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50 Practical Ways to Alter the Relative Efficiencies of Behaviors

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Behavior analysts have long recognized the need to increase at least one behavior when attempting to decrease another and usually focus primarily upon increasing a wide variety of behaviors (White & Haring, 1980). But the strengthening of any behavior relative to another is not necessarily simple and records of empirically supported treatment options can be interpreted in an over-simplified manner. The current paper attempts to connect various treatment options across behaviors through a common principle—levels of one behavior will tend to increase and levels of another will tend to decrease when the first behavior is made more efficient than the second. The primary objective of the current paper is to articulate a wide variety of variable dimensions available to behavior analysts, teachers, and other professionals responsible for behavior change. In complex environments, many factors are beyond our control and many treatment options are non-viable. The greater the variety of treatment options available, the "larger the analyst's toolbox", the greater the chance that viable treatments will be found and that ineffective strategies can be effectively modified before being set aside. One recurring theme is that various forms of response blocking can and should be minimized and replaced with strategies that make more desirable behavior more efficient than less desirable behavior, leading learners to "choose" more desirable behavior. An additional objective of the paper is to reframe the debate about whether it is appropriate to use extinction or punishment, wherein those strategies are frequently interpreted in absolute terms, in relation to decreasing undesirable behaviors, and inevitably result in negative side effects. A more nuanced discussion about extinction and punishment considers the extent to which parametric applications of either might be appropriate to make a less desirable behavior less efficient than a more desirable behavior and includes the potential impact upon increasing desirable behaviors.

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Introduction

Behavior analysts are interested in replacing aggression with mands for tangible reinforcers (Durand & Merges, 2001), self-injury with safe transitioning (McCord, Thomson, & Iwata, 2009) or engagement with sensory activities (Favell, McGimsey, & Schell, 1982), and elopement with communication (Piazza, Hanley, Bowman, Ruyter, Lindauer, & Saiontz, 1997; Tarbox, Wallace, & Williams, 2003). But we are also interested in replacing some of the time a learner spends playing by himself with time spent engaged socially (Walton & Ingersoll, 2013), "impulsivity" with improved self-control (Neef, Bicard, & Endo, 2001), disruptive behavior with requests for assistance (Carr & Durand, 1985), and some requests for assistance with improved problem-solving (Rosales-Ruiz & Baer, 1997). Note that a particular target, such as requesting assistance, may be appropriately targeted for increase or for decrease, depending upon the context.

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It may benefit flexible analysts to view behavior and intervention strategies from a variety of perspectives during assessment and intervention, including but not limited to function (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982), molar/molecular analyses (Baum, 1973; Donahoe & Palmer, 1994; Shimp, 2013), constructivism (Goldiamond, 1974b; Goldiamond, 1976; Vygotsky, 1986), motivating operations (Laraway, Snycerski, Michael, & Poling, 2003), contingency shaped vs. rule governed behavior (Skinner, 1969), learning channels (Haughton, 1980), seeking ways to make work fun; the potential for conditioned stimuli to function as reinforcers (Ferster, 1961), and the selection of behaviors targeted for increase. One perspective that is compatible with each of these, and the main thesis of this paper is that relative rates of any pair of behaviors can be changed by altering the relative efficiencies of each. These interventions are based largely upon the Matching Law (Herrnstein, 1961) and extensions thereof.

Though not necessarily written formally into Behavior Intervention Plans, most learners are working far more towards increasing behaviors than towards decreasing behaviors. And the inter-relationships between various target behaviors can be complex, such as when substantial allocation of reinforcers to toilet training contributes to decreased opportunities to reinforce mands or to work on academics, or such as when increased opportunity to participate in interesting behavior chains helps to condition attention as a reinforcer while also strengthening reading skills, measurement skills, and more. Broad and multicomponent interventions to strengthen response classes, such as social play, can have broad and meaningful impacts on repertoires like communication.

In the interest of simplicity and space, let us temporarily set aside some of the complexities, such as the selection of repertoires targeted for increase, stimulus and response classes and the broad value of “time in”, and revisit these complexities in the Discussion section. Let us focus temporarily on relatively linear analyses, primarily considering the relative efficiencies of only two behaviors at a time.

What About Function?

The importance of functional assessment (Iwata et al., 1982) is widely recognized within the field of behavior analysis and is clearly relevant to behavior change. But simple function-based interventions, such as Differential Reinforcement of Alternative behavior (DRA) meet neither the necessary nor the sufficient conditions for behavior change.

Presumably, aggression maintained solely by tangible gain can be replaced by mands for items if aggression no longer results in tangible gain and if manding consistently results in tangible gain. But the replacement process is rarely so simple. If not already in repertoire, mands will need to be prompted, and there may initially be a limit to the types of prompts and the timing of prompting that will be effective for a particular learner. Some learners will resist some forms of prompts (Ward & Grimes, 2008), especially when those prompts follow behavioral escalation and perhaps function more as redirection, a consequence of less-desirable behavior that tends to impact behavior less regularly than proactive prompts. And it may not be feasible for a particular item or activity to be available each time it is requested. These factors can make it difficult to increase the relative efficiency of manding.

Some will find it difficult to withhold tangible items following aggressive behaviors. Depending upon the magnitude and duration of episodes of aggression, “blunt” forms of extinction may be unsafe (Lerman, Iwata, & Wallace, 1999), unethical *Ethical Code for Behavior Analysts* (the Code, BACB, 2022), or socially invalid (Wolf, 1978). These factors can make it difficult to decrease the efficiency of aggression.

For the purposes of this paper, "blunt" extinction refers to cases in which broad classes of stimuli/consequences are withheld for relatively long periods of time, perhaps through an "extinction burst". Because of the potential challenges associated with the blunt use of extinction (Lerman, Iwata, Shore, & Kahng, 1996), such as by unequivocally following through with non-preferred expectations, it is frequently useful to consider other options (e.g., Athens & Vollmer, 2010). Denials, response blocking, and other variants of "no", can sometimes result in emotional responses, unwitting reinforcement, counter-control, and other forms of "baggage". A learner may watch for opportunities to engage in unauthorized behaviors when a teacher is distracted or too far away to block. As possible, it is usually better to allow students to engage in behaviors while altering the efficiencies of those behaviors relative to other behaviors. When thoughtfully arranged, these interventions can help to decrease the efficiency of an undesirable behavior while minimizing the negative side effects sometimes associated with extinction. "No" can frequently be replaced with, "yes, on these terms", wherein the terms gradually decrease the efficiency of the less desirable behavior. We don't necessarily need to eradicate the efficiency of the less desirable behavior, only to make it less efficient than the more desirable behavior, such as by requiring a determined student to ask nicely for us to join their script, then requiring them to tolerate a brief delay and ask nicely, and so on.

Let us begin with relatively narrow intervention options before working through the Matching Law, motivation, and multicomponent interventions targeting unique learner repertoires.

Reinforce Desirable Behavior

Class wide token economies, such as "Tiger Bucks" for a school with a tiger for their mascot, are unlikely to function as the maintaining consequence for an undesirable behavior and therefore, even if effective as a reinforcer, can be considered "generic"—non-specific, an example of behavior modification. But, when provided contingent upon attending quickly to teacher mands for attention, Tiger Bucks might have broad positive effects, setting the stage for subsequent participation in instruction and establishing opportunities for further reinforcement of a variety of learner behaviors. Increases in the use of generic positive reinforcement can sometimes be effective independent of the function of undesirable behavior (e.g., Wilder, Harris, Reagan, & Rasey, 2007). If a student is leaving to escape work, the Tiger Bucks may give him an extra reason to stay for work. If elopement is maintained by attention, some attention will be available as he is receiving Tiger Bucks and this may prove more valuable than the attention gained by eloping, these may compete with elopement. Of course, "Tiger Bucks", reinforcement, can take many forms, such as playing or joking with learners, clicks or "TAGs", the Good Behavior Game (Barrish, Saunders, & Wold, 1969), edibles, praise, recognition that one has met a goal, the Self-and-Match system (Salter & Croce, 2014), and much more. Note, though not strictly necessary for reinforcement, knowing the function of a behavior can help to identify potential alternate reinforcers that resemble the maintaining consequence, which can contribute towards the efficacy of Differential Reinforcement of Alternative Behavior.

But even with the simple plan of reinforcing desirable behavior, if an effective reinforcer has not been identified, bootleg reinforcers are available, effort required for desirable behavior is too high, effort required for elopement is too low, or reinforcement of elopement is too high, then "Tiger Bucks" will be unlikely to increase participation in instruction or to decrease elopement. And positive reinforcement is not without potential negative side effects (Perone, 2003). Most stark is the fact that reinforcement is contingent and, for many, earning anything less than the maximum possible "feels like losing".

Put less desirable Behavior on Extinction

When planning to use extinction to decrease a behavior, to withhold a consequence that is maintaining a behavior, one needs to know the function of that behavior. If "throwing mulch in the air" is maintained by attention, planned ignoring will function as extinction. But if mulch tossing is maintained by the sight of the mulch falling to the ground, planned ignoring will not function as extinction.

Continuing with this example, for extinction to be effectively achieved, the learner needs some type of tendency to emit a competing or replacement behavior. "Appropriate play" is one reasonable, loosely defined, option. Extinction will likely have no benefit unless the student has some history of enjoying things like swinging, using slides, or joining peers in games. The stronger and broader this response class, the better. Here, again, knowing the function of the mulch tossing can have the benefit of guiding our selection of increase behaviors that share elements, such as helicopters, Kerplunk, bubbles, stomp rockets, and authorized "ticker-tape" for the learner who likes to watch the things fall and a wide variety of pro-social behaviors maintained by attention for the student whose mulch tossing is maintained by attention.

If the student's attention manding repertoire is weak or if attention is not readily available following mands, attention manding may not be a more efficient means of gaining attention than mulch tossing. Interventions may need to at least temporarily focus on ways to teach attention manding in more favorable conditions, increasing the strength of attention manding and thereby improving the efficiency relative to mulch tossing.

For another example of the use of extinction, consider eye contact as a potentially desirable quality of manding (e.g., Lee, Eskritt, Symons, & Muir, 1998). In this case, teachers are not trying to decrease the levels of any behavior, but rather to sustain one behavior while strengthening a desirable component of that behavior. One may, for example, put mands without eye contact on extinction and provide FR1 reinforcement for manding with eye contact (Carbone, O'Brien, Sweeney-Kerwin, & Albert, 2013). In this study, one participant had learned 300 different mands and tended to mand at a rate of approximately 1/minute, a strong mand repertoire, prior to implementation of the extinction strategy. Eye contact strengthened without weakening the mand. An under-appreciated benefit of extinction is that it tends to increase response variation and some of these variations can be shaped into useful repertoires.

Perhaps this extinction strategy would do more harm than good for learners with weaker mand repertoires? Perhaps some learners, rather than manding with eye contact, would stop manding? In this case, one might establish the relative efficiency of manding with eye contact by reinforcing mands without eye contact on an FR2 schedule and with lower quantity or magnitude while reinforcing mands *with* eye contact on an FR1 schedule and with greater quantity or magnitude. Or a teacher might disregard eye contact as a potential goal until the learner is first manding at a high rate.

Extinction, especially in blunt applications that are sustained through a "burst", can come with negative side effects (Lerman, Iwata, & Wallace, 1999; Sidman, 1989), such as increases in response magnitude, variety, and duration, counter-control, and conditioning teachers as aversive stimuli. It is frequently possible to modify escape extinction procedures, and thereby decrease the chance of negative side effects by providing forms of positive attention while maintaining an expectation for a learner to follow through with an expectation (C. Tarbox, J. Tarbox, Bermudez, Silverman, & Servellon, 2023).

Punish less desirable behavior

Unless attempts to punish unwittingly function as reinforcement, such as the use of time out as a consequence of escape-maintained behavior, punishment can be effective without knowing the function of a behavior. A student required to miss recess or dessert may be generally less likely to demonstrate a particular undesirable behavior. This may increase the likelihood that he engages more frequently in a variety of appropriate behaviors.

Extinction and punishment are sometimes viable options and sometimes the best options. Rudy had access to everything, including our attention, almost entirely on his terms during play, which was available for extended periods of time. There was no obvious opportunity to make play more efficient than it already was. He threw a matchbox car across the room and his mom responded, “let’s drive the car”. He threw another and I responded, “let’s drive”. Car throwing quickly increased, suggesting that it was maintained by attention.

There was no likelihood of self-injury and, though he made a mess, Rudy wasn’t breaking anything. After checking with his mom, who had been with us throughout the session, she was happy for us to remove the cars (response cost, a form of punishment) and withhold attention (extinction for attention-maintained behavior), so we did. He pinched my legs, but it didn’t really hurt. He called me “stupid” and dumped out small toy boxes. As the inter-response time of this response class began to increase to more than 10 seconds, we began to turn our attention toward him. Early attempts resulted in immediate increases in throwing, presumably because our attention functioned as an SD for throwing. We withdrew our attention each time he threw. After five or six attempts, across 15-20 minutes, we were able to provide positive attention without it resulting in throwing. The rest of the session was very smooth, with an apparently greater appreciation for our attention that, among other things, accelerated our ability to show him new ways to play with toys and to get him to participate well in daily living routines. He was very happy to drive the cars with us and no longer threw cars.

Besides having little or no room to increase the efficiency of play, of “time in”, it is likely that the success of punishment and extinction in Rudy’s case depended upon an already existing tendency toward self-regulating behavior and extensive Degrees of Freedom as it relates to options for independent play and options for gaining attention. Had these conditions not been present, attempting to combine response cost with extinction may have done more harm than good. Likewise, had we parametrically altered dimensions of the procedure, such as by removing a larger number of toys or requiring 60 seconds of calm before providing attention, the procedure may have been ineffective. At one endpoint of the Degrees of Freedom continuum, had we, rather than only limiting access to our attention and the matchbox cars, attempted to require him to sit in an assigned area (time out from all toys and from freedom to roam), physical intervention would have likely been required and he may have made a game out of the attention necessarily required to enforce this time out. A blunt example of time out would have likely been contraindicated.

The Matching Law

The Matching Law (Herrnstein, 1961) states that, in concurrent schedules, behaviors occur in direct proportion to reinforcement available for each behavior. A hungry pigeon with the opportunity to peck a green disc associated with a VR3 schedule of reinforcement or a red disk associated with a VR6 schedule of reinforcement will peck the green disc twice as often as the red. Subsequent observations across behaviors and species have noted that relative effort required for each behavior is also a relevant variable. For the hungry pigeon,

each peck requires essentially the same, low degree of effort. For the student, writing a word may be substantially more difficult than saying a word. As such, if writing and speaking are reinforced on similar schedules, the student may consistently choose to respond vocally. How many more M&M's would need to follow writing before a student might choose writing over speaking?

Further additions to the Matching Law are reviewed by Athens and Vollmer (2010). A learner will tend to choose a particular behavior more frequently when the associated reinforcement is of greater quantity, quality, or duration, or when there is less delay to reinforcement relative to other options. Alternately, teachers can decrease the efficiency of a behavior by decreasing the quantity, quality, or duration of associated reinforcement or by increasing the delay to reinforcement. These four variables logically afford at least eight additional ways to alter relative efficiency, more when you consider altering more than one element at a time. Let us consider some examples.

Consider a student learning to sign "eat". The first time he signs with only a model, rather than a partial physical prompt, we might give him two mini-M&M's instead of one. This difference in quantity may make relative independence more efficient than relative prompt dependence.

Consider a student assigned a worksheet. He may ask for a break and receive access to an iPad without internet access or he may endure to the completion of the worksheet and receive access to an iPad with internet access. This difference in quality of reinforcement may render worksheet completion more efficient than taking a break. A learner who likes video games might only access his favorite games when he finds a friend to play with him.

A child may prefer to recruit assistance to put on his shoes, but if his mom waits 90 seconds to provide this assistance, she may render independence more efficient than assisted responding by virtue of the delay associated with receiving assistance. Alternately, a learner may tend to hit himself in the head with his shoe within two seconds of being asked to put on his shoes. In this case, providing assistance within seconds may render accepting assistance with shoes more efficient than hitting himself in the head with the shoes. Put another way, he may have no need to hit himself. This is one example of how careful target selection is relevant.

A learner may earn five minutes of iPad time if he remembers to raise his hand to tell his teacher he has finished his work and only two minutes of iPad time if he leaves his seat to bring his work to the teacher without first raising his hand and waiting for acknowledgement. The difference in duration of access may make hand raising more efficient than getting out of his seat—it may provide incentive sufficient to help him "remember" to raise his hand.

Note, the learner in the hand raising example may have verbal repertoires sufficient to benefit from the stated contingency. For many learners, efficiency is not easily increased by allowing five minutes of iPad instead of two minutes. This is because positive reinforcement involves a stimulus change (Michael, 1993) from no access to access. This change occurs once, at the moment the iPad is given. At the end of two minutes of iPad time, there is no naturally occurring stimulus change indicating that a three-minute bonus remains. And the beginning of the third minute comes two minutes *after* he emitted the target behavior, so it lacks the temporal contiguity necessary for effective reinforcement.

Some potential solutions to this challenge are available. A teacher may associate one location with short durations and a different location with long durations. In this case, the immediate stimulus change from no iPad to iPad while at the table can provide moderate reinforcement because the table is consistently associated with two minutes of iPad access, and the stimulus change of moving from the table to a nearby beanbag can provide

more robust reinforcement because the beanbag is consistently associated with five minutes of iPad access. Timers can sometimes help, as well.

We may be able to painlessly shape social referencing on a swing by pushing with low magnitude while the learner looks elsewhere and by pushing more vigorously when he looks at us.

Making the intensity or magnitude of a reinforcer proportionate to the quality of a response, such as by bouncing a student higher on a trampoline when he spontaneously echoes us, is also referred to as a "conjugate schedule of reinforcement" (e.g., Lovitt, 1967). Conjugate schedules can also be employed by combining a variety of reinforcers together, proportionate to the quality of a response, adding another two options for making one behavior more efficient than another. For example, a student who "aces" his spelling quiz for the first time may earn the chance to throw a coin in a wishing well, showing off his accomplishment for several teachers on the way.

Alternately, we may wish to decrease screen time and may make it less efficient by isolating it from some other preferred activities. Perhaps iPad time is only available indoors or only on a particular couch that does not allow for food or drink. We may limit the variety of video games available or allow access to a video without allowing repetitive rewinding. Let a learner listen to music, but only Steely Dan, a band with exactly one good song.

The Matching Law and conjugate schedule variables reviewed to this point have all addressed the consequence side of the equation, relating to the quality, quantity, duration, delay, and variety associated with reinforcement. While response and antecedent interventions are also relevant, we will first consider additional consequence variables.

Shaping is a consequence intervention. Perhaps a learner frequently mands in an agitated manner and sometimes mands with aggression. In this case, reinforcing agitated mands may be a temporarily necessary means of making agitated mands more efficient than aggressive mands. If a teacher is able to replace aggressive mands with agitated mands, she may later be able to raise her criteria, so that calm mands are reinforced more consistently than agitated mands. Or she may be working with an "impulsive" student and teaching him to wait for permission to take preferred items. She may want him to eventually wait up to 30 minutes to take an iPad from its charger, but attempting to start with this criterion may make it more efficient for him to take the iPad without permission than to wait for permission. Attempts to block this response may evoke hitting or elopement. Decreasing wait time to two minutes may make waiting more efficient than premature grabbing. Alternately, premature grabbing may result in the iPad becoming unavailable for one hour before resetting the 30-minute charging/waiting time and, if hitting or elopement are not too strong, this punishment procedure may decrease the efficiency of premature grabbing.

"Diminishing arrays" can be used as a consequence to increase the efficiency of listening skills. In this case, each accurate selection response results in that picture being removed from the array and not replaced. The array of eight becomes an array of seven, and so on, until all of the pictures are gone. The learner sees, and hopefully appreciates, his progress. The work gets increasingly easy with each accurate response.

In the case of "enhanced differential negative reinforcement", each response earns escape from more than one expectation. One way to accomplish enhanced differential negative reinforcement is for a student and teacher to take turns working through problems on a math sheet. In this case, each student response results in escape from two math problems and can of course be combined with praise. Looking at the number of response requirements removed parametrically, the teacher may take two or three turns for every student response. Or, to further improve the efficiency of participation by also reducing the time spent engaged with the worksheet, one or more problems

can be crossed out for each problem completed. Note that decreasing time spent engaged with the worksheet also decreases the delay to access more preferred activities.

Similarly, a student may hesitate to join in a new behavior chain, such as washing a window. A teacher may increase the efficiency of participation by completing many of the steps for him. This is a "facilitation", distinguished from a prompt by the fact that facilitations do not require the student to actively participate.

Alternately, it may sometimes be helpful to decrease the efficiency of a behavior by adding response requirements. One strategy sometimes employed by Montessori Schools is to allow students to transition between activities as frequently as they like, but only after cleaning up the activity in which they're currently engaged. The added response requirements decrease the efficiency of transitions and contribute to growth in "attention span".

A student may be asking for Cheeto's at an unhealthy level. Rather than saying "no" and perhaps leading to aggression, we might begin to make Cheeto's contingent upon retrieving a paper towel, later a paper towel and a plate, later handing out plates to friends, for example, until our learner concludes that it is sometimes more efficient to pursue other endeavors, such as swinging.

Marjorie argued that she needed help with math that we knew was at her level. Joining her in argument or negotiation would likely prolong the discussion. Bluntly denying assistance would likely lead to aggression. So, we accepted her request for assistance, requiring a degree of effort from her for each math problem. After a few responses, she wondered aloud when she would be getting her first check. We translated this question into a request to try the next math problem by herself. She declined, so we continued to help and eventually gave her a check. By the time she had engaged in 16 responses and earned only two checks (a VR8 schedule of reinforcement for prompted responding), she decided to try an easy problem by herself and we immediately provided her 3rd check (an FR1 schedule of reinforcement for independent responding). She quickly finished two more problems, earning two more checks and two forms of backup reinforcement (escape from the remainder of the sheet and access to leisure activities). Briefly considering other parametric options, had we reinforced prompted responding on a VR2 schedule, Marjorie probably would have insisted on prompts throughout the activity. Had we reinforced prompted responding on a VR20 schedule, she probably would have aggressed.

Response Variables

Demand fading (Pace, Iwata, Cowdery, Andree, & McIntyre, 1993) is easily understood. Proactively reducing a packet of worksheets to a single worksheet increases the efficiency of worksheet completion relative to the efficiency of swiping work materials from the table.

Alternately, an adult friend and behavior analyst successfully quit smoking by wrapping his cigarettes in 10 layers of tape. He could smoke as often as contextual circumstances allowed but had to unwrap the cigarettes each time. The increased effort decreased the efficiency of smoking.

Barney had a long history of opening and closing multiple doors multiple times before transitioning to meals. Left completely unchecked over weeks, with no requests for him to hurry, he engaged in these behaviors for increasing durations, until it had negative effects upon the whole family's meal. With requests for him to hurry, the duration generally remained the same but was accompanied by increases in agitation and sometimes resulted in aggression. We added explicit choice opportunities along with extra response requirements. We asked, "do you want to come eat or do you want to do some doors?" When he chose doors, we translated this to 30 seconds of carefully dusting parts of the door, thereby adding response requirements, and then closing the door, for two consecutive doors. Responding with variants of "yes" to his preference to engage with doors helped decrease

ambiguity and anxiety associated with whether or not doors were available. Though he was not at all averse to dusting and frequently wiped tiny pieces of lint from tables and chairs with his index finger, adding dusting as a response requirement with the doors helped to decrease the efficiency of opening and closing all of the doors and he soon happily chose to join his family at lunch rather than dusting and closing more doors.

Output channels (Haughton, 1980) refer to form of response. Learners may point, touch, say, give, write, match, mark, build, paint, and more. Learners prefer some response forms more than others. For a learner dysfluent with handwriting, consider letting him speak the answers to questions. Let learners "dot mark" answers on a worksheet rather than circling them. Let dysfluent typists write their essays and let dysfluent writers type their essays.

Alternately, we can shift to less preferred output channels when interested in decreasing the efficiency of an undesirable behavior. Kellyanne, a 17-year-old girl in a special education classroom, complained that she was hearing voices and needed to go home. This was a common occurrence that sometimes resulted in getting picked up early and sometimes, when it was less clear that she would be picked up early, resulted in high magnitude aggression. Functional assessment strongly suggested that reports of hearing voices were false and were maintained primarily by escape and avoidance, and this opinion was shared by the school psychologist. We avoided the side effects associated with extinction and ambiguity by attending to her complaints. We decreased the efficiency of the complaints by adding expectations through an inefficient output channel. We suggested that she write down what the voices were saying. After a short while writing, Kellyanne said she wasn't hearing the voices anymore and we celebrated this accomplishment with her. She never heard voices again.

Similarly, Ron was nagging his dad about when his dinner would be ready. We had Ron write out his requests for information and only responded to written responses, not to vocal responses. Non-disruptive self-entertainment, a broad response class, started to look good in comparison with the extensive handwriting required to get Dad to remind him for the 8th time that he was cooking the pasta. Note, for this type of repetitive behavior, blunt planned-ignoring or directions not to repeat the excessive vocalization tend to be ineffective and tend to lead to nonproductive bursts. For learners who can write, this strategy provides another sneaky benefit—learners can speak more quickly than they can write, so writing tends to slow them down, which is less compatible with their initial aroused state. This intervention can thereby have the additional benefit of naturally calming a student.

Activities that require travel require more responses over a longer period of time and are therefore less efficient for many learners. Other learners prefer to move at a high rate, and for them, incorporating travel into an activity, such as finding teachers and friends to interview, increases the efficiency of the activity.

Consider allowing a student to choose to respond standing or seated, while listening to music, sitting with a view of the playground, while wearing noise reducing headphones, or circling with a marker instead of a pencil.

Fluent repertoires require less effort and new composite skills are learned more easily when relevant component skills and tool skills have been taught to fluency. Teachers who allocate substantial time to building fluency are, in a molar sense, increasing the proportion of work with activities that are relatively easy and thereby increasing the efficiency of participating in assignments relative to various forms of assent withdrawal.

Antecedent Variables

Modify input channels (Haughton, 1980), the sense through which instruction is perceived, making them easier or more preferred for behaviors targeted for increase or less preferred for behaviors targeted for decrease. A learner may respond more readily to visual stimuli than auditory stimuli, for example. He may be averse to

touch and prefer that you support him through modeling or that you allow him to explore a challenge without any socially mediated support.

A learner may prefer a fast pace of instruction or a slow pace of instruction, and a teacher who matches her pace to his preference may be making participation in instruction more efficient.

Consider some of the following antecedent strategies for increasing the efficiency of behaviors like remaining in an area, participating in instruction, joining games, or waiting for a turn. Prompt generously, perhaps errorlessly (e.g., Cipani, 1987). Allow access to a fidget during group. Let your student work with a partner. Provide a wobble for your student's seat. Make work easier, such as by replacing double-digit addition with single-digit addition. Include fewer participants in a turn-taking game, so less waiting is required. Provide tools to make participation easier, such as a calculator for math. Especially for learners who dislike pacing to a teacher, afford them free operant (Ferster, 1953) response opportunities. Free operant activities allow students to engage at their own pace, among other freedoms (Lindsley, 1996). Free operants, such as independent sorting, can be contrasted with "restricted operants", such as a teacher-directed match-to-sample activity.

A student new to the game "Hotter/Colder" may not yet appreciate "hotter/yes" and may be disinclined to change direction contingent upon "colder/no", two of the top goals of the game. Free scanning may be a strong repertoire and may compete with responsiveness to teacher feedback. Free scanning can be made less efficient by hiding prizes in harder places, dramatically thinning the schedule of reinforcement for free scanning and increasing the chance that a perseverant learner will begin to respond to teacher feedback. What about a student with less perseverance? He may simply move on to other endeavors, such as self-stimulation. Reactively encouraging or reminding this student to continue searching is antithetical to the development of perseverance, another priority of the game, and may be aversive. It is generally more productive to allow this student to fail to find the prize. But an extended history of failing to find the prize will likely undermine future interest in hotter/colder, so it is in the teacher's interest to ultimately increase student success without relying upon reminders to continue searching. In this case, we may want to start by hiding prizes in easier places, rendering scanning more efficient than self-stimulation, building a history of success with hotter/colder, and later raising the bar by hiding prizes in harder places. Or we may start by supplementing "yes" with a point directed towards the prize. Note, this gestural prompt t would only be added immediately *after* accurate student orientation earns a "yes", not as a way to recruit attention from a student who has stopped looking for the prize.

Dimensions Grids (Ward, 2013) list a variety of variables that make any particular target easier or harder, such as in the following example targeting tolerance of toothbrushing.

Table 1

Dimensions Grid for toothbrushing

Easier	**Harder**
Non-electric toothbrush	Electric toothbrush
Front teeth	Back teeth
Short duration	Long duration
Only water on toothbrush	Toothpaste on toothbrush
Shorter durations	Longer durations
Toothpaste with preferred taste	Less preferable toothpaste
Counting to mark progress during calm tolerance, used as immediate conditioned reinforcement for calm tolerance	No counting
Generous reinforcement (i.e., counting) criteria	Stingy reinforcement criteria

Dimensions Grids afford analysts numerous options for making any activity easier, more efficient, as necessary to maintain assent and help chart a course towards closer approximations of the terminal target, "the real world". Instruction for this learner may begin with a wet toothbrush (no toothpaste) touched to his front teeth while his teacher counts to five, for example. As a "harder" level of one dimension is introduced, it can sometimes be counterbalanced against "easier" levels of another dimension. This learner may now have two toothbrushing programs, one in which a wet toothbrush scrubs his back teeth for five seconds and another in which a toothbrush with paste on it scrubs his front teeth for 10 seconds.

Among other benefits, describing plans for moving forward with dimensions grids helps to achieve buy-in from parents or teachers concerned about what they consider excessive generosity in programming. A thoughtfully arranged dimensions grid makes it increasingly feasible to exaggerate differential reinforcement, such as by resetting an activity when a student pulls away prematurely, because success is achievable with average, baseline learner effort, or tolerance. This can be contrasted with expectations requiring a learner's best possible performance, wherein exaggerations of differential reinforcement superimposed over excessive failure may lead to frustration, divestment, and other side effects.

Alter Motivation (A Category of Antecedent Interventions)

Decrease motivation associated with undesirable behavior or with emotions that are incompatible with happy engagement. Use "neutralizing routines" (Horner, H. M. Day, & J. R. Day, 1997). Feed a hungry learner. Proactively arrange vigorous exercise for a "kinetic" student. Let a tired toddler take a nap. Spend several minutes at a time proactively conversing with the attention-loving student.

Increase motivation for desirable behaviors. A child put to bed at 7:30 may not be tired and may engage in a wide variety of behaviors to avoid sleep. Wait until 8:45 to start his bedtime routine. He will be more tired, more motivated to sleep, and the routine will be smoother. We will briefly revisit sleep interventions in the next section.

Parents of children with food refusal issues tend to try to feed their kids early and often, while they're less hungry. This can exacerbate the fact that food, plates, tables, and parental reminders are aversive. Feed them later, when they're hungrier, and many of these same stimuli will begin to function as reinforcers. Feed them more preferred foods.

Multicomponent Examples

Once more, a recurring theme in many of these strategies is that we minimize the potential side effects associated with "no" and similar variants, like response blocking. Rather, as possible, we respond with variants of "yes", sometimes supplemented with strategies to reduce the efficiency of a behavior or allow students to engage in inefficient behaviors and learn from the natural consequences of those behaviors.

In *Sleep Better* (Durand, 1998), in addition to sometimes recommending later bedtimes, the authors describe "graduated extinction" as an alternative to blunt extinction. Rather than wait for a child to cry himself to sleep, parents enter the bedroom periodically, on fixed intervals, non-contingent upon their child's behavior. This non-contingent reinforcement minimizes emotional responses, allowing the child to relax. The duration of each parental visit is short and the quality is governed, to include simple redirections to bed and minimal touching. Fixed time intervals systematically increase, so that parents are entering less and less often. Relaxed children eventually grow tired of waiting for their parent's next visit and go to sleep.

Returning to feeding issues, JD struggled with lunch time. He wasn't a big eater and his lunch was scheduled for 11:00, so he rarely ate much of his lunch. He craved attention, but less attention was available during lunch because it coincided with staff lunch breaks.

JD started going to the bathroom every day at lunchtime, which unavoidably changed his staff ratio to 1:1, reinforcing trips to the bathroom with enhanced attention. Each day, JD was spending longer amounts of time in the bathroom, talking to others and playing in the sink. This further reduced the staff-to-student ratio that remained in the lunchroom. Staff sometimes told him it wasn't time to go to the bathroom, but this tended to result in aggression.

We moved his lunch time to 12:00, so he was hungrier and usually ate most of his lunch. This gave him something relevant to do in the cafeteria. We also noted that JD dislikes sitting at cafeteria tables, so we provided a much more preferred beanbag in the lunchroom.

When JD said, "potty", we prompted him to say, "I need potty". This variant of "yes, on these terms" was achievable, but not easy, and usually required two prompts, decreasing the efficiency of going to the bathroom by adding response requirements. After voiding, we provided JD a wipe for his hands, circumventing the reinforcement associated with playing in the sink and decreasing the time spent in the bathroom.

For another example, let us consider "scrolling", rapidly engaging in a variety of responses until a response is reinforced. A learner who has "mastered" several mands may, when offered a chip, very quickly sign "up", "tickle", and "chip". This learner, perhaps impatient about any delays in reinforcement, apparently finds it more efficient to quickly emit a higher number of responses than to slow down and emit one, more thoughtful response. Agitation correlates positively with fast responding and negatively with attending to teacher prompts. Teachers tend to try a variety of strategies, such as reinforcing when the learner eventually signs "chip", shadowing the learner's hands to block hasty responding, or attempting to prompt the correct response more quickly than the student can err. These strategies are rarely successful, and response blocking tends to further agitate learners while undermining the opportunity for the learner to develop self-regulating behaviors.

We've had success combining modeling, a non-intrusive prompt that can increase the efficiency of slowing down enough to benefit from prompts, with a natural form of punishment of rapid scrolling by transitioning from SD (i.e., the chip is held in view) to S-delta (i.e., the chip is moved behind our back). This process can be thought of as chaining, wherein SDs also function as conditioned reinforcers and interruptions to SDs can function as conditioned punishers. In this case, moving the chip back into view reinforces self-calming and subsequent prompts reinforce waiting to be prompted. As the student successfully slows and calms, brief time delays can be gradually introduced in between the presentation of the chip and the teacher model.

Note, before introducing this strategy, teachers need to be familiar with how their learner is likely to respond to the transition to S-delta, the punishment of hasty responding with the removal of the chip from view. Initially, few students calm within the first five seconds. Some leave the area, which is certainly a choice that should be available to them and hopefully results in them returning again in the near future. Some attempt to pull the teacher's arm to bring the chip back into view, which a teacher may be able to ignore. Some will engage in unsafe behaviors and may not be good candidates for this strategy. But for learners for whom this strategy is appropriate, a side benefit is that they learn that teacher support is valuable, rather than a thing to be avoided, and the value of this accomplishment cannot be overstated. Students slow down, relax, and are dramatically more responsive to teacher SDs and prompts.

Similarly, consider "attention-contingent SD completion", a strategy in which a teacher again refrains from blocking a student who tends to respond prematurely, and instead follows premature responding with an interruption of the target SD. For example, a teacher may hide a preferred item and begin telling a student, "your teddy bear is in the…" A student with a history of premature responding will tend to leave his teacher and start searching for the teddy bear, but he does not yet have enough information to find it. The teacher needn't remind him to stay or call him back but can instead let him search unsuccessfully, putting premature searching on extinction. A perseverant student will return to the teacher on his own and seek more detailed information.

As appropriate, schedule discussions of some student complaints for an inconvenient time, such as student downtime. This strategy acknowledges the student's desire to communicate, reducing the chance of escalation. For example, Roger complained about another student's breath, apparently maintained by escape/avoidance as it occurred primarily during language arts and the same student sat near him during other subjects. Rather than saying "no" to the conversation, we decreased the efficiency by scheduling it to occur after language arts (i.e., at the beginning of free time). Few students remain interested in these conversations when they could otherwise be playing video games.

Some students have a strong preference for movement and wander while they eat. While not necessarily a pressing matter, most parents and teachers would prefer that their children eventually learn to remain in an area while eating and this repertoire is directly relevant to eating in restaurants and cafeterias. Most have tried response blocking with poor outcomes. We've had substantial success with a multicomponent program in which we put several bites of highly preferred food on a plate. The learner is allowed to leave the table with a bite of food, but not to take the plate with him. When the learner leaves the table, we take control of the plate. When he returns, he is presumably ready for the next bite. At this time, we impose a brief delay, usually triple the amount of time it took the student to return to the table. If, for example, it took him 10 seconds to return, we'll wait 30 seconds to provide access to the plate of food, but analysts should feel free to explore other parameters. Students quickly learn that, if they want to eat preferred foods as quickly as they would like, it is more efficient to sit for longer periods of eating. Additionally, many students who wander during meals do so in part because a TV is on in a different room and playing a preferred program. We usually turn that TV off during meals and sometimes provide videos on an iPad at the table while they eat.

Discussion

Behavior change is complex and consideration of relative efficiencies of various behaviors is just one of many perspectives that may support analysis and treatment. This paper has reviewed many examples of strategies for altering relative efficiencies and, in the interest of spurring analyst creativity, bound examples of those strategies according to common variable dimensions, such as those associated with the Matching Law.

Analysts are also most effective when they consider teacher values, strengths/weaknesses of students and teachers, training schedules, density, data systems and more. Given the individualized challenges and frequent limitations imposed by various settings, such as the social invalidity of edible reinforcers in a general education classroom (Ward & Pniezak, n.d.), analysts need to be flexible and can benefit from "having a big toolbox".

Let us now revisit the complex and, ideally generative nature of learning. The extent to which a learner participates readily in instruction, considered across all teacher expectations, impacts the emotional value assigned to teacher bids for attention (Tiemann & Markle, 1991). The greater the proportion of teacher expectations deemed inefficient by a learner, the more likely that future teacher bids function as conditioned

punishers and Reflexive Conditioned Motivating Operations (CMO-Rs) (Laraway et al., 2003). Towards the development of a healthy student-teacher relationship, "small wins add up". Replacing a pencil with a marker may not only increase assent regarding a dot-to-dot worksheet but this small "win" may also contribute on a molar level to a learner's inclination to join his teacher in future instruction. What might start as a carefully contrived way to begin a relationship, such as helping to put a few Connect 4 chips into the stand and reinforcing by emptying the stand, may eventually grow into greater trust in a teacher, greater appreciation of teacher feedback, and more generalized confidence and pride in taking on a variety of challenges.

Another complexity that should be revisited is the question of constructivism and the selection of behaviors targeted for increase. Though this paper, in interest of simplicity and space, has usually addressed the relative efficiencies of only two behaviors at a time, it is best practice to align more closely with a constructivist approach, focusing primarily on increasing behaviors. Instruction on these target behaviors is most effective when behaviors are scaffolded (Vygotsky, 1986). Scaffolding is relatively straightforward when doing component analyses of zipping, where prerequisites will include targets like gross motor movement, reaching, gripping, pulling, and bilateral coordination. Scaffolding is more complicated when looking at a behavior like tolerance of change, where components can include: tolerance of *anything*; favorable contexts for appreciating change; self-advocacy; responsiveness to functional mediators; "trust" in the student-teacher relationship; some ability to self-calm; and responsiveness to any teacher expectations.

For analysts whose interventions are not currently effective, it may be helpful to reassess the relative efficiencies of the behaviors in question. Perhaps prompting a student to mand calmly after he has first screamed isn't resulting in the replacement of screams with calm mands? Perhaps there is too great a history of initiating with a scream and it is too efficient to follow screams with prompts for calm mands? Perhaps screaming needs to be made less efficient by following it with a 10-second count before having another chance to mand calmly? Perhaps screaming can be made less efficient by requiring a few listening responses before prompting a calm mand? Perhaps calm manding can be made more efficient by contriving dense practice sessions.

Consideration of efficiency is relevant not only when attempting to make one behavior more efficient than another, but also when the goal is to strengthen a number of behaviors without making any less efficient than other concurrently available options. Recognition of this dynamic is relevant when, for example, considering whether to push for a vocal response after a student has spontaneously handed his teacher a picture of a desired item. Clearly, the addition of the vocal is desirable, but when required, this can decrease the rate of spontaneous manding in comparison to other options, such as self-stimulation. Similarly, when we first inherited a young dog who had started biting her family, she was very tense and uninterested in meeting us. After providing a few non-contingent treats, she calmed slightly and we taught her to sit for treats. We then tried to follow sitting with "lay down" and rather than successfully establishing a "lay down" response, she stopped following directions to sit. Apparently, the extra response requirement following sitting functioned as a parametric variant of extinction, rendering sitting less efficient. We subsequently changed our expectations, reinforcing sitting without further directing her to lay down.

Relative efficiencies are also relevant when one teacher is more capable of certain things than another. Consider that an experienced teacher is capable of modulating supports in real time according to a learner's effort and success, and another teacher has not yet developed this repertoire. Without proactive modifications, it will be less efficient for the learner to work with the second teacher than with the first, and this could contribute to a contrast effect (Koegel, Egel, & Williams, 1980), to various forms of assent withdrawal with the second teacher.

A thoughtful analyst may proactively address this by starting the second teacher only with the learner's most preferred and strongest activities, pending development of more flexible teaching repertoires.

Finally, viewing a wide variety of variables relevant to relative behavioral efficiencies parametrically, rather than as false dichotomies, may provide a forum for productive discussion among members of our field. For example, an analyst who understands how to parametrically "dial up" or "dial down" the efficiencies of behaviors may choose to enhance the distinction between the relative efficiencies if more robust change is needed, or to decrease the distinction in relative efficiencies if the current arrangement leads to undesirable side effects that do not quickly wane. Perhaps the question "is it ok to use extinction?" might be replaced with "to what extent might it be appropriate or useful to decrease the efficiency of a behavior?"

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