using the restroom, with almost identical data in healthcare facilities despite signs that read, "Employees Must Wash Their Hands Before Returning to Work." Because of these data, researchers in an intensive care unit at a New

Dr. Barbara Bucklin is a global organizational behavior management (OBM), learning, and performance improvement leader with over 20 years of experience. She collaborates with her clients to identify performance gaps and recommend solutions that are directly aligned with their core business strategies. She oversees design and development processes for learning (live and virtual), performance-support tools, performance metrics, and a host of innovative blended solutions.

Dr. Bucklin is on the Board of Directors for the Organizational Behavior Management Network. She has taught university courses in human performance technology, the psychology of learning, organizational behavior management, and statistical methods. Her research articles have appeared in Performance Improvement Quarterly and the Journal of Organizational Behavior Management. She presents her research and consulting results at international conventions.

York hospital changed staff hand-washing behavior almost instantly by installing an electronic board that displayed the percentage of the shift that was washing their hands.

The book uses the old 'carrot' and 'stick' description in its analysis. In this case, the 'carrot' was the immediate feedback on the billboard every time staff washed their hands, paired with positive comments from peers. The author contrasted this with the 'stick' strategy, which was the threat of disease if staff walk out of the restroom without first washing their hands.

Sharot explained these results in a couple of ways. One was a 'go, no go' reaction in the brain; she claimed that the brain is built to associate forward action with reward and not with avoiding harm, "we are more likely to execute an action when anticipating something good rather than anticipating something bad."

She also wrote about immediate and certain consequences as being more powerful than future and uncertain consequences. As behavior analysts, we know *this* to be the causal factor. Whether the consequence is reinforcing or punishing, its effectiveness depends on its immediacy and certainty. The immediate and positive feedback after handwashing was much more powerful than the delayed and uncertain consequence of disease.

Behavior Analysis Point of View: ABC Model and PIC/NIC Analysis

Readers of *Operants* should not be surprised by the author's example in which the "Employees Must Wash their Hands" sign doesn't influence behavior without providing immediate feedback for having done so.

In the workplace, the functions of behavior are the same as anywhere else. In our science, we can use the well-known ABC Model (Antecedent – Behavior – Consequence) to explain what's happening. The sign is the antecedent, handwashing is the behavior, and there has always been a threat of a future, yet uncertain, behavioral consequence of health problems for engaging in the opposite behavior (i.e., walking out of the restroom without washing hands). When a positive, immediate, and certain consequence was added for engaging in the desired behavior, it's easy to explain why handwashing increased. Based on this analysis, here are some tips and reminders to those of you who work in OBM or manage staff.

Behavior Analysis at Work (i.e., OBM) Reminders

Although we understand the principles of behavior best, it's often difficult to consistently and rigorously apply them in the world of business. I was talking with a friend and business owner about this essay as I was writing it, and he said, "That sounds like a great reminder. It's amazing how much better my employees perform when I simply thank them for a job well done. It positively impacts our culture, and everyone does better. But, when I get caught up in my everyday challenges, it's hard to remember."

OBM Reminder #1: Antecedents won't work by themselves

The first reminder is that antecedents alone won't do much to change behavior. Those outside our field often find this difficult to grasp. I've heard clients say something like, "Well I told my employees to change, I explained the new way they do things, and I even put up a sign. I don't understand why they didn't change." What's most likely missing in these cases? Pairing the antecedent with behavioral consequences. What happens if employees engage in the 'new' behaviors? What happens if they don't? When paired with behavioral consequences, antecedents work well by establishing "expectations." Think about how nicely the world would work if the signs around us all the time were reliably paired with the consequences they warn us about. Think about what would happen

if there were immediate positive reinforcers every time construction workers wore their hard hats in the work zone, and/or immediate punishers every time they entered the zone without hard hats. In reality, the behavioral consequences for walking out of the restroom without washing our hands or entering a construction zone without the proper equipment are delayed and uncertain (and possibly not explicit), and that's why they don't change behavior.

If you're in a position to pair the antecedents in your environment with consequences, do so. It needn't be expensive or time consuming like the electronic billboard in the hospital restroom. Simply say "thank you" or provide another social reinforcer when you see employees comply with the antecedents around them.

OBM Reminder #2: Behavioral consequences must be immediate and certain

This is a challenge in business settings. We're criticized in OBM for using the term 'reinforcer' when the stimulus we're referring to is delayed by hours, days, or even months following the behavior. We know that a reinforcer by definition is a stimulus change that occurs immediately after the behavior and increases the probability of that behavior. Here are a few ideas for immediate reinforcers in the workplace:

- Use a point system in either a low-tech way (e.g., whiteboard) or a high-tech way (e.g., online performance portal). With this method, employees immediately see points or scores that bridge the gap between their behavior and more delayed rewards such as monetary incentives.

- Catch employees performing the behaviors and deliver immediate social reinforcers, as in the example my friend shared when he "catches" his employees doing a good job and thanks them for it.

- Create a culture where peers are encouraged and reinforced for delivering immediate positive reinforcers to each other.

- Find 'natural' reinforcers in the environment and capitalize on them. For example, set up job tasks so the more challenging and less desirable work is followed by easier and more enjoyable work. We call this the Premack Principle; the more enjoyable tasks serve to reinforce completing the less enjoyable ones.

When your workplace culture is full of positive, immediate, and certain consequences, you'll see the beneficial side effects, just like my business-owner friend explained. Why? It's pretty simple from a behavioral perspective. The person delivering the positive reinforcement is seen as a reinforcer and is sought out by the receiver. This improves their relationship. If this is happening across the organization at all levels, you can imagine the trust, respect, and job satisfaction that ensues.

OBM Reminder #3: Personalize the "reinforcers" you use

Many employers complain that they tried to use positive reinforcement in their businesses, but it didn't work. If it didn't work, what they selected were not reinforcers. Effective managers and OBM-ers give employees choices. They ask questions to find out what restaurants they like, where they like to shop, what sports teams they follow, and if they enjoy public recognition or prefer to stay behind the scenes.

If you can, try out some of their choices. To confirm that it's working, keep talking to employees about their likes and dislikes, and more importantly, observe and respond to their work behavior and results.

OBM Reminder #4: Avoid negative, immediate, certain (punishers) if possible

Immediate and certain consequences are effective no doubt; however, using punishers in business creates an aversive environment and should be avoided. This is the opposite of the positive effects we see when we use reinforcement in the workplace. When using punishment, the punisher (e.g., the manager) is negatively reinforced for punishing the unwanted behavior because it appears to go away. This results in more punishment from the manager and ultimately more avoidant behavior from the person whose behavior is punished. The person delivering punishment needs to consider that he/she is seen as a punisher and is avoided by the receiver. As you can imagine, this deteriorates the relationship. With this aversive environment, employees may ultimately avoid the workplace, feel embarrassed, stop participating, or even quit.

In conclusion

As I conclude these reminders, I again encourage you to read the book, *The Influential Mind,* that prompted me to analyze these behavioral consequences in the workplace. If you're in a position to do so, please remember, from one behavior analyst to another, to ensure that your antecedent strategies are correlated with immediate positive reinforcers, and that those reinforcers are personalized to the individual. ▬

Consciousness and Decision Making: Some Neuro-Operant Considerations

Daniele Ortu, PhD

Daniele Ortu received his MA from AI-LUN in Nuoro (Italy) and his PhD from the University of Stirling (United Kingdom). He is a Research Assistant Professor in the Department of Behavior Analysis at the University of North Texas, where he teaches Verbal Behavior and Behavioral Neuroscience. His primary interests are real time measures of brain activity, specifically Electroencephalography and Event Related Potentials and how they relate to a Skinnerian perspective. Conceptually, Daniele is involved in understanding how brain responses can help provide some missing pieces of the puzzle when it comes to comprehending complex human behavior.

Consciousness and decision making are arguably hot topics in current neuroscientific research. Here we discuss these topics from a neuro-operant perspective, proposing interpretations consistent with a Skinnerian perspective and arguing that such a perspective can lead to more pragmatic definitions and potentially transformative technologies compared to phenomenological and reductionist alternatives.

The Holy Grail of Consciousness - is it worth it?

The topic of consciousness, and specifically human consciousness, has gained increasing amounts of attention by scientists in the past fifty years. Indeed, being able to explain what consciousness is from a scientific perspective has been described as the 'holy grail' of contemporary science. In the current paper we propose that the 'quest' for consciousness is not going to be fruitful as long as (1) the concept is defined in an heterogeneous way and (2) 'understanding' consciousness is defined in a reductionist fashion, i.e. by mapping consciousness to some brain areas and putting causation of conscious behavior in the brain. Recently, consciousness has been defined by the neurobiologist, Koch, as "having an experience — the subjective, phenomenal 'what it is like' to see an image, hear a sound, think a thought or feel an emotion." When we speak of 'having an experience', the controlling variables may vary, but they probably often refer to sensory/perceptual behavior (e.g., listening to a song, watching a person move, suddenly feeling cold, etc.) Or is it maybe the case that when humans speak of 'having an experience' they are describing their own discriminative behavior of ongoing sensory/perceptual operants (e.g. conditioned or unconditioned seeing or hearing, listening to a speaker, responding to facial expressions, etc.) Either way, when defining what we mean when we talk about 'having an experience', we do not need to use categories that go beyond the scientific experimental and interpretative domains. In other words, describing a perceptual response *is* behavior. Whether it is vocal or written, whether it involves discriminating the uniqueness of a friend's face, whether we can describe how a powerful a current memory is, 'having an experience' is not something that happens in another domain, and perhaps it does not require any kind of 'special' explanation. Moreover, if we analyze closely Koch's definition provided above, we realize a multitude of potential problems with it. First, the idea that the subjective and experiential factors are the defining features of what consciousness is eliminates the need for a clear distinction between human and nonhuman organisms. Surely, cats, dogs, pigeons, pigs, etc. experience what it is like to see an image, hear a sound or feel an emotion. Why would it be otherwise? Any analysis from a neuroanatomical perspective points to striking similarities across species. In fact there are more similarities than differences.

From an anatomical perspective, consciousness in recent years has not been considered to involve a fronto-parietal network anymore, but neuroscientists have been focusing instead on parietal networks. Parietal networks are typically considered to be involved in sensory, perceptual, primary, and association areas, both unimodal and polymodal, and humans share a similar anatomical functional differentiation with many other species that are not considered to be 'conscious', at least in the way the term is used when referring to humans. The part of the brain that is consistently referenced when describing the human uniqueness at a neuroanatomical level is the prefrontal cortex, which has most recently been considered irrelevant in its contribution to consciousness. In other words, there does not seem to be a clear anatomical difference between humans and nonhumans that may be clearly pointed at when looking for a neural correlate of consciousness. Moreover, when the scientist points to an area of the brain to explain behavior, she may be falling into the contiguity fallacy. Just because something is happening immediately before something else, it does not mean that it represents the cause. For instance, why would brain activity be a cause for subsequent behavior (for instance, pressing a button) more than a subthreshold muscle movement happening immediately preceding the button press? A perhaps more complete account involves both proximate, and ultimate causes, without the constraining assumption that one cause is more important than the others. In fact, while all can be described as equally important within the chain of events preceding a response, proximate causes do not tell the whole story, especially when it comes to understanding the behavioral function of a response. Contextual causes to similar responses may vary a lot, and from this perspective pinpointing the brain area that is active before a response may not uncover the whole picture when it comes to describing what 'conscious behavior' is. The topic described here represents a wider issue within modern neuroscience, in which reductionism is still relatively dominant.

Shifting perspectives from neural reductionism to the essentialistic idea that humans are conscious because they "have language", could it be the case that consciousness can simply be equated with language? From a behavioral perspective, some of the main functions of human language are 1) to describe elements or relationships in the natural environment 2) to provide resources during a motivational state. Arguably, a large number of nonhuman species engage in kinds of verbal behavior that align along the same functions. While it can be argued that human verbal behavior has a striking degree of complexity when it comes to tacting and manding, to make the case for a qualitative difference across humans and nonhumans would require evidence that is currently not present. Even when trying to assign the uniqueness of human linguistic faculties to recursive syntactic structures, it has been shown that nonhuman animals like songbirds can learn recursive vocal patterns similar to the one that characterize human verbal behavior. What about the statement common within some subareas of behavior analysis that language, equated as relational learning, is uniquely human? Emergent relations, transfer and transformation of stimulus functions are fundamentally important topics in the stimulus control domain, but require an explanation - they do not explain - unless we want to assume their existence as axiomatic. Moreover, the transformation of stimulus function observed so readily in humans may be an outcome measure of some moment-to-moment problem solving, a skill humans have to typically learn extensively early on in life. Are non-human animals given the same prerequisites when they are suddenly put in an operant chamber to take part in an equivalence or relational frame experiment?

Summarizing, even if consciousness was defined in a useful manner, both from a neuroanatomical and purely behavioral perspective there are no clear reasons to assume interspecies differences in degrees of consciousness. A useful way to describe consciousness, that could apply easily to all species and makes some pragmatic sense, would be to describe it as 'degrees of responsiveness'. When awake, we respond to our name differentially compared to other names, as demonstrated easily by measuring orienting responses. We are more likely to turn around when hearing our name compared to other names. When we sleep we can still respond to our name differentially compared to other names, but the response requires a powerful measurement tool like EEG/ERPs. Stimulus control is still operating, but at different degrees of response strength. Patients in a vegetative state may show minimal responding compared to patients that are asleep or in a coma, and from this perspective the idea of a continuum of degrees of responsiveness may be pragmatically advantageous compared to the often ill-defined concept of consciousness as a phenomenological construct.

Stimulus Control vs. Decision Making: A Neuro-Operant Perspective

The central executive, top down processing, executive functioning, are just some conceptual examples of modern day homunculi in cognitive neuroscience. Ultimately, decision making can probably be understood best in terms of response competition in the repertoire based on current stimulus control, as repeatedly described by Palmer. Within each response system, the strength of each response varies in a moment to moment fashion as a function of stimuli present in the current environment and the past history of reinforcement. Within an individual response system, only one response occurs at any given time, but multiple responses can co-occur when considering multiple response systems. Within that conceptualization, a response system can be considered an anatomically constrained and defined subset of environment-behavior relations. For instance, given the anatomical organization of the human vocal apparatus,

humans seem to be able to engage in a single vocal response at any given time. Conversely, based on the anatomical organization of human arms and hands, multiple responses can be emitted concurrently; and within each hand, each finger can potentially respond independently from the others, provided that the organism learns to move the fingers independently.

In covert speech, the anatomical constraints that are encountered in overt speech should not be an issue. However, a person is typically not able to engage in multiple concurrent covert verbal streams. It appears that the constraints typical of the vocal apparatus are maintained in covert speech. When the vocal response becomes covert through ontogenic development, what prevents individuals from learning to engage in multiple parallel vocal streams? The covert version of the performance of interest also appears to be constrained by anatomical factors even when considering other behaviors. For instance, a guitar player who is covertly rehearsing a scale will not do so by using an arbitrary number of fingers and arms. Rather, the anatomical constraints that were present during learning still play a role in future covert practices. Similarly, when a person loses a limb or loses the ability to control some or all muscles due to paralysis or amyotrophic lateral sclerosis (ALS or Lou Gehrig's disease), they still appear to be able to retain covert speech and other covert topographies.

Within a response system, what prevents multiple responses to occur at the same time resulting in a potentially maladaptive topography (e.g., trying to go both left and right at the same time when about to run into a person walking in the opposite direction)? One potential interpretation can be found in Palmer's analysis of response competition. Palmer suggests that at any given moment, the strength of each response in the repertoire is influenced by current stimulation: "shifts in stimulus control can favor the target response so that it becomes the dominant response in its response system". As Neely has reviewed extensively, and Palmer and I have separately interpreted elsewhere, current stimulation therefore changes the strength of responses that are not emitted, as evidenced by a large number of priming experiments. When response strength increases up to a certain value, the response is emitted. An emitted response can be observed/measured (overt) or unmeasured (covert). Neuroscientific evidence supports Palmer's perspective and describes how the basal ganglia, the motor cortices and the thalamus are involved in a neural loop critical in inhibiting competing responses once a dominant response has reached a critical point of "no return".

The notion of response competition might be expanded to account for multiple response systems. For instance, if current textual stimulation (e.g. Starbucks, latte, cappuccino) increases the strength of the vocal response *coffee*, leading to the emission of a vocal response 'coffee', emission of the vocal response should not prevent the organism from engaging concurrently in behavior involving another response system, for example, walking. Anatomically, the vocal apparatus and the locomotive apparatus appear to be relatively independent. If anatomical constraints are (at least in part) what is driving the separation across response systems, it is possible in principle that if those anatomical constraints were eliminated, then the organism - given the appropriate contingencies of reinforcement - could learn to engage in a number of concurrent responses that would in principle be constrained only by the computational capabilities of the brain.

Brain Machine Interface (BMI) research has recently highlighted how monkeys with implanted electrodes in their brain cortex can learn to control additional robotic limbs while still retaining the ability to move their actual arms. Analogously, from a stimulus perspective, rats have been shown to be able to respond to changes in infrared light when an external sensor is connected to their brain cortex, while concurrently discriminating other changes in the visible light spectrum. The same neural populations appear to be able to simultaneously "learn" how to respond to multiple sources of stimulation, incoming from both biological and electronic receptors.

Given the possibility of n-number of additional non-biological interfaces to operate on the environment, and n-number of additional receptive mechanisms to detect incoming stimulation, the behaving capabilities of organisms appear to be potentially expandable beyond the current limitations dictated by the anatomical constraints due to natural selection. Organisms are at birth equipped with response systems that were congenial at points in time that may not reflect current environments. The possibility of adding response systems (e.g., robotic arms) and stimulus systems (e.g., robotic eyes) may greatly expand the behaving potential of organisms. Moreover, both response and stimulus systems need not be physically connected or located in the same environment as the biological organism. Response and stimulus systems can potentially be located in additional environments, with the biological organism constituting the physical locus, or hub, in which the actual, mechanistic selection of environment-behavior selection takes place at the neural level.

These are just some of the possibilities involved when rethinking decision making in terms of stimulus control and response competition, in relation to what we currently know about neural mechanisms. Together with the abandonment of a reductionist perspective, decision making as stimulus control inevitably opens the door to new technologies that may allow expanding environment-behavior relations with the addition of non-biological stimulus/receptor systems and response systems. ▬

Beth Garrison on Reading Skinner, *Operant Coffee*, and Making a Difference

Interview by Ryan O'Donnell of *The Daily BA*

What is your back story in behavior analysis?

Before I became an undergraduate student at Temple University, I was a classically trained flutist for 10 years and my goal was to be a member of a major orchestra. Temple University had an amazing music program, and although I applied and auditioned, I did not get in. So, I thought about it, and enrolled as an "undecided major" because I wanted to re-audition, which I did in the spring of my freshman year, and again did not get in. That was when the professor of the psychology course assigned us to read *Beyond Freedom and Dignity* and *Walden Two* by Skinner and something clicked for me. After reading both books, I thought it was amazing that there is a technology of behavior that could potentially "save the world," and I said, "Let's do it!"

The professor of that class introduced me to Dr. Phil Hineline, another professor at Temple University, who was a student of Herrnstein. I went from "undecided" to psychology as my major. Dr. Hineline took me under his wing in the research lab. I worked on an honors thesis with him, where we looked at ABA classrooms in the Philadelphia area while studying various outcome measures, as well as staff training and development for those classrooms. During that time, I was really learning about behavior analysis and I fell in love with the science.

Right after completing my undergraduate studies, I went for my master's degree in ABA at Temple University, and that was where I was introduced to Organizational Behavior Management (OBM). My thesis advisor was Dr. Don Hantula. Under his guidance, I completed a master's thesis where I worked with women in a drug and alcohol rehab facility. We worked on a therapeutic workplace where we taught them job skills so that when they left the facility they could find jobs. I love working with ABA therapy programs for people diagnosed with developmental disabilities, but I wanted to go outside my comfort zone a bit and get experience working with a completely different population in the therapeutic workplace. The principles are still the same, so you are still setting up antecedents and changing consequences to shape behavior within that setting. It was a really great experience!

You mentioned some works of B. F. Skinner and how did they impact your career choice. Was there any sort of "aha!" moment that influenced your professional life, or chapters that gave you that next idea?

I've read certain books at certain time periods, from my undergraduate studies to where I am currently as a professional.

Beth Garrison is a Board Certified Behavior Analyst and holds a Master's Degree in Education from Temple University. She is the Senior Consultant for Shaping Development, LLC, an organization committed to helping people shape individual, staff, and organizational development. In her spare time, Beth serves as the CEO of Operant Coffee, LLC, a company that is committed to combining her love of behavior analysis and coffee.

Beth is an Adjunct Instructor for Temple University where she teaches basic and applied level courses in applied behavior analysis, as well as "Careers in Psychology" courses.

She serves on the Board of the Dissemination of Behavior Analysis Special Interest Group, and she is pursuing her PhD in Applied Behavior Analysis at The Chicago School of Professional Psychology.

Science and Human Behavior was the third book I read. I needed more of a background in behavior analysis, and I think that was more of a primer for me. That was an eye-opening book. There is actually a quote in that book, that I think is important to where we are heading in our field. Skinner wrote: "We need not retreat in those sectors where science has already advanced. It is necessary only to bring our understanding of human nature up to the same point. Indeed, this may well be our only hope."

It is probably one of my favorite Skinner quotes. Mainly, because we are a young science, but we *are* a science. We need to look at where we can bring our understanding of human behavior to the point where the other sciences are. And I think that was where I said, "This is awesome. I can join this science, I can study it, and we can hopefully help to advance it." That is what I love about *Science and Human Behavior*.

In grad school I was learning to talk the talk. That's where *Verbal Behavior* came in, and then *About Behaviorism*. I liked *About Behaviorism* because it shows our science in a different light.

After graduating, I signed on with a company, became a BCBA, worked my way up to become Director of Training and Development, and then was promoted to Clinical Director. I focused on honing my skills in ABA therapy, but also the OBM side of behavior analysis. I oversaw clinics and ABA therapy programs in multiple states, which was really great development in leadership and organizational management strategies. From there, I had the opportunity to become CEO of an adult services division.

I did that from June of 2016 to September of 2017, and then I pivoted to form two businesses: *Shaping Development* in September of 2017, and then *Operant Coffee* in October of 2017. Interestingly enough, *Operant Coffee* was formed from me re-reading *Walden Two*.

Was there a specific line or chapter or was it the whole book?

No, actually I was drinking coffee on my couch and reading *Walden Two.* I thought about a community that uses the principles of behavior analysis and about our science. How can we use it to "save the world?" A lot of people don't know about our science, don't understand what we do, or have misperceptions about what we do. Dissemination is a major component of what we have to do as behavior analysts. I was thinking, "how can I educate the broader population about our science?" I looked at the coffee I was drinking, and it hit me. I can use coffee! And I can put labels that define behavior principles. And I can name the coffee after great behavior scientists in the field, and it just started steamrolling from there.

The branding happened first. I decided on the name because of the term *operant behavior*, and "Operant Coffee" kind of rolled off easily. Then I started thinking about my first blend and I thought, "Let's use alliteration. B. F. Skinner — "Burrhus's Breakfast Blend."

The hurdle was finding a roaster. I knew what the branding was going to look like and I knew what it was going to be called, I just didn't know what it would taste like. I am a BCBA, not a coffee roaster. I emailed about 20 companies in the United States, to see if they wanted to partner with me and no one got back to me. My last email was to the Philly Fair Trade Roasters. We started emailing back and forth and then held a conference call, and then I went down there. During our very first meeting, we created the blend, which was awesome.

I like the fact that they are fair trade certified coffee, which means they are part of co-ops where the goal is that the farmers are paid a decent wage. The other thing that attracted me is its organic coffee, so it limits the use of pesticides when growing the coffee trees. And one other thing that was important to me, along with "saving the world with behavior analysis," is that the roasters I work with recycle, and compost everything when they produce the roasted coffee.

OBM is a part of your background. What are you pulling in from the OBM world to Operant Coffee?

Ultimately, I am trying to run the business from a scalable perspective. I use behavior analysis to

make my business more streamlined, analyzing if there are any breakdowns in the model. It is an e-commerce business so there is no brick and mortar store, and I don't have a coffee shop. I sell through my website. It is really cost-effective because you aren't paying rent or utilities every month. You set up your online store, you find what you want to sell, you partner with a wholesaler, and the wholesaler manages the inventory. In my case, coffee is roasted every week and sent out to customers.

Are there certain data you are tracking when looking at the OBM side of your business?

I am fascinated by people's behavior — what do they click on, what makes them purchase the product. I am fascinated by behavior when it comes to social media, as far as the marketing side of it. Some of the analysis in there is also looking at culture, and the people I am marketing to — what they respond to, what reinforces their behavior and what does not. The interesting thing is, the European Union just came out with new privacy protection law, which is going to hurt my process a bit. We can't store certain data, so I will need to perform analysis daily, as opposed to weekly as I have been doing.

There is another aspect: I am looking to create a culture in my business. Right now, it is just me, but I want to create a certain culture for the business as it grows and as I develop my team. I am also looking at the culture of *Operant Coffee* itself. Who is my customer, who am I trying to serve, where am I going to be able to disseminate behavior analysis to a larger audience? It is all behavior analysis, even going back to social media marketing, and A/B testing, it is all behavior that we are trying to analyze.

You can find Operant Coffee at www.operant-coffee.com ▬

A surprise from Beth: if you visit www.operant-coffee.com and use the coupon **BFSKINNER** at checkout you will get 15% off!

About the Interviewer:

Ryan (left) interviewing Beth Garrison.

I'm Ryan O'Donnell. I have an M.S. in Applied Behavior Analysis, however my interests have grown to include many other subjects, including entrepreneurship and capturing perspectives and stories through various media. These interests and skills have allowed me to work with a lot of great people. I've started three businesses, a behavioral think-tank, a podcast, a professional development movement, and helped organizations that support people with Intellectual Disabilities, to list a few. Currently I lead product development and distribution for High Sierra Industries as a Learning Systems Development Specialist. Outside this role I focus on building a community of thought leaders and doers to create content that increases the transparency of behavior analytic technologies with the hopes of creating a platform that truly saves the world. My interests are from artificial intelligence and machine learning applications to the theory and philosophy behind Why We Do What We Do (wwdwwdpodcast.com). In my spare time you can find me consuming social media, prepping/climbing a giant mountain, or walking around with my camera in my hand (and, occasionally, all simultaneously). Connect with me personally on most all social platforms via @TheDailyBA and let me know what drives you to pursue the Behavior Analysis vision. ▬

Meet the New Chair of the B. F. Skinner Foundation's Development Committee

By Joyce Tu, Vice President
B. F. Skinner Foundation

I am excited to introduce Sarah Trautman-Eslinger to our *Operants* subscribers and B. F. Skinner Foundation supporters. She has agreed to lead the B. F. Skinner Development Committee!

In 2004, Sarah founded a premier ABA agency in California, STE Consultants. She earned her undergraduate degree at Gonzaga University with Dr. Stephanie Peterson. That's when she fell in love with behavior analysis! Sarah earned her master's degree at San Francisco State University, and has been a Board Certified Behavior Analyst for the past 13 years.

Sarah started her work as a behavior analyst at the Spectrum Center (a non-public school) in California, before starting her own agency. Her goal has always been "to provide the most effective ABA services for as many people as possible!" Sarah is proud to be "obsessed with clinical quality!" Her favorite book by B. F. Skinner is "*Enjoy Old Age*" (co-authored by M. E. Vaughan), and Sarah plans "to live a long and productive life by following Skinner's advice in that book."

Sarah Trautman-Eslinger

Sarah currently serves as President of the California Association for Behavior Analysis (CalABA) Board of Directors. She has previously served CalABA as an Ad Hoc Committee member and Conference Chair. Sarah also served as an auctioneer for the B.F. Skinner Foundation auction at the 2016 and 2018 CalABA conferences, raising funds for both organizations! The 2018 CalABA auction was conducted during the inaugural CalABA Red-Carpet & Reinforcement event where both the B. F. Skinner Foundation Student Research Award and the Julie Vargas Student Research Awards were given.

Sarah has already started a fundraising Facebook page for the foundation; along with other new fundraising activities! The B. F. Skinner Foundation Board of Directors is delighted to welcome Sarah!

Sarah knew that applied behavior analysis (ABA) was what she wanted to do for a career as an undergraduate at Gonzaga University. Sarah completed her Masters Degree in Special Education at San Francisco State University with an emphasis on vocational education for adults with developmental disabilities in 2001. Sarah became a Board Certified Behavior Analyst in 2004, the same year she founded STE Consultants. In addition to her work at STE Consultants, Sarah is involved with practice management and public policy issues related to ABA services. Sarah has led workshops and served on numerous panels at regional and national conferences focused on practitioner issues and health insurance reform. Sarah has guest Lectured at San Francisco State University, has trained special educators and behavior analysts internationally and frequently travels around the US to provide consultative support to ABA business owners. Sarah is the President of the California Association for Behavior Analysis (CalABA) -www.calaba.org. Sarah is a founding board member of the Council of Autism Service Providers - www.casproviders.org.