WHITE PAPER 10 / ACADEMY OF STRENGTH

The Myth of Endless Variation

Why More Exercises, Grips, Machines, and Movement Options Do Not Automatically Build More Strength

> “A variation earns its place by solving a defined problem - not by making the program look more complete.”

Executive Thesis

The modern fitness industry can turn exercise selection into an endless catalog: another grip, another angle, another machine, another movement for every visible part of the body. Variety is easy to sell because it looks personalized and feels new. Neither quality proves that the program is building more strength.

The human system adapts to demands it can practice, measure, and progressively master. For broad general strength, a small collection of stable, scalable compound movements usually provides the greatest return on training time because meaningful load is distributed across far more musculature at once while the person coordinates, stabilizes, and transmits force across multiple joints. Machines, isolation work, alternate grips, and movement variations can build muscle or solve a defined problem. They should complement - not casually replace - the foundational patterns.

THE CLAIM - STATED CAREFULLY
Machines produce force. Isolation exercises can build muscle. Variations can improve a specific task or address a specific need. The Academy claim is about breadth and training economy: foundational compound patterns usually train more total muscular mass and more of the coordinated human system within one movement.

What This Paper Does Not Claim

It would be false to say that machines do not produce force, that free weights always produce more force, or that a leg extension, leg curl, or leg press cannot make someone stronger. A machine can expose a muscle to high force, and its external load may exceed the load used in an unsupported movement. Numbers printed on different machines are not directly comparable because lever arms, pulleys, friction, body position, and range of motion change the force experienced by the person.

It would also be false to claim that compound lifts automatically transfer to every activity. Strength is expressed through a task. The movement pattern, range, velocity, stability, and skill used in training all influence what improves most.[2,4] The Academy selects compound patterns

because they are broad capacities worth practicing and measuring - not because they make specificity disappear.

Variation Is a Tool - not a Training Principle

Progressive overload, appropriate effort, repeatable technique, recovery, and consistency are training principles. Variation is one way to organize those principles. A 2022 systematic review of eight studies involving 241 young men found that systematic variation may support regional hypertrophy and dynamic strength, while excessive, random, or redundant variation may compromise gains.[1] The evidence base was small and narrow, so it does not establish one ideal amount of variety. It does reject the assumption that more variation is automatically better.

Frequent rotation also weakens measurement. If an exercise disappears before technique stabilizes and performance can be compared across time, novelty replaces feedback. A movement cannot reveal adaptation when it is never repeated long enough to establish a reliable record.

Machines: What They Do Well and What They Remove

Machines can be excellent tools. A guided path may reduce balance and stabilization demands, make a muscle easier to load near fatigue, accommodate a person who cannot yet perform an unsupported pattern, or allow useful training around equipment, pain, anatomical, or return-to-training constraints. Removing a demand is not automatically a defect when removing that demand serves the goal.

The same feature creates the limitation. When the machine supplies the path, support, and part of the stability, the person does not have to solve those portions of the task. A free-weight squat and a leg press both train force through the hips and knees, but they are not the same skill. One requires the lifter to organize the load, trunk, feet, balance, and bar path; the other lets the machine constrain much of that problem. Neither fact makes the leg press useless. It makes the adaptations different.

A 2023 systematic review and meta-analysis of 13 studies and 1,016 adults found no overall difference between free-weight and machine training for hypertrophy, jump performance, or neutral strength comparisons. Strength gains favored the mode in which they were tested: free-weight training improved free-weight tests more, while machine training tended to improve machine tests more.[2] That is specificity - not a verdict that one tool never works.

Local Force Is Not Total Training Value

Force can be discussed at several levels: the force produced by one muscle, the force at a joint, the force against an external object, or the force expressed through a complete task. A machine or isolation exercise may create very high local muscular force. A compound movement distributes the external demand across a larger network of prime movers, synergists, and stabilizers. The advantage is therefore not merely that compound movements can often be loaded heavier. It is that the load is shared across more of the body at the same time.

That distinction matters. The Academy does not choose foundational movements because they win every isolated force comparison. It chooses them because a small number of movements can provide a hypertrophic stimulus across more total muscular mass while also developing technical control, joint-to-joint coordination, whole-body stability, and repeatable performance

under load. This is a judgment about return on training time, not a claim that every participating muscle receives its maximum possible stimulus.

Strength Is Specific to the Task

Strength training changes both tissue and control. Hypertrophy can increase force-producing potential, while neural learning and coordination improve how that capacity is expressed in the practiced task.[3] A 2025 meta-analysis covering 43 studies and 1,660 participants found that dynamic strength improved with roughly twice the effect observed in transfer to untrained isometric strength measures.[4] The exact numbers should not be generalized to every activity, but the direction is clear: strength transfers imperfectly.

This is why “functional” should never be treated as a magical label. A movement is functional in relation to a function. If the goal is to improve a machine test, training the machine is specific. If the goal includes standing, sitting, carrying, bracing, and controlling the body under load, then practice that preserves more of those demands has a stronger programming rationale.

Standing, Sitting, and the Lower-Body Example

Consider an adult who can safely practice standing from and returning to a chair. That pattern requires the person to manage body mass through the feet, ankles, knees, hips, and trunk while controlling balance and direction. A leg extension trains knee extension. A leg curl trains knee flexion. A leg press is a useful multi-joint machine exercise, but the seat and guided path support part of the task.

For broad lower-body strength, the Academy would usually begin with the standing-and-sitting pattern and progress its range, control, repetitions, or load before replacing it with a sequence of seated machines. The reason is not that the chair pattern must produce more absolute force than a leg press. The reason is that it practices more of the capacity the Academy intends to build. Machines can then be added when a specific need justifies them.

The evidence supports restraint rather than a sweeping superiority claim. In a small study of 16 older adults without a nontraining control group, 12 weeks of home-based chair-targeted squats improved both sit-to-stand performance and leg-press performance, but not the measured knee-extension torque or muscle thickness.[10] In a randomized trial of older adults, standing cable and seated-machine training both improved the primary physical-performance measure with no significant difference between groups; some secondary chair-stand and carrying outcomes favored standing training, while machine chest-press strength favored machine training.[9] Both studies are consistent with task specificity. Neither proves that standing exercise is universally superior.

Hypertrophy: One Muscle Is Not the Whole System

Machines and single-joint exercises can produce hypertrophy. The free-weight-versus-machine meta-analysis found similar average muscle growth between modes.[2] A 2026 direct comparison found that leg press and knee extension produced comparable growth in the vasti and whole quadriceps, while knee extension produced much greater rectus femoris growth. But the leg press also grew the gluteus maximus and adductor magnus.[7] That last distinction is central: a per-muscle comparison does not measure the total muscular mass stimulated by the exercise.

Consider a weighted chin-up and a curl. A curl can directly load the elbow flexors and may equal or exceed the biceps stimulus produced by a chin-up. The Academy claim is not that the biceps

must grow more from chin-ups. It is that the chin-up simultaneously distributes body mass and added load across the elbow flexors, shoulder extensors and adductors, scapular musculature, and forearms while the grip and trunk stabilize the task. One measurable movement therefore exposes much more total musculature to meaningful tension.

> **THE HYPERTROPHY DISTINCTION**
> The relevant Academy comparison is total muscular mass trained per unit of time - not which exercise wins for one muscle. A curl may be excellent for the biceps. A weighted chin-up trains the biceps while placing a substantial demand across a much larger part of the system.

This is a programming inference grounded in anatomy and the available single- versus multi-joint evidence; the cited research does not establish an exact whole-body hypertrophy advantage for every compound exercise over every isolation exercise.[5-7] An isolation-based program could stimulate comparable total muscle mass by adding enough exercises and volume. The cost is usually more movements, more time, and more complexity. Single-joint work remains useful when a specific muscle or region needs additional stimulus. Compound-first programming is about hypertrophy economy, not denying the value of a precise tool.

Total muscular development still does not erase the distinction between muscle growth and broad strength. More muscle can raise force potential, but strength performance also reflects practice, coordination, range, velocity, stability, and the conditions of the task.[3,4] Greater total hypertrophic exposure and greater whole-system demand are complementary advantages; neither guarantees transfer to every activity.

Coordination Is an Adaptation

A compound movement requires muscles to act across joints as agonists, synergists, stabilizers, and antagonists. Strength training can improve the nervous system’s organization of that task; changes in intermuscular coordination appear to be an important contributor to strength gain.[3] This is one reason repeating a stable movement matters: coordination is learned through exposure, not downloaded from a list of exercise names.

> **TRANSFER BOUNDARY**
> Coordination in a squat is coordination for squatting. It may support other tasks, but it does not teach a sport skill, prevent every fall, or guarantee mastery of another movement. General strength and specific practice must work together.

Grips, Angles, and the Illusion of Precision

Changing grip or angle changes mechanics. That can alter range of motion, joint loading, comfort, leverage, and muscle contribution. The mistake is turning every detectable difference into a required new exercise. In a small acute study of 15 men, three pronated lat-pulldown grip widths produced generally similar activation of the latissimus, trapezius, and infraspinatus, with only limited differences across phases and muscles.[8] Acute electrical activity also cannot establish long-term superiority by itself.

A grip variation earns its place when it improves tolerance, fits anatomy, changes a documented mechanical need, or supports a defined outcome. “This feels different” may start an observation. It does not finish the programming decision.

When Variation Earns Its Place

Variation is justified when the current movement cannot be performed safely or productively; when equipment or anatomy requires another version; when a defined muscle or range needs additional work; when a return-to-training plan calls for reduced complexity; when boredom threatens consistency and a compatible change preserves the training purpose; or when a long training history requires a new stimulus. The change should still preserve a way to measure whether it worked.

Single-joint work can also be efficient for a narrow goal. A review of 23 studies found broadly similar upper-limb strength and hypertrophy outcomes between single- and multi-joint approaches in the available comparisons, while noting possible reasons for targeted work and limits in the evidence.[5] In one ten-week trial of untrained men, adding arm isolation to bench press and lat pulldown did not produce additional measured size or strength gains.[6] These findings do not prohibit accessories. They remove the presumption that accessories are always necessary.

The Academy Decision Rule

Before adding or replacing an exercise, the Academy asks four questions: What problem does it solve? What outcome should improve? How will improvement be measured? When has the variation completed its purpose? A fifth practical question follows: Is the expected benefit worth the time, fatigue, attention, and recovery it consumes?

This rule protects both simplicity and individual judgment. It prevents exercise minimalism from becoming dogma, because a useful tool can earn its place. It also prevents endless novelty from becoming the program, because every addition must answer to a purpose. Current evidence supports many effective resistance-training modes; consistent participation and progressive training matter more than collecting every available option.[11]

Conclusion

More exercises do not automatically train more of the person. More machines do not automatically produce a more complete program. More grips do not automatically create more precise adaptation. Options have value only when they serve the outcome.

For broad general strength and total muscular development, begin with a small number of standing, pressing, pulling, squatting, and hinging patterns that distribute meaningful load across large fields of musculature and can be practiced, loaded, and measured. Keep them long enough to learn from the record. Use machines, isolation work, and alternate variations when a defined need earns them - not when complexity is being mistaken for expertise.

> “Master what builds the system. Vary only with a reason.”

References

1. Kassiano W, Nunes JP, Costa B, Ribeiro AS, Schoenfeld BJ, Cyrino ES. Does varying resistance exercises promote superior muscle hypertrophy and strength gains? A systematic review. J Strength Cond Res. 2022;36(6):1753-1762. doi:10.1519/JSC.0000000000004258

2. Haugen M, Andersen V, Saeterbakken AH, et al. Effect of free-weight vs. machine-based strength training on maximal strength, hypertrophy and jump performance - a systematic review and meta-analysis. BMC Sports Sci Med Rehabil. 2023;15:103. doi:10.1186/s13102-023-00713-4

3. Folland JP, Williams AG. The adaptations to strength training: morphological and neurological contributions to increased strength. Sports Med. 2007;37(2):145-168. doi:10.2165/00007256-200737020-00004

4. Saeterbakken AH, Stien N, Paulsen G, et al. Task specificity of dynamic resistance training and its transferability to non-trained isometric muscle strength: a systematic review with meta-analysis. Sports Med. 2025;55(7):1651-1676. doi:10.1007/s40279-025-02225-2

5. Gentil P, Fisher J, Steele J. A review of the acute effects and long-term adaptations of single- and multi-joint exercises during resistance training. Sports Med. 2017;47(5):843-855. doi:10.1007/s40279-016-0627-5

6. Gentil P, Soares SRS, Pereira MC, et al. Effect of adding single-joint exercises to a multi-joint exercise resistance-training program on strength and hypertrophy in untrained subjects. Appl Physiol Nutr Metab. 2013;38(3):341-344. doi:10.1139/apnm-2012-0176

7. Kinoshita M, Maeo S, Kobayashi Y, et al. Hypertrophic effects of single- versus multi-joint exercise: a direct comparison between knee extension and leg press. Med Sci Sports Exerc. 2026;58(7):1566-1580. doi:10.1249/MSS.0000000000003957

8. Andersen V, Fimland MS, Wiik E, Skoglund A, Saeterbakken AH. Effects of grip width on muscle strength and activation in the lat pull-down. J Strength Cond Res. 2014;28(4):1135-1142. doi:10.1097/JSC.0000000000000232

9. Balachandran A, Martins MM, De Faveri FG, Alan O, Cetinkaya F, Signorile JF. Functional strength training: seated machine vs standing cable training to improve physical function in elderly. Exp Gerontol. 2016;82:131-138. doi:10.1016/j.exger.2016.06.012

10. Yoshiko A, Watanabe K. Impact of home-based squat training with two depths on lower limb muscle parameters and physical functional tests in older adults. Sci Rep. 2021;11:6855. doi:10.1038/s41598-021-86030-7

11. Currier BS, D'Souza AC, Fiatarone Singh MA, et al. American College of Sports Medicine position stand. Resistance training prescription for muscle function, hypertrophy, and physical performance in healthy adults: an overview of reviews. Med Sci Sports Exerc. 2026;58(4):851-872. doi:10.1249/MSS.0000000000003897