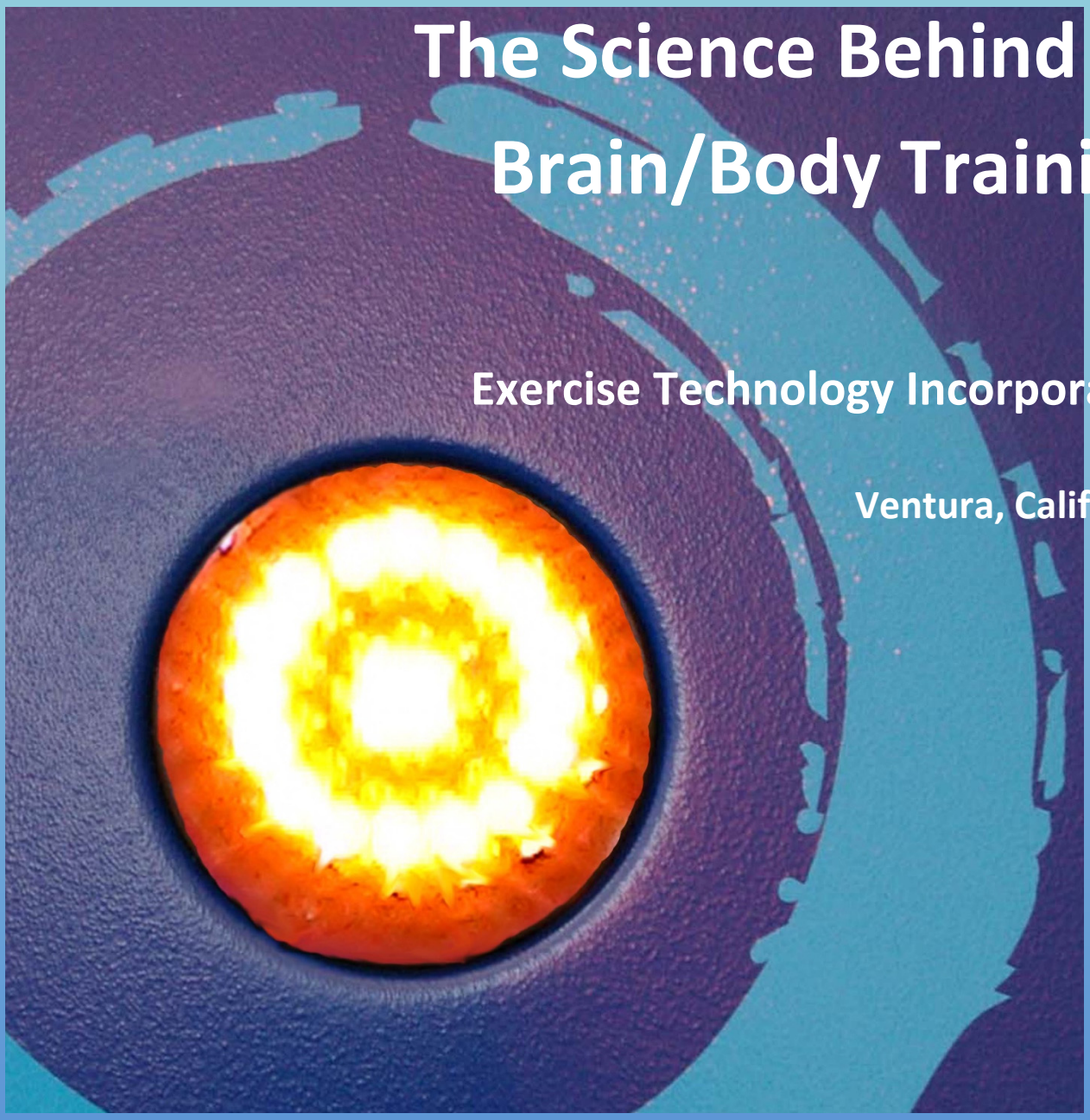
Sportwall Fitness Effects:

The Science Behind Its Brain/Body Training



Exercise Technology Incorporated

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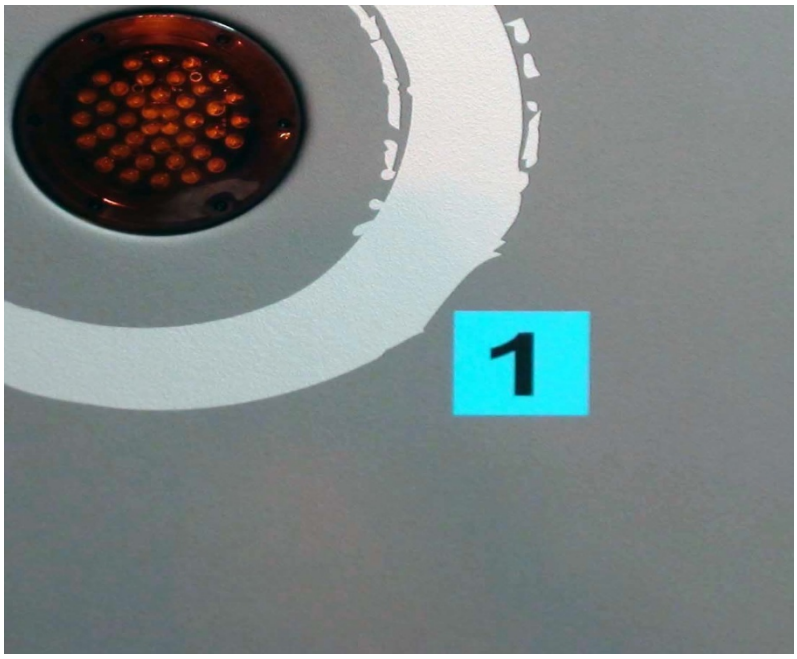

Sportwall Fitness Effects:
The Science Behind Its Brain/Body Training

University Researchers Rated Sportwall #1 in User Enjoyment and Energy Expenditure[1]

Introduction

When the words "exercise" and "gaming" were combined to yield "exergaming", the term was used to describe video games that are also a form of exercise.[2] Beyond repetitive finger movement, these interactive video or electronic games PROMISE whole body player movement, similar to that of "real-life" exercise participation. Whether any exergame can increase energy expenditure enough over sedentary video gaming, to be considered a viable adjunct to more traditional exercise is the question. This paper will document how Sportwall products deliver on that promise.

Sportwall's XerPro and XerTrainer are recognized as two of the original, most enduring concepts in the category of exergame fitness training, but they differ significantly from modified video games that promote physical activity. Instead of simulating play, they engage players in a real kinesthetic experience with dynamic, integrated, multi-planar athletic movement using actual sporting goods. The result is a powerful combination of both functional training AND sports specificity training in one multi-sensory system (see the next section for details).

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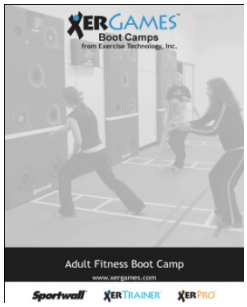
Success is measured by the ability of participants to keep the game in play as a result of real athleticism rather than emulated movement called for in other exergames. The original concept behind the creation of Sportwall was to create fun, short, fast moving full-body games that engage maximum intensity and focus with results measured via electronically generated scores and rewarding sounds. Today, this approach continues to incentivize repeated play until mastery takes place.

This concept has evolved into a wide range of applications from training high performance athletes to providing highly engaging, brain integrated, physical exercise for children with special needs. This enormous flexibility is one of the most unique aspects to Sportwall programming. Instructors are free to choose from a wide array of curriculum/lesson plans for every sport and sector of the community. See our web site for curriculum options: http://www.xergames.com/customersupport/bootcamps.html.



Sedentary lifestyles have impacted the amount that children exercise AND their desire to exercise. To engage them our systems offer fun, interactive activities with immediate feedback incorporating computer game technology they already enjoy. Our reputation as the company that offers "computer games that make you sweat" and "serious fitness for people who love to play" is well deserved.

Engaging both sides of the brain requires keen art and science. Exploring this requires a close look at Sportwall programming. The following sections describe its impact on learning, fitness, motor skills, mood, and brain activity of its players.

Sportwall Conditioning for Mind and Body--How it Works

When it comes to localizing and tracking moving objects, it is likely that the human brain evolved to develop, learn, and operate optimally in multisensory environments.[3] Thus, multisensory training protocols can better approximate natural settings and are more effective for learning.[3]

Sportwall programs are fitness training products for all ages and ability levels. Visual, auditory, and physical tasks are integrated in performing the motor skills required. These protocols, with their profound and SIMULTANEOUS brain/body stimulation, are the key element that differentiates a functional training program from a general conditioning program.

This unique form of exergaming stimulates greater input to the proprioceptors of the motor system, and with it, greater subsequent refinement of movement patterns. The resistance and motor patterns encountered by the use of real sports equipment creates more dynamic neuromuscular control in a functional setting of play.

Sportwall programs are specifically designed to stimulate the body and the brain concurrently. This is accomplished by:

- Encouraging team participation and engaging sustained focus with short-attention grabbing computer games that are played sequentially to pursue mastery of skills and score
- Providing full body exercise by stimulating the hands, feet, eyes, ears, and vestibular system (stimulating the proprioceptive input to the motor and vestibular systems) in playing real games with real sporting goods (not simulated)
- Requiring high levels of attention and focus for success (staying consciously "in-the-now")
- Engaging in cognitive decision making under pressure
- Delivering a cardiovascular workout in a game format

"Functional Training" is used by physical therapists as a comprehensive form of rehabilitation to return patients to daily living activities, as well as competitive sports by using movement in multiple planes while weight bearing. In contrast, "Strength Training" might use a weight machine, bands, or free weights and usually focuses on a uni-planar, one joint motion to build muscular strength.

Sportwall's brand of functional training uses a variety of activities that can focus on the core/torso, agility, speed, balance, flexibility, power, and strength while SIMULTANEOUSLY developing high levels of neuromuscular efficiency.

Sportwall's brand of functional training (also during weight bearing) uses a variety of activities that can focus on the core/torso, agility, speed, balance, flexibility, power, and strength while SIMULTANEOUSLY developing high levels of neuromuscular efficiency. This process of engaging the hands, feet, ears, and eyes develops not just eye/hand, but visual-perceptual motor skills.

As seen in the next section, the added element of integration of the right and left brain hemispheres has been documented to enhance brain plasticity as well as whole brain thinking, cognition, attention, and focus for learning. In short, Sportwall has been proven to help in the classroom too.

Brain Plasticity – Physical Exercise Stimulates Cognitive Capacity

Brain research strongly supports the link between movement and learning. The brain and the body's movement and learning systems are interdependent and interactive. For example, motor development provides the framework that the brain uses for academic concepts.

Children who have developed fine motor skills through daily exploration and manipulation of a wide variety of objects also possess the cognitive foundations necessary to build academic success.[4] Neuroimaging techniques are revealing that certain motor tasks activate both motor and cognitive areas of a child's brain.[4]

The body's vestibular system controls balance and spatial awareness which facilitates the student's ability to place words and letters on a page. Tracking specific patterns with the whole body (using a noodle, ball, or hands in some of the games) promotes the brain's ability to encode symbols.

> "About eighty-five percent of school age children are predominately kinesthetic learners. Using movement in the learning process helps many children retain and retrieve information more efficiently. Physical activity prepares the brain for learning by providing a healthier body/brain that works more effectively. All things being equal, healthy active students can learn better." Jean Blaydes Madigan, Neurokinesiologist, Thinking on Your Feet.[5]

Of course, these physiologic principles apply to adults too. In his book, Dr. Dharma Singh Khalsa, M.D., reports that, "several researchers revealed stunning evidence that powerfully supports the efficacy of exercise in achieving and maintaining optimal mental function in people of all ages".[6] He also reports that exercise, when it is combined with thinking, is most valuable because it grows the largest number of dendritic connections.

Increasing evidence suggests that the brain operates in many ways like a muscle – atrophying from disuse and increasing capacity with active use, even late in life. This is the "use it or lose it" adage espoused by Dr. Joseph Jankovic, professor of neurology and director of the Baylor College of Medicine Movement Disorders Clinic in Houston.[7]

The brain thrives on stimulation. Unlike other organs that wear out after a certain number of years the brain becomes sharper the more it is used. Physical exercise can increase cognitive capacity just by driving blood and oxygen to the brain.

Strong evidence suggests that exercise stimulates production of neurotrophic factors (also called brain-derived neurotrophic factor or BDNF), which helps repair brain cells, prevent cognitive decline improve learning and promote mental as well as motor performance[7]. It may slow the onset of degenerative brain diseases like Parkinson's syndrome.[7]

Harvard psychiatrist, John Ratey, MD, refers to BDNF as "Miracle-Gro for the brain".[8] He calls BDNF "a crucial biological link between thought, emotions, and movement." So how do you get more BDNF?

Daily aerobic exercise is best but including intervals of sprints are even better. In a recent German study volunteers who did two 3-minute sprints (separated by 2 minutes of lower intensity) during the course of a forty-minute treadmill session demonstrated higher increases in BDNF than non-sprinters. Not only that, the sprinters learned vocabulary words 20 percent faster than non-sprinting exercisers. It seems even a small amount of high-intensity exertion can have a profound effect on your brain.[9]

When the brain is engaged by having to make decisions under pressure while playing interactive ball sports, the benefits are enhanced significantly because gross motor skills must be incorporated. Neurons develop only when the player is confronted with a demand for greater efficiency (skill development). As far as the brain is concerned, if you need a skill, you develop it only when you are confronted with the need, and then practice performing it.

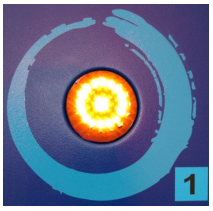
Motivation to play for long periods occurs as a new score is established every few minutes.

The XerPro/XerTrainer makes training more fun while taking the brain-body connection to a level beyond typical sports in that the games are short, specific, more intense, and tuned to the appropriate level of difficulty until the player is ready for the next. Motivation to play for long periods occurs as a new score is established every few minutes.

Unlike other computer simulated games where a player holds a device and pretends to play by waving it around, the XerPro/XerTrainer engages the whole body in a real-play game with real sporting goods where the hands, feet, eyes, ears, and vestibular system are all involved in the activity. This produces a computer-generated score, which measures actual athleticism, cardiovascular fitness, and intellectual agility.

The value of the computer-generated games is that successive demands at each level of difficulty are randomly produced. This requires the player to stay "in-the-now", ignoring any internal or external distractions, in order to prepare for the next challenge. Profound focus on the present allows the XerPro/XerTrainer programming to target development of all five core brain areas:

- Memory (Short Term/Long Term)
- Speed, Accuracy, Reaction Time
- Attention/Focus
- Problem Solving
- Cognitive Agility



Sportwall Physical Training for Accomplished Athletes

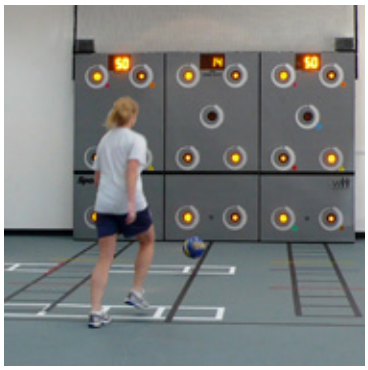
In today's competitive sports environments, athletes as well as parents are continuously seeking ways to improve performance and ultimately gain an edge over the competition. Sportwall programming helps skilled athletes push their limits AND cross train.

Cross training refers to speed skaters who train on bicycles, a tennis player who works out on a speed bag, a cross country skier on roller blades, or a gymnast on a trampoline. The most successful athletes regularly train away from their chosen sport in activities that improve the athletic characteristics

required. More importantly, seasonal facilities may not be available. Sportwall programming supplies the ideal off season physical challenges or a break from the monotony of sport specific training.

Even elite athletes can find the challenges to strength, power, and endurance they need, but also the general athleticism required by their sport. Application of speed, agility, strategy, and technique under pressure is also found here. Strong athletes don't win the battles, athletic ones do. Sportwall is the first training system to fully utilize technology to improve conditioning in athletes of all ages and abilities WHILE improving their decision making under pressure.

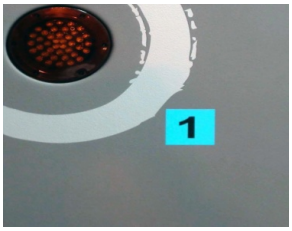
Because the Sportwall XerPro/XerTrainer ramps up its demands in a systematic fashion, it is appropriate for athletes of all abilities and levels of competition. The system challenges professional athletes as far as they are willing to be pushed, yet is accessible to amateurs and beginners. The level of the athlete will determine which training is initiated and its specific progression.



Sportwall has the ability to quantify/score the success of individual movements. To an accomplished athlete, an improvement of ONE percent can represent a huge competitive gain, but that gain is correspondingly difficult. Accurate scoring/feedback become extremely important when the athlete is digging deep for effort and the highest levels of motivation are required. Sportwall meets that need.

The athlete or coach gets accurate assessment and can track progress. Athletic improvement can be accomplished in a systematic and highly engaging format, allowing the highest level of sports specific endurance.

<u>Athletic Training-- XerPro/XerTrainer can be utilized to improve:</u>



- First step (reaction) quickness
- Reaction time
- Dynamic balance and postural stability
- Plyometric adaptation in sports specific movements
- Explosive change of direction
- Kinetic chain linking and complex movement patterns

Brain Speed: Delivering the Edge in High Performance

Elite athletes are superior in three main areas: strength, skill, and speed. Strength training should be general and focus on maximizing cardiovascular and muscular capability. Skill training is functionally specific; practice makes perfect only if one practices perfectly.

Speed is what truly separates the elite athlete from the good athlete. Not sprint speed, but rather information processing speed, also called reaction speed - the recognition of stimulus and ability to react quickly and EFFICIENTLY to that stimulus. Efficiency also depends on peripheral awareness and visual memory. It is recognition of patterns, memory, and mental preparation combined with the ability to apply strategy and technique under pressure.

For years, coaches have searched for the "ultimate tool" for speed development. Physical speed is the manifestation of what goes on in the athlete's mind before he reacts. Mind speed is the essence of greatness. According to neurologist, Dr. Carla Hannaford in her book *Smart Moves,*

> Research indicates that when both eyes, both ears, and both feet are being equally used, the corpus callosum (responsible for whole brain processing) orchestrating these processes between the right and left hemisphere becomes more fully developed – cognitive function is heightened and ease of learning increases.[10]

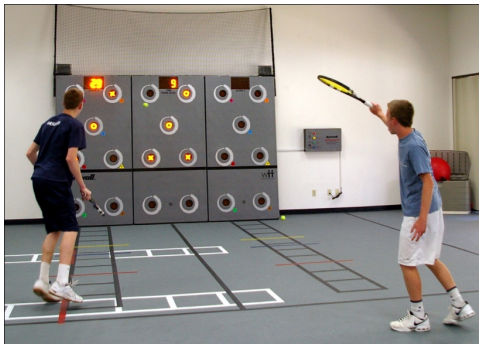
Sportwall training enables athletes to merge the mental and the physical. Regular use will literally improve the speed at which the mind functions.

Sportwall training enables athletes to merge the mental and the physical. It continually pushes the athlete to higher levels of intensity, which in turn pushes performance by the neurological system. Regular use will literally improve the speed at which the mind functions.

How?

Movement specialist M.A. Greenstein, Ph.D., in a Q & A session on Facebook wrote that exercise is "important for generating blood and oxygen flow. This results in neurotransmitter release (which) has been shown to boost strength of synaptic bonding, stimulating glial cell activity for information flow".[11] The faster an athlete's mind works, the slower the game appears, leaving more time to apply strategy and technique. That is what is meant by being in the "zone" or what sport psychologists call the "flow".

Sportwall programs accomplish this by encouraging right and left brain intelligence and balance. It coaxes the player to perform movements that develop the corpus callosum, the super highway of connective motor and sensory axons that connects the two hemispheres of the brain.



Dr. Greenstein writes, "There is an important correlation between the use of spatial intelligence and long term memory. Movement, cardiovascular exercise can help to grow the area of our brain that creates new memories—the hippocampus".[9] She notes the work of Harvard psychiatrist Dr. John Ratey, who says that 20-30 minutes of cardiovascular exercise enables more "fruitful synaptic bonding".

In fact, movement is essential to the development of all four lobes of the brain. As activity in all lobes of both hemispheres increase with movement, more dendritic connections form, myelination increases, and those dendritic connections extend across the corpus callosum.

The better the connection between hemispheres, the more intelligently we are able to function. Maximum proficiency at critical thought, or skilled movement, requires peak activity of both hemispheres. This is how Sportwall activity promotes whole brain thinking.

Fighting Youth Inactivity, Obesity, & Morbidity

Now called the "childhood obesity epidemic,"[12] the prevalence of overweight children and adolescents has increased dramatically over the past several decades. With it comes unheard of incidence of chronic diseases like obesity, diabetes, and heart disease in our children. As children become heavier worldwide, greater numbers become at risk of having Coronary Heart Disease (CHD) as adults.[13] The culprits in this assault on our health are not hard to imagine.

Screen time, including watching television, surfing the internet and video gaming, has been associated with promoting inactivity which has led to this rapid increase in obesity. How much screen time? Children ages 8-18 spend approximately over an hour playing video games, 1.5 hours on a computer, 4.5 hours watching TV, and 7.5 hours on entertainment media…PER DAY![14]

Though video gaming has only been partially blamed for the rapid increase in the prevalence of overweight children and adolescents, there has recently been a rise in interest in active electronic games that require physical movement as a way to engage children in activity.

Why not engage them in real sports? The answer is that sports are not universally engaging to children.

"Previously we've focused on sports as a way to get children physically active," but not all of them are interested in organized sports. Schools are trying to make their P.E. classes more inclusive to children of different sizes and interests, and I think this is one way of doing that."

Dr. Bruce Bailey, Assistant Professor of Exercise Science at Brigham Young University says, "Previously we've focused on sports as a way to get children physically active," but not all of them are interested in organized sports. He adds, "Schools are trying to make their P.E. classes more inclusive to children of different sizes and interests, and I think this is one way of doing that."[1]

Experts agree that finding activities that most, if not all, children will embrace is a challenge. Enjoyment appears to be the key element in promoting adherance to strenuous physical activity for them and deserves detailed study. Enjoyment is important to understand because children tend to participate in physical activity that they enjoy.[15] So, if exergames are a potent way to engage youth interest, how do the major exergame products compare to each other in terms of their level of engagement and physical exercise?

Energy Cost of Exergaming: A Comparison of the Energy Cost of 6 Forms of Exergaming[1]

For the first time, we have some significant scientific research comparing the effects of exergaming on children. The details are worth note as the perceptions of the children, as well as their physiological response to the exercise, are described.

In this study published in March of 2011, 39 boys and girls averaging 11.5 years of age were examined via indirect calorimetry for energy cost and surveyed for enjoyment/perceived exertion while playing 6 exergame systems and treadmill walking (3 mph) at the University of Massachusetts, Boston. Three of the games were commercial products, Sportwall (Ventura,CA), Bug Invasions--Lightspace (Lightspace Corp.), Goalie Wars--Cybex Trazer (Medway), and three were consumer products, Dance Dance Revolution (Konami Corp.), Boxing--Wii (Nintendo of America Inc.), and Jackie Chan Alley Run--Xavix (SSD Company Ltd.).

Each of these systems includes multiple games and multiple levels of difficulty within games. Some levels are too easy both physically and mentally, and other too frustrating. Pilot research revealed which levels for each game would likely be the most aerobically challenging (via ratings of perceived exertion or RPE), while still maintaining the fun gaming experience. Before testing the study group, each child was supervised while getting familiar with each game for 10-15 minutes, twice a week, for a 2-week period.

The Sportwall was unique in that participants were divided into 4 or 5 per team to compete in relay type sprints (intervals) for 15 feet to the wall to score points. Each game was played in 4-minute blocks with 30 seconds rest between games.

During 5 minutes of rest between each activity, children were asked, "How much did you enjoy this activity?" The 10-point discrete analog scale ranged from "not at all" to "very much". This type of analog scale has been successful in measuring physical activity enjoyment in children.[15,16]

Appropriately, more than half of the children were classified as overweight or at risk for overweight. Critical to our health mission as a society is finding answers for our most at risk children. These answers should also address differences in the appeal of physical activity to boys and girls. To be successful, we will need to capture both genders equally, hopefully during the same activity. This University of Massachusetts study also speaks to these needs.

Exercise Results

Every child expended significantly more energy in all studied exergames than at rest AND significantly more energy than 3 mph treadmill walking during Trazer, LightSpace, Xavix, and Sportwall.

Energy expended by Wii Boxing/DDR was similar to 3 mph walking, but the other games were significantly more aerobic, with Xavix and Sportwall highest. Since 3mph is considered brisk walking for children, as well as adults, this is a significant endorsement of the cardiovascular benefits of these particular exergames.

This level of exertion was termed "moderate to vigorous," consistent with US Dept of Health and Human Services recommendations for children.[17] Remember that these experts chose each game and level to maximize the exertion while maintaining player engagement to better study any therapeutic effect.

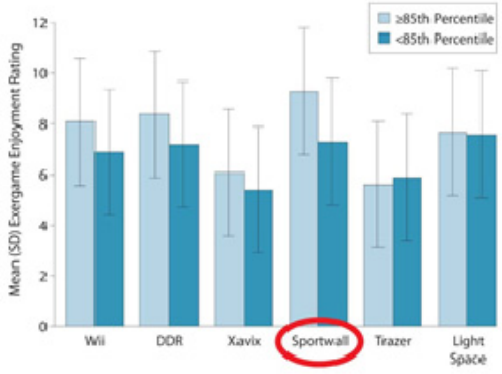
The question of whether children, or the games themselves, will push the cardio challenge deserves further study. Clearly, gaming environment, game choice, and game level can greatly influence energy expended. This is likely where parent, teacher, and coach guidance come in for most exergames. Despite the caveats, these exergames showed impressive potential for augmenting cardiovascular exercise needs. [Non-research side note: It is our experience, that Sportwall is unique in that it intrinsically pushes players to higher levels of exertion, without outside influence.]

Self-reported enjoyment was very high for all the activities in this study with Sportwall at the top.

Enjoyment Results

Self-reported enjoyment was very high for all the activities in this study with Sportwall at the top. Dance Dance Revolution (DDR) was rated second, followed by LightSpace, Wii, Cybex Trazer, and Xavix. Again, other games/levels might have different results.

Generally, boys enjoyed the exergames more than girls, but there were other noteworthy gender differences found. Not surprisingly, Boys liked Wii Boxing and the Xavix Jackie Chan game a bit more and Girls liked Dance Dance Revolution a bit more. Now for the "eye openers":



1) Both genders similarly enjoyed LightSpace, CybexTrazer, Walking, and Sportwall regardless of classification of weight. As noted, transgender appeal will likely be one hallmark for exergame purchase.

2) Importantly, children classified as above norms for weight enjoyed the exergames more than the other children. This is the group less likely to participate in regular sports.

Adolescents and teenagers of NORMAL weight, struggle with self-esteem, identity, and fitting in with peers. At

Sportwall invisibly pushes levels in player strategy, focus, power, precision, balance, and footwork. This is exactly what all sports demand.

this age, the risk is high that they will develop sedentary routines with extreme amounts of screen time that could last for the rest of their lives. For those overweight in this age group, discrimination on the play yard likely multiplies this risk exponentially.

For an exergame to win the battle that THESE young people face, it will have to do more than raise heart rates. It must show those in the above weight norms that they can succeed physically along side their more fit cohorts. That this group enjoyed exergames more probably reflects surprise, relief, and encouragement all at the same time.

Sportwall Rated Highest for Enjoyment

3) Interestingly, **children in these above weight norm groups also preferred Sportwall more than the other children.** Among the exergames examined, only Sportwall has short bursts of high intensity and forms teams. This preference for Sportwall held up despite measurements of greater exertion than during the other games for this group. Remarkably, **Sportwall represented MORE exercise AND more enjoyment for them.**

These researchers believe that while exergaming is "most likely not the solution to the epidemic of reduced physical activity in children, it appears to be a potentially innovative strategy that can be used to reduce sedentary time, increase adherence to exercise programs, and promote enjoyment of physical activity. This may be especially important for at-risk populations, specifically children who carry excess body weight." Of course, longitudinal studies are needed to document exergaming's lasting effects.

Sportwall Programming Promotes Social Integration

It is likely that Sportwall provides both genders and overweight children a chance to contribute more subtle physical and mental attributes such as alertness, intelligence, precision, coordination, quickness, empathy, or even leadership to their team. A sense of belonging mixed with accomplishment is undoubtedly a potent concoction at this age when future activity patterns are being created.

That would go a long way to explaining this preference, as Sportwall appears to provide these children a unique stage to perform. In this respect, Sportwall programming certainly distinguishes itself among its competition in terms of socialization.

Sportwall programs develop social skills and interpersonal cooperation through social interaction in a spirit of fun. Opportunities to work together as a team create an environment where participants develop and enhance concepts such as inclusiveness, cooperation, and mutual support.

Learning how to be part of a team as a valued member raises confidence and a sense of self-esteem. Instead of only one winner, with Sportwall training there is a new winner every few minutes, so players have numerous opportunities to improve their scores, and experience the feeling of success.

Perhaps more importantly, the system provides an easy way to recover and rededicate in the face of a loss, a task often more difficult on the playground. For children and adolescents who experience this type of discrimination, Sportwall programming must feel miraculous.

Opening the Doors to Participation in Sports

> "Many schools, gyms, community centers, and hospitals include (Sportwall's) digital target games that challenge players on speed and motor skills as they throw a ball allowing for sports simulation games that allow users to feel like they're playing games such as soccer, tennis or baseball." Jeannine Stein, Los Angeles Times, March 13, 2011.[18]

Sportwall is a perfect match for any participant. It is an opponent that never misses and always plays the ball back at the speed and direction directed by the player. Changes in feedback and response are instant. Since most systems are installed in a fairly confined space, required skills to maintain play develop rapidly. The temptation to drive up scores and continue play is irresistable. It invisibly pushes levels in player strategy, focus, power, precision, balance, and footwork. This is exactly what all sports demand.

Beyond enhancing these natural skills, the system promotes an intrinsic human need, dare we say even "a love for movement." Body and brain find a concert of new confidence, which in turn fosters a strong desire to pursue life-long physical activity, a desire that may not have happened otherwise.

On the playground, self-esteem frequently hangs on a child's ability to throw and catch a ball. Yes, it is a primitive measure of social acceptance among children who MIGHT be picked to a team. We continually observe children previously marginalized to the sidelines being integrated back into playground activity just weeks after Sportwall practice because the system provides a more protected, unintimidating environment at their school. For this purpose, the versatility of the system is essential.

"The number of games and activities that might be used is endless," Health and Physical Education Supervisor Eileen Dibattista told the Medford High School.[19] "The wall is designed to stimulate the body and the brain simultaneously." The set up allows for individual activities or team activities when students might compete to attain the highest scores and both traditional game skills and total body conditioning can be accomplished.

"With childhood obesity being the epidemic that it is, I think it is great that this is available for our kids," said Medford High School Committee member George Scarpelli, also a coach. As for the specific physical benefits of the XerPro, Dibattista said, "The functional training program of the Sportwall XerPro provides a mind and body connection." In her words, "This is unlike a traditional conditioning program, which focuses on isolated muscle groups."

Some of the athletic uses Dibattista credits include throwing accuracy through a series of targets, increased arm strength, improved speed, agility, and passing techniques. Body balance, stability, core strength, and coordination can be improved as well by adding other elements, such as agility ladders.

Dibattista summarized her impressions by saying, “It is exciting to provide our students with this additional opportunity. The XerPro enhances our physical education classes by providing a modern and improved delivery model. Technology is what students expect in today’s world.”

Sportwall for Improving Neurological Development

Movement is essential to maintaining physical and emotional health. Unfortunately, the past two decades have witnessed a drastic reduction in physical movement in industrialized countries. The risks associated with sedentary living continue to increase as technological “advances” impact our lifestyles.

One non-electronic example of this at the earliest ages is stiff safety car seats. Yes, they have come a long way to protect infants/toddlers while driving, but now they convert to home carriers. The home carriers then slip into high chairs, the ultimate convenience for parents.

What most parents don’t realize is that hours a day in these devices prevent some spinal, neurological, and muscular development which babies and toddlers depend on to learn to lift their own heads and manipulate the curvature of the spine in a wide variety of postures. Technology has impacted childcare also.

In the childcare industry, increased concern for security at facilities has helped drive the use of indoor sedentary computer games and television for entertainment. Previously, childcare was dominated by outdoor playground activity, the physical movement necessary to fully develop the body and brain.

What are the results of these changes in childcare?

Some researchers like Dr. Alweena Zairi[20] who study the underlying causes of under performance in children, believe these practices effect pre-school neurological development and the academic potential of children by the time they start school. Teachers are finding they have to deal with a growing number of children suffering from numerous conditions born out of a childhood of conditioned inactivity.

The XerPro/XerTrainer has been designed to provide a safe space for group exercise based on engaging activities and games with particular emphasis on those who typically do not otherwise choose to exercise or work out at a gym. Since 2003, various professional treatment centers have been using the Sportwall systems to treat a range of neurological disorders. Some are mentioned below.

Treating Childhood Motor Delays, Autism, ADHD/ADD, LD, and Obesity at Fitness for Health, Rockville, MD

Fitness for Health (FFH) is a state-of-the-art fitness facility specializing in programs for children with coordination and motor delays, ADHD/ADD, LD, weight management, and self esteem issues. "Parents can't drag their kids away from video games," says Marc Sickel, the founder of Fitness for Health in Rockville, Maryland. He continues:

Learning how to be part of a team as a valued member raises confidence and a sense of self-esteem.

I thought there had to be a way to tap into that obsession—especially if it could help children with special needs. We have devised creative ways to utilize the Sportwall to meet the needs of our

population which include the goals of increasing motor planning and processing, multi-planar movement, improving academics, increasing tracking abilities, and cardiovascular endurance.

Here are some examples of how FFH programming is applied to the Sportwall XerPro:

For sport specific activity to improve processing, motor planning, and athletic skills, FHF places letters of the alphabet above or below each light, incorporating word games. Players use ball throwing, kicking, or even tennis groundstrokes for accuracy while spelling. This improves tracking and processing for an athlete and adds an academic component for children.

Multi-plane skills are often trained on the XerPro game level 4-2. Here, children raise their arms to "knock the lights out" as they move right to left with sliding steps across the panels, then left to right to return. The next level of complexity adds the feet to "knock the lights out" which are located below waist level.

After that, children are asked to use the right hand to hit a light to the left and vice versa. Then the feet are similarly asked to cross the midline. Simultaneous centralizing movement can be added by having the participant use both hands to hit a light. All sports require upper and lower extremity movements in single and multiple planes. XerPro's forte is adding difficulty that the player actually enjoys with sounds for scoring.

The "Tic-Tac-Toe" game allows for increased cardiovascular endurance. At the same time, it forces the child to make fast decisions pushing their processing abilities. For more intensity, FFH uses game 4-1 for 30 seconds with a weighted ball to ramp up cardiovascular endurance and motor planning.

Sportwall programming certainly helps develop fundamental sports skills, visual spatial awareness, tracking, motor planning, processing, cardiovascular endurance, and more.

A medicine ball is placed 20 feet away from the center of the left wall panel, and a spot is marked 20 feet away from the center of the right wall panel. The player runs up hits lights out, runs to the ball, picks it up and carries it to the other spot, puts it down, runs up and hits another light, and continues the pattern until the time runs out – usually 30 second intervals. That is pretty strenuous!

FFH uses a fascinating exercise to improve memory, recall, focus, and visual spatial awareness. Laminated cards of photos of the Sportwall with different light patterns are used. The child views the card for 3-30 seconds (depending on their level). Then using game 4-1, the child must recreate that pattern from memory during the game.

This is only one example of the system's versatility, in software engineering terms an attribute of "open architecture" which, allows educators to innovate.

Sportwall programming certainly helps develop fundamental sports skills, visual spatial awareness, tracking, motor planning, processing, cardiovascular endurance, and more. Still, we feel the system's capabilities have yet to be fully explored.[21]

Sportwall XerTrainer in Developmental Optometry

Eighty percent (80%) of an individual's information is obtained through vision. Nearly everyone is born with the potential for good eyesight.[22] Most do not

realize that, like any muscular skill, all visual skills are learned. We have learned to see, just like we learn all other skills. Astonishingly, "even the most elite athlete can learn to see better," says Dr. Polan.

"Far too many children are being diagnosed and treated for ADD, ADHD, and Dyslexia. Unfortunately, many of these children may be simply demonstrating the symptoms of an under-developed or under-stimulated neurological system."

Dr. Gary Polan, a pioneer in the field of Developmental Optometry is based in Pacific Palisades, CA. He has been using the Sportwall XerTrainer in his office since 2004. According to Dr. Polan,

> I have used the XerTrainer as an integrative tool as a part of my visual/perceptual vision therapy (VT). Younger patients with deficiencies in laterality, directionality, gross motor, visual-motor organization, and visual-motor integration are targeted for training on our XerTrainer. Patients with these diagnoses often exhibit isolated symptoms including poor handwriting, letter and number reversals (often referred to as dyslexia), and poor eye-hand coordination.
>
> Patients with visual tracking problems (pursuits and saccades) can also benefit from our XerTrainer. Typically, two 120-second consecutive runs are performed. Patients are urged to improve upon their first score.
>
> Most of the procedures are done with hand hitting rather than ball hitting as this allows for a quicker integrative response to achieve desired therapeutic goals. Laterality/directionality patients are instructed to use left hand on left side and right hand on right side lights. Crossovers are not permitted.
>
> More difficult levels are used as patients improve. "Find the Tune" is a good exercise for multi-sensory integration training, namely visual-auditory processing. All serious vision therapists would benefit from XerTrainer in their office. XerTrainer has become a useful and fun tool for patients with specific visual perceptual deficiencies. In fact, patients often ask if XerTrainer is going to be part of their vision therapy session for the day.[22]

Sportwall XerPro/XerTrainer Can Help Manage Sensory Processing Disorder (ADHD, Dyslexia, Autism, Asperger Syndrome)

It is difficult to estimate from parental surveys but Sensory Processing Disorders (SPD), which affect children entering public schools from kindergarten, are conservatively estimated at 5.3% and may be as high as 13.7%.[23] Another study estimates 16% prevalence of Sensory Over-Responsivity (SOR) in elementary school age children.[24] In any case, this is clearly now a mainstream issue.

We have come to discover that movement is essential to promoting neurological development. The lack of natural developmental movements such as months of crawling, or free outdoor exploration and activity, has resulted in a population that increasingly lacks the necessary neurological stimulation. Numerous studies have now revealed the importance of movement to the development of the brain and emotional intelligence.

If this multifaceted stimulation does not occur, normal development is stymied and appropriate adaptive responses are not achieved. As a result, mental, physical, emotional development, and behavior are impacted negatively. More profound issues in neuromuscular and visual-perceptual-motor development become likely.

Far too many children are being diagnosed and treated for ADD, ADHD, and Dyslexia. Dr. Polan has treated many patients, diagnosed in this group of disorders, who can be helped without drugs.[22]

Unfortunately, many of these children may be simply demonstrating the symptoms of an under-developed or under-stimulated neurological system. Long-term administrators in occupational therapy environments have repeatedly commented on how effective the Sportwall programs are at helping children to essentially "re-wire" their brains.

Cambian Education, the largest provider of specialized residential education and care for young people with Autism and Asperger Syndrome in the UK, has invested in Sportwall in each of their facilities.

Clare Stockley, PE Programs coordinator for Cambian Education says,

> We chose the Sportwall because it's versatile, straight forward, and a great way of delivering PE through ICT (Information and Communication Technologies, aka IT). We use the Sportwall from ages 9-19 and they all love it as it's just as much a fun game as a good workout".
>
> As our students have Autism Spectrum Disorders (ASD) they're not always willing to join in with team games, but the Sportwall is the ideal medium for them to compete against each other without direct interaction. They can play easily by themselves, but also in small groups without feeling stressed. It engages the students and allows them to think about what they're doing. They develop body awareness and problem solving skills when deciding how to reach each light in sequence at different heights.
>
> The students particularly enjoy throwing things at the lights, which again is great for coordination and developing reaction times. It provides a sensory dimension to the lesson and students can be creative with it. One student likes to play it in the dark so that the lights are even brighter. The Sportwall is ideal for children with ASD's as it enables them to learn by direct experience. The instructional cues are visual, decreasing the human element, which also helps the students to learn.[25]

Sportwall Training on Mood: A Natural Alternative to Anti-depressants

Sportwall's XerGames training is often presented in play format that appeals to those who traditionally do not want to exercise or play sports. This makes it a critical tool to reach the enormous numbers impacted by sedentary technologies.

According to the Harvard School of Public Health, inadequate physical activity and inactivity is now rated as the FOURTH leading cause of preventable death in America.[26] This preventable cause of death was ranked above high blood sugar and high LDL cholesterol.

It is easy to believe that this sector of the US population is most likely associated with higher levels of stress, obesity, and mood disorders. Exercise can elevate mood even in our later years. According to one meta-analytic review, "chronic exercise is associated with improved mood in the elderly". [27]

That said, a routine of exercise to elevate mood and assist learning is best addressed in our youth. For Elaine Alexander of the Kansas City School District, the XerTrainer does just that. She says, "Our students absolutely love the XerTrainer". She continues, "They ask to play on it and the whole class's demeanor changes to one of total cooperation when they know we are going to work with the XerTrainer. If we need to change from another activity to the XerTrainer, we never hear any complaints. We find the XerTrainer can be

adapted to almost any skill we are teaching. We believe the XerTrainer is the most motivating piece of equipment we have in our program!"

The principal at Woodland Elementary School, Craig Rupert says, "PE4Life has had a tremendous influence on the lives of our students. It's not just the increased levels of fitness we are seeing in our kids which has everyone excited. Students are also more motivated throughout the day, their enthusiasm is way up, and discipline issues are way down." [28]

> ***"Our students absolutely love the XerTrainer. They ask to play on it and the whole class's demeanor changes to one of total cooperation when they know we are going to work with the XerTrainer. If we need to change from another activity to the XerTrainer, we never hear any complaints. We find the XerTrainer can be adapted to almost any skill we are teaching. We believe the XerTrainer is the most motivating piece of equipment we have in our program!"***

Due to the neurochemical response, many researchers have concluded that we can control mood through exercise and thereby dramatically impact human psychological health. In addition to its massive appeal to the "at-risk" population, this section explores how Sportwall's "short-burst-short-rest" style of interval training programs can:

- release endorphins which lift mood,
- stimulate the elimination of adrenalin and cortisol improving the sense of well-being, and
- naturally increase the production of neurotransmitters (building blocks of hormones) such as serotonin, norepinephrine, and dopamine (known as "the happy hormones").

Endorphins

Endorphins function as neurotransmitters that act as the body's "natural painkillers" as they resemble opiates in their abilities to produce analgesia and feelings of well being. Endorphins are responsible our ability to diminish, or even ignore, physical pain. They are also partly responsible for the "runner's high" often reported by devout runners. Importantly, endorphin production increases with the frequency of exercise. All people, regardless of history, will experience a rise in endorphin levels with exercise of even modest intensity.

It is a fact that endorphin production increases with the frequency of exercise. All people, regardless of history, will experience a rise in endorphin levels with even modest regular exercise. Those who establish a regular exercise routine often report a sense of beneficial "addiction" for their body.

Sportwall Promotes the production of the "Happy Hormones"

Inactivity is a major contributor to depression. A study of 276 middle-aged women found that those with a positive sense of well being engaged in about 85 more minutes of physical activity per week than women who were clinically depressed.[29]

About 10% of the US population (27 million) was taking prescription anti-depressants in 2005.[30] Of those, about 700,000 are ages 5-17, a group that has doubled its use from 1995 to 2005 according to the Archives of General Psychiatry. This is astonishing usage.

While serotonin, norepinephrine and dopamine are critical ingredients found in anti-depressants, they are produced naturally

in a healthy person whose diet, exercise, and stress levels are well managed.

David C. Nieman, PhD, author of "The Exercise-Health Connection,"[31] explains that the benefits of exercise far exceed that of any medication or supplement. He suggests since the results of exercise can last for days, it is a safe and natural way to raise neurotransmitter levels and relieve depression.

Neurotransmitter levels affect the way a person feels, which is why they have been referred to as the "feel-good hormones" or "happy hormones". Aside from enhancing mood, they also help control sleeping habits and digestion.

There are several conditions that may arise if neurotransmitter levels, especially serotonin levels, are low. Depression, migraines, constipation and feelings of increased stress are possible indicators that serotonin levels are low. While serotonin, dopamine, and norepinephrine levels may be boosted using different kinds of drugs or medication, many experts support the idea that exercise may be just as efficient.

Dopamine

Dopamine stores can become depleted with chronic stress, or anxiety, intense trauma, starvation, or low carbohydrate diets. Performing long duration exercise at moderate intensity can elevate dopamine levels.

Norepinephrine

Norepinephrine is the chemical in the brain that controls physical wants and needs and is increased along with serotonin during strenuous exercise and continues long after exercise is completed.

Serotonin

Serotonin helps to govern the healthy function of the other neurotransmitters as well as providing critical support to the entire neurological system. Many stress related conditions are being tied to shortages of serotonin production. These include chronic fatigue syndrome, fibromyalgia, migraine headaches, anxiety, and depression.

Serotonin is produced in the intestines and 75% is used to control intestinal activity. The remaining 25% is synthesized in the brain. The rate of serotonin production in the neurons determines mood. High serotonin levels are linked with elevated or happier moods, whereas low levels are linked with feelings of anxiety and depression.

Although all neurotransmitters affect mood, serotonin is considered the most crucial and exercise is one of the most efficient stimulators of serotonin production. While exercise is often linked to weight loss, it can in fact also help a person feel better. Several studies have found that once a person engages in physical activity the brain's serotonin function increases, which in turn reduces depression, anxiety, and stress.

Sportwall's Balanced Programming: Key to Performance & Adherence

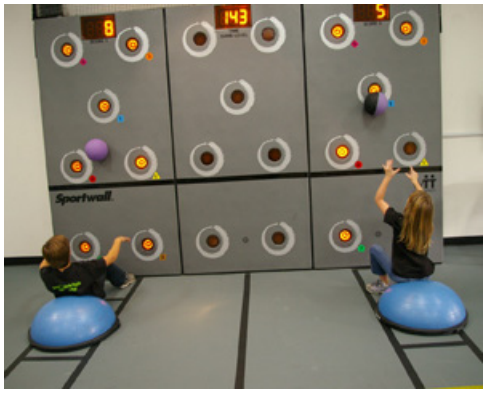
While even mild exercise will have a positive effect on our neurochemicals, exact effects vary with the severity of exertion. While exercise at very high intensity and long duration can cause adrenalin levels to become elevated while serotonin levels drop, as long as the body is not over stressed the more demanding the exercise, the better the chances of increasing serotonin production.

Sportwall's interval training (short-burst-short-rest) regimen, when delivered to groups, is an excellent way to achieve the balance needed to optimize results without over-producing adrenaline or under producing serotonin. Intensity is balanced with recovery during a thirty to sixty minute workout. This may explain why schools that have adopted the Sportwall programs are noticing a significant reduction in aggression and out-of-school suspensions.[27]

The thrill of play and competition, balanced with intermittent rest, holds the player's focus on the game and not the length of time spent exercising.

Interval training is now well documented to hold the key to maximizing performance. Also called compensation, the body must rest following a period of activity in order to replenish its biochemical sources of energy. Too much stress without recovery increases risk of injury and burnout. Too much rest without stress will lead to atrophy and weakness. Balancing stress and recovery is essential to increasing performance and adherence.

All Sportwall training programs utilize this method of training, a key to its superior adherence and performance results, especially among at risk populations. Inactive people often report that pain is the greatest barrier to adopting an exercise regime. Sportwall's format of short/intense games, followed by short rest in preparation for the next turn, is believed to be a key factor in successfully encouraging individuals to conquer this "pain barrier".



The thrill of play and competition, balanced with intermittent rest, holds the player's focus on the game and not the length of time spent exercising. Add the neurochemical release of "happy hormones" and the drudgery of regular exercise is replaced with the pleasure that play brings.

Summarizing Sportwall's Superior Position in the Exergame Market

While it can be argued that many of the components discussed in this document can be fulfilled with other programs and training equipment, there is nothing that compares with the Sportwall XerPro and XerTrainer in several areas, which should be critical to consumers.

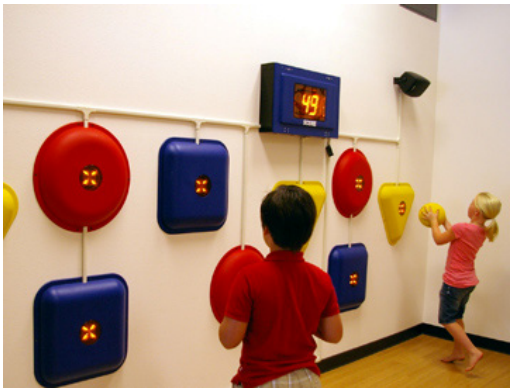
First, the programming is extremely diverse. It can be tailored to all population groups from children with special needs, both boys and girls, elite athletes, and seniors. Sportwall has the support of educators and researchers for every cohort group mentioned.

Second, the programming does not discriminate with regard to skill level as it meets players at their own abilities. Each player will find it easy to prepare the system for his or her level.

Third, and most importantly, these are programs, which have mainstream appeal. They break through the social barriers and gender stigma found in regular sports. They even engage the traditionally inactive.

The "Energy Cost of Exergaming" study described here shows that Sportwall's programs can provide appropriate levels of exercise, and more importantly the LEVEL of appeal required, for children who traditionally do not want to exercise or are repelled by competitive sports.

Because the structure of the programming involves multiple short games played in teams, there are no permanent winners. Instead, the chance for everyone to succeed is repeated every couple of minutes which incentivizes continual pay. Often, educators have to "pull the plug" to end play.



Since groups can play together or one team can play against another, a high level of camaraderie is quickly built. The combination of rapid skill development along with social connection leaves players inspired with a sense of belonging after each class.

A special note to older generations--today's computer gamers sense no barriers to overcome as they see Sportwall activity as a game rather than a workout or something done only by athletes. In this way, Sportwall eliminates the "jock" stigma to exercise. Similar to other three-dimensional electronic engineering puzzles, "nerds" like it too.

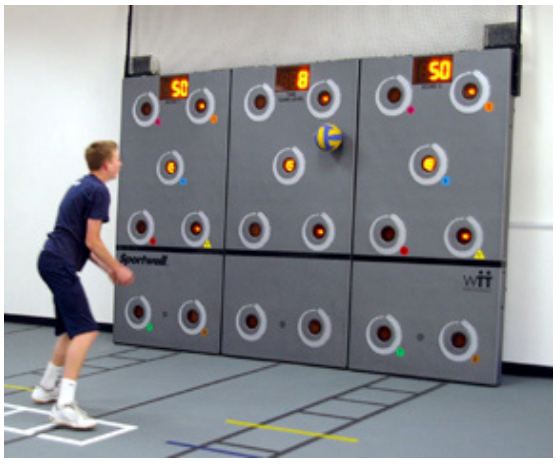
On the other end of the spectrum, seniors have affirmed that play is for the "kid in all of us". They report that their mental clarity was sharper for days after participating in a class. Essentially, Sportwall represents a form of time machine. They get to visit the playground again.

Installation convenience: Since the programming is so diverse, facilities have preferred to install the systems in general purpose rooms where everyone can have access to them, rather than dedicating them to a room for a particular group. This way, for example, seniors can use them in the mornings, youth in the afternoons, and adults and athletes in the evenings. An added advantage is that when not in use the systems take up only 4" of depth on a wall, which also helps alleviate the need for a dedicated room.

Instructional growth: when instructors fully engage with the wide range of programming available, they begin to create their own routines and programs. This is when a level of excitement ignites and true believers are born as they discover the limitless possibilities of Sportwall programming. Passive supervisors often become inspired physical educators.

We have developed a wide variety of program manuals designed to get instructors started in their own field of interest, whether for sports training, group exercise classes, or personal training sessions. Using our drills initially provides a feel for how the process and results come together.

Score Tracking: an effective way to ensure sustained use is to incorporate score tracking and team competitions. This can be done in two ways: by using the score tracking charts or by encouraging players to post their scores on a social networking site (such as Facebook) along with a video clip of the play to validate the authenticity of the score.



Facilities can either dedicate their own page to tracking scores or they can use the company's official score tracking site. Some facilities also hold competition days where teams challenge each other for the high score of the day in a particular game. Since games average sixty seconds, it is easy to get a lot of action happening quickly.

In our experience new ideas quickly emerge as instructors find themselves easily adapting drills to achieve their desired results. We encourage instructors to share ideas on our blog, http://www.xergames.com/blog/ or on Facebook, http://www.facebook.com on Sportwall XerGames. This way, resources available to both new and experienced users will grow continually.

"In our research, the Sportwall did everything else the other exergames could do, but the intensity level from the interval training, camaraderie, and team work stood out. Even those who were waiting for a turn were jumping up and down yelling and encouraging the others. Fit and less fit children played together." (personal communication, Bruce Bailey, Ph.D., Assistant Professor, Exercise Sciences, Brigham Young University. July 2011.)

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Evidence in this document has been gathered from scientific research, interviews with medical/science professionals, and experienced observations by seasoned trainers who have worked with the Sportwall products and programs in their facilities during the past seven years.

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