



Revitalize Your Warmup Routine Using an Ecological Dynamics Approach

By Lisa M. Burrell

Whether you are practicing on your own or working with a group of students, there is a good chance that you have adopted a warmup routine. Traditionally, warmups include drill-like exercises that feature repetition to hone a set of skills with the goal of creating automaticity.

Have you ever considered the relationship between the kinds of warmups you do and their impact on long-term learning and performance? Movement scientists who study complex skill acquisition are finding that performers who replace conventional repetitive routines with more variation are better equipped for long-term transfer of learning and are more adaptable when faced with challenges in performance. Adding flexibility and variety to your warmup strategies can improve self-regulation, prepare your students to problem-solve effectively, and enhance their ability to listen closely, both to themselves and within an ensemble.

STEPPING AWAY FROM BRAIN-MACHINE MODELS IN PERFORMANCE SCIENCE

The connectedness between warmups, practice, and performance has been a focal point in sports science research over the last thirty years in an approach known as Ecological Dynamics.¹ This research is changing the way coaches and trainers structure warmups and subsequent practice and is improving athletes' preparedness in competitive performance settings. Ecological Dynamics proponents point out that drill-type routines that isolate skills and employ rote-repetition to build automaticity are the products of technology-influenced theories of brain function that became popular as arms manufacturing took center stage after the Second World War.² These concepts, which are still influential in our approaches to practice and teaching, give us the impression that our brains are machines that need to be programmed and fine-tuned to produce and replicate perfect models of technique.

AUTOMATICITY VERSUS DEXTERITY

Soviet neurophysiologist Nikolai Bernstein (1896–1966) was one of the first motor-learning specialists to challenge the validity of the programmable brain, arguing not only that human brains were far more complex than machines, but also that human learning was dependent on the adaptation and evolution that takes place as each individual human interacts with their environment. His work showed that skills become more stable not when they are repeated or “perfected” but rather when they are subject to continuous variations that force performers to adapt to changes in self and circumstance. The act of continual problem-solving using what Bernstein called “repetition-without-repetition” creates *dexterity*, or the ability to make optimal choices as challenges arise.³

TOOLS FOR DEVELOPING DEXTERITY: AFFORDANCES AND CONSTRAINTS

Ecological Dynamics uses Bernstein's principles to help coaches construct practice scenarios through which players can develop dexterity. Two important pedagogical applications of Ecological Dynamics are teaching players to perceive *affordances* and using *constraints* to illuminate new affordance possibilities. The term *affordance* refers to an opportunity to act. Individual affordances can vary based on physiological factors (height, weight, strength, range of motion, etc.), developmental status, learning background, and various psychosocial traits. Tasks also have different affordances that might depend on variations in the equipment being used and changes in the specific application of that task. Finally, varied environments create new affordances (temperature/humidity, group size, practice versus competition, etc.).

To give this a tangible context, consider two violinists performing a spiccato bow stroke. Do they have the same affordances? They will probably perform in slightly different parts of the bow, with different degrees of bounce, different angles, and different

amounts of flexibility in the arm/hand/wrist/fingers, depending on personal body mechanics, degrees of development, equipment (strings, violin angle, amount of rosin), degrees of humidity, acoustics, and an infinite range of other factors.

Since affordances are both complex and constantly evolving, Ecological Dynamics coaches impose *new constraints* in each practice task to help direct the players' discovery, particularly when a set of opportunities exist but are not yet perceived. To highlight various affordances in the above scenario, students could be asked to attempt to reproduce the same spiccato sound in different parts of the bow, or at different speeds, or with different weight/balance relationships by holding the bow at different distances away from the frog, or even holding the bow at the "wrong" end of the stick.

ECOLOGICAL DYNAMICS IN YOUR CLASSROOM: WARMUP GUIDELINES

If you want to try some of these principles in your teaching, you do not need to start with a complete overhaul. Just making slight changes in your warmups can have a significant impact on the way your rehearsals proceed. Here are some ways to start:

Remember the connectedness of task–environment–individual in developing affordances.

- Bernstein's *repetition without repetition* is perfect for applying to existing scale or drill sequences. Just use the exercises you do as a starting point and add new constraints to each task to develop students' perception skills.
 - ▶ Change the rhythm to suit something you will later explore in repertoire.

- ▶ Change the octave, transposition, or fingering so that students' attention will be drawn to the sound of the melodic pattern.
- ▶ Change the articulation to mimic various vocal sounds or other instruments in the orchestra.
- Change the *environment* in which the task is performed.
 - ▶ Reorganize the classroom setup so that different ranges of instruments/voice are side by side.
 - ▶ Sit or stand in a circle, facing away from each other to heighten listening skills.
 - ▶ Change the acoustic environment: go into the hallway or the auditorium, or send small groups of different instruments into a practice room.
- Use constraints that draw attention to *personal affordances*.
 - ▶ Do the warmup with one eye closed, then close the other.
 - ▶ Do it standing on one leg or sitting on one sit bone.
 - ▶ Do it with a beanbag on your head.

As you gain comfort in creating warmup variations, look for activities that are perception-based rather than conception-based. Other than explaining the rules of the new variation, minimize use of verbal instruction.

- Encourage students to use their ears to adapt to new systems of intonation:
 - ▶ Play or sing scales with keyboard accompaniment for equal temperament.

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- ▶ Play a tonic drone to hear how to adjust harmonically.
- ▶ Listen to ringing tones (strings) or a Pythagorean pitch generator to adapt to more melodic tuning.
- Incorporate sight-centered activities:
 - ▶ Choose students to be movement leaders.
 - ▶ Conduct students through warmups and change tempi as they play.
 - ▶ Focus visual attention on parts of the bow or places on the instrument.
 - ▶ Create cues to signal students to alternate between reading warmup material, watching a conductor, watching a section leader, and looking at students in another section.
- Help students develop proprioception and kinesthetic sense by redirecting attention:
 - ▶ Where is the top of your head when you are playing this? Your nose? The back of your head?
 - ▶ Move from one sit bone to the other as you play each half note. Do you prefer to move R-L or L-R?
 - ▶ Target-practice difficult intervals by deliberately overshooting or undershooting them, getting closer to the target with each intentional miss.
 - ▶ Squeeze your fist, toes, or teeth together while you play or sing. Squeeze your toes, but not your fists. Squeeze your right fist and left toes.

Look at learning as *nonlinear*. Teach things out of order and follow your own and your students' interests and curiosity in creating new affordances.

- Teach them how to individually self-regulate:
 - ▶ String players can use sticky notes to mark places in the bow where they most often play—avoid the sticky spots!
 - ▶ Choose your own octave.
 - ▶ Choose your own fingering.
 - ▶ Improvise a variation.
- Explore *safe uncertainty*—another concept in Ecological Dynamics—which encourages early and safe experimentation with more advanced functions:
 - ▶ Bouncing bows and vibrato movements for beginning string players.
 - ▶ Variations on uses of breath for singers and wind players.
 - ▶ Fun challenges with extended techniques for effect.
- Encourage student-led variations:
 - ▶ Student-composed rhythms: students say or clap rhythms that mimic words or names and work together to notate and perform on their instruments.
 - ▶ Bingo-style missing notes: choosing a note, like the tonic or one that is frequently out of tune, to audiate or sing rather than play.
 - ▶ Students choose an advanced technique they want to try; you find the safe variations they can begin to explore.


Keep your focus on *long-term transfer of learning*. Demonstrate how the adaption of skills versus the perfection of skills is what

creates dexterity in performance.

- Create puzzles that will guarantee mistakes:
 - ▶ Deliberately play a variation the “wrong” way.
 - ▶ Add complex multitasking—can you count, sing, or say the Pledge of Allegiance while you play?
 - ▶ Work in groups to decipher a complicated new rhythm.
- Use techniques you will need in your repertoire, but show how these techniques can vary:
 - ▶ Play the same rhythm in widely different tempi or in different meters.
 - ▶ Play a new articulation in different dynamic contexts.
 - ▶ Play/sing crescendi and diminuendi over several beats starting with small subdivisions of these beats, and then increase the lengths of the notes until these inflections happen over single multi-beat notes.
- Show the evolution of fundamental learning:
 - ▶ In the beginning you had one way to play staccato. How many ways can you interpret staccato at this speed today?
 - ▶ When you first started, you might have learned to keep all your fingers down. Now you have a choice about where this technique is helpful and where it might get in the way.
 - ▶ Intonation is more challenging now because you have the ears to adapt and adjust, but now you also have the agility to change pitch when your pitch doesn't fit the context.

INTERESTED IN LEARNING MORE?

I created a structured warmup matrix process that you can use to develop a set of novel variations tailored to your classroom and lesson needs. You can print a PDF of a basic matrix form and access a set of directions and sample matrices I have used in teaching string players. I also compiled a list of bibliographic material with highlights on articles and websites I find to be user-friendly for delving into Ecological Dynamics strategies. For these resources go to www.tmea.org/burrell2025.

Finally, please contact me at Lisa.M.Burrell@lonestar.edu to share your experiences and ask any questions that arise. 



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