

# **Technology and Surf Extinction; How Artificial Waves Threaten Traditional Surf Ideals**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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## STS Research Paper

### Introduction to Artificial Waves:

Surfing culture is incredibly nuanced and is not quite like any other sports community. This distinction is in part because most surfers do not simply see surfing as a sport; surfers claim that there is an inherent connection with nature and its power, a spiritual and therapeutic connection, and even a religious connection (Ponting, 2017). Due to spiritual ties with surfing, there is backlash within the surf community against the commercialization of surfing, which includes massive media attention, profiting off surf tourism, and surfing as a competitive sport. Perhaps the most significant step in surf commercialization recently was the development of Kelly Slater's Surf Ranch wave pool: an artificial, mechanically produced perfect wave, complete with perfect barrels and long rides (Is Kelly Slater's Artificial Wave the Future of Surfing? - Los Angeles Times, n.d.). This technology spreads the sport to landlocked individuals and provides the opportunity for repetition in training, something that is immensely scarce in nature. Despite these benefits, many in the surf community argue that these pools really lead to dilution of skill, de-spiritualization of the sport, and even class division. Are wave pools the future of surfing, or the death of it?

While analyzing the polarizing topic of wave pool technology, the concept of social construction of technology (SCOT) is helpful for understanding how the social backlash of the surf community might change the trajectory of artificial wave technology progression and its implementation. In addition, the concept of technological momentum is a useful framework to analyze the future impact of wave pools on surf culture itself. While the social views of the surf community might shape wave pool technology now, the spread of artificial waves may end up becoming the shaping factor for the community, changing the sport itself. The utilization of these

frameworks helps provide a comprehensive study of the following research question: How do artificial wave pools threaten the traditional social ideals of surf culture, and how will this technology shape the future of the sport? The nuances of surf culture is a scarcely addressed topic for research, so this research is helpful for the surf community to understand the implications of artificial waves and how it may affect the future of the sport.

### **Methods of Research:**

Using search engines specifically for academic research papers, sources were gathered that apply to the research question. In searching for academic papers, using key words such as “wave pool,” “surfing,” “social construction,” “authenticity,” “surf parks,” and “lifestyle sports” narrows down search options to papers discussing the social aspects of surfing and similar sports, as well as papers discussing wave pool technology and its critiques. More colloquial articles from popular surf magazines are also being used to provide opinions from people in the surf community directly, to be used as evidence. Using this document research method, I have procured a collection of sources which all pertain to the concepts of wave pool technology and surf culture. With these sources, I will use discourse analysis to compile the important and relevant aspects of these sources and construct an argument to my research question based on this research. This method will provide a well-informed approach to answering the research question, enabling analysis of all sides of the conversation equally and totally. This analysis includes discussion about how exactly artificial wave pools detract from the main allures of natural surfing, how they might bring about a socioeconomic divide, and how other sports have gone through similar revolutions. There will also be discussion on the benefits of wave pools, such as bringing money to the sport, propelling top surfers’ skills, and opening the sport to the

masses. In the end, these pros and cons are weighed to conclude on the impact wave pools will have on the future of surfing.

### **Traditional and Industrial Surf Culture:**

To fully analyze the impact of wave pool technology on surfing, it is important to understand the facets of surfing that go beyond mere physical activity. Human rights researcher Mark Stranger claimed that surfing is a “pursuit of an ecstatic communion with nature” (Stranger, 1999), illustrating the tie that surfing has always had with nature. Human geographer Jon Anderson also wrote that surfing is “not simply a site of human-nature relations, but also as a space of spirituality” (Anderson, 2013). People will give up career and relationship opportunities for the sake of building a life around surfing, and in surf towns the social hierarchy can depend on one’s wave riding ability, such as at North Shore, Oahu. Not to mention, the Hawaiian people have an ancestral tie to the sport, as surfing was born from the Hawaiian natives and was a sign of class (Surfing History and Origins of Surfing, n.d.). All this to say that surfing is more than a simple athletic activity.

It is also crucial to understand the current division that exists in modern surfing. There are two main subsections of modern surf culture, the “soul” surfers and industry surfers. The former conforms to a more traditional mindset in surfing, in line with the ideals described above such as leisure, freedom, and spirituality (Roberts & Ponting, 2020). In more recent history, however, there has been a major commercialization of surfing. Commercialization involves huge media attention, popularization of surf style, the rise of professional surfing as a competitive sport, and utilizing surf tourism for profit (Warren & Gibson, 2014). This side of surfing is the industry side. Although it can be argued that both sides need each other to be sustained, there has always been conflict from “soul” surfers claiming that the industry is full of “sell-outs” and that

commercialization is not true to surfing, it isn't authentic. This division is one that is polarizing for members of the surf community worldwide, and the introduction of wave pools has been a catalyst for the tension between "soul" surfing and industry surfing.

### **Frameworks to Analyze Wave Technology Impacts:**

Artificial wave pools are a great example of how technological advancements with clear benefits can have numerous unforeseen effects on the community in which it exists, altering social views and structures unintentionally. In order to analyze the extent of wave pools' impact on the surfing community, the STS frameworks social construction of technology and technological momentum will be utilized. Social construction of technology (SCOT) is the idea that social constructs in society are pivotal in shaping how technology develops. SCOT has five major related components: interpretive flexibility, relevant social group, closure and stabilization, the wider context, and the technological frame (Klein & Kleinman, 2002). These concepts together describe how different groups can have different influences on technology development. While SCOT is a key concept in beginning to analyze the relationship between society and technology, it has been criticized for its lack of structure (Klein & Kleinman, 2002) and lack of detailed analysis on technological development itself (Pinch, 1996).

Despite not providing a detailed approach on unearthing an exact cause-effect sequence for society and technology, SCOT as a general framework is still helpful in shedding light on social influences on technology. SCOT will not be used here as a definitive analysis of wave pool impacts and the future of surfing, but instead as a general framework through which the topic can be viewed in order to gain new perspective. SCOT will be used to discuss how the social perception of wave pools by surf culture could reshape the design and implementation of wave pool technology in the future. Surfers tend to reject industrialization and embrace tradition,

so this social hesitancy to surfing change could greatly inhibit wave pool technology development.

Technological Momentum is the idea that the relationship between societal influence and technology is time dependent; a new technology is often shaped by the society around it, but as the technology grows larger and more complex it becomes the shaper of society (Hughes, 1994). Technology historian Thomas Hughes says this provides a more accurate, time dependent approach to viewing society and technology than just SCOT or technological determinism. It is argued, however, that technological momentum does not actually present any new model as an alternative to social construction and technological determinism, but instead it is just combining the two and presenting it in a different package (Colarossi, n.d.).

This being said, technological momentum is still a useful concept to use because even if it is not a completely new framework, it still provides a useful junction of social construction and technological determinism and provides structure to when each one should be used.

Technological momentum is not only useful for analyzing the present and past but is also useful when predicting the future of the relationship between a technology and the society in which it exists. Technological momentum is helpful for this research because it gives insight into how wave pool technology may end up reshaping surf culture itself in the future, as opposed to the other way around. While wave pool technology is young right now and surfers have the ability to reject the technology, there may be a future where wave pool technology is deterministic in surfing, forcing all surfers to adapt to surfing's new reality.

### **Benefits of Wave Pools:**

The topic of artificial surfing waves is certainly polarizing, and for good reason. While there are important points both for and against wave pool technology, the true impact of wave pools on surfing culture lies somewhere in the middle. Wave pools will never replace natural surfing, as many soul-surfers fear, but instead it will likely become a supplement to it. The ultimate proving grounds will remain in the raw power of the ocean, but wave pools will merely be a tool for training or having fun when real surfing is not available. The spread of wave pools will inevitably increase industrialization of surfing, which will bring some positives and negatives, but this does not mean that all surfing everywhere will follow suit. When it comes down to it, surfing is what the rider makes of it, so if a surfer wants to get away from industry surfing and connect with nature spiritually, that will always still be an option. Similar to the idea of social constriction of technology, the surf community will not be forever changed for the negative because the ultimately it is the surf community itself that decides how wave pools are implemented. The progression of the surf community is self-driven, so the correct balance of wave pool use will inherently prevail. The introduction of this new technology opens more possibilities for the sport than it closes, and therefore will push the sport to the next level, as opposed to plateauing as it has in the past decade.

To delve deeper into the details of wave pools, it is important to first understand the idea behind their creation, and what pain-point is being addressed. While the concept of wave pools actually dates back to the 1920's (Alderson, 2015), the first wave pool that rivals a real ocean wave was Kelly Slater's Surf Ranch, in 2015. The idea is that good waves are a scarce commodity in nature, and endless perfect waves on demand solves that issue. For example, skateboarders can attempt the same trick on the same park feature hundreds of times over and over until they get the skill down. In surfing however, you must be at the ocean, the conditions

must be good, and even then, there are only so many waves that come through, which you have to battle other surfers to take. Even if a surfer has an empty lineup to himself and can try the same maneuver over and over, each wave itself is very different so you cannot achieve the same repetition that other sports have. A wave pool is the solution to all these drawbacks. With a wave pool, you can surf even if you aren't even near any ocean. It allows surfers to achieve the repetition that the ocean lacks, with endless waves of perfect size and shape. In addition, every wave can be the exact same to help the surfer predict how the wave will act. For these reasons, wave pools are a dream for any surfer attempting to maximize their skill, and wave pools will likely help the top surfers break the barriers of what was previously thought possible on a surfboard.

In addition to raising the skill level in surfing, the industrialization inherent to the introduction of wave pools has its own benefits. As discussed before, wave pool technology will spread the sport to the masses, making it available to people everywhere. Wave pools are incredibly expensive to create, ranging from 20 to 200 million dollars (Rodriguez, 2020), and operation costs can add up to being even more expensive than the production. For this reason, the implementation of wave pools will likely only be by major companies looking to profit off surf tourism. By nature, the profit model of wave pools means heavy marketing as well, leading to a massive increase in the surfing population. While this industrialization has many negatives which will be discussed in a future section, there are also notable benefits. For one, commercialization of surfing means surf products and accessories would be easier to come by, and cheaper to buy since large corporations can mass produce products at a cheaper rate than small local surf shops. It also brings a lot of money to the sport, which leads to better equipment, more surf entertainment such as surf films, and allows the top athletes to make surfing their



whole career, as opposed to a side hobby. This parallels the idea of technological momentum because as wave pool technology becomes more prevalent, it starts to shape and influence the lives of the surfers themselves. These benefits are crucial for the sport to continue to progress and grow, as it allows the everyday surfer to have more access to all things surfing related.

### **Drawbacks of Wave Pools:**

Despite these clear benefits, there is heavy backlash in the surf community about artificial waves for many reasons. For one, the industrialization of surfing has always been highly criticized. The industry side of surfing is viewed as being “sell-outs”. Surfing was born from and has always been linked to counterculture. Surfing was popularized in America in the 50s by those rejecting the nuclear family mold and looking to get together with friends to socialize, drink, and party. The sport continued to be influenced by counterculture in the early 2000’s with the shortboard revolution, at which time surfing was practically synonymous with heavy partying and drugs (Booth, 2013). Because of these rebellious roots, a lot of surfers think that surf industrialization is selling out their counterculture pastime to big corporations looking to profit off them.

Another major complaint about surf industrialization and wave pools is that they completely diminish the core values of surfing that were outlined earlier, such as spiritualism and experiencing nature. Historically, surfing was founded in Polynesian islands such as Hawaii, and was an activity that was more about culture than competition. This idea that surfing is meant to be a way of life as opposed to competitive sport has carried on throughout the entire lifespan of surfing, advocated through “soul-surfers”. To soul-surfers, surfing is a getaway from society, a connect with nature, and outlet to feel real adventure and risk, and soul-surfers argue that the industry side of surfing lacks all these values. Surfing is more than just a sport, the excitement of

it lies in the entire surfing experience. This involves the excitement of the search to find good waves not knowing what you'll find, the risk involved with trying to conquer the power of nature's waves, the social scene surrounding the adventure. A wave pool may try to recreate these experiences the best they can, but in the end a wave pool can only successfully create the physical aspects of surfing, not the peripheral experiences that make surfing so loved. Soul surfers fear that if wave pool technology is the future of the sport, then all of these values will get lost as generations go by, forgetting what surfing is all about.

Not only do wave pools lack the authenticity of real surf experience, but it is also argued that surfing in a wave pool is essentially "cheating". A major part of surfing is being able to read and predict the ocean: understanding how and where waves will form over different ocean floor contours, knowing what part of the wave formation process is the best time to take off on a wave, and positioning yourself correctly to take off in the pocket of the wave. This knowledge is gained only through years of experience surfing and is what sets apart an average surfer from an exceptional one. The problem with artificial wave pools is that it completely takes away this entire aspect of surfing. In a wave pool, surfers do not have to think about any of these things, as a perfectly timed and shaped wave is guaranteed every time. Not only does wave pool surfing completely ignore the importance of wave selection, but having perfect waves every time also acts as a handicap for whomever is riding the wave. For example, completing a backflip on a wave in a pool is certainly impressive, but the surf community tends to not consider it an actual trick until it's done in the ocean due to the unrealistically superior conditions. By denying credibility to maneuvers done in wave pools, the surfing community is discouraging the use of wave pools in serious competition, which shapes the way that the technology is implemented. This is a great example of SCOT, because the negative public view of wave pools by

professional competitors redirects the use of wave pools from a competing arena to more of a tourist destination, since tourists aren't as invested in receiving credibility from the surf community in their skill.

The issues described above outline the physical limitations of wave pool technology, but perhaps even more pervasive are the socioeconomic and environmental consequences. Due to wave pools being so expensive to build and operate, they are naturally very expensive to use as a consumer. For reference, booking Kelly Slater's Surf Ranch costs around \$10,000, averaging around \$450 per wave (Kelly Slater's Lemoore Surf Ranch [2022 Update] Pricing & Insights, n.d.). This high cost leads to a divide in the surf community, where the only ones able to use these wave pool training grounds are the extremely wealthy and those of celebrity status. Given the repetitious advantage that wave pools provide, this gives the high society a distinct and significant advantage in surf training over the common surfer. It is feared that this cost barrier will make it so that it is practically impossible to rise to a professional level of surfing without being extremely wealthy, homogenizing professional surfers to being only upper class and inhibiting social mobility in surfing.

Lastly, it is important to note the environmental issues that come with wave pools. Due to surfing's previously described connection with nature, the surf community tends to have a special interest in sustainability and world preservation. Sustainability is a common theme in all surfing-related products and marketing. Wave pools, however, are very large installations consisting of massive construction emissions, water usage, and power consumption (Rodriguez, 2020). This provides an extra layer of controversy to the wave pool discussion, since the resource usage of a single wave pool blatantly contradicts the sustainability efforts by the majority of the surf community.

## Analysis of the Future of Wave Pools

With all of the benefits and consequences of wave pools outlined, it is possible to accurately analyze how this technology might impact the future of the sport. With the clear training benefit that wave pools provide, there is no doubt that their use will be adopted by many professional surfers looking to maximize their abilities. This will most likely lead to expedited progression of surfing maneuvers and surfer skill. Surfing maneuvers and tricks have been relatively flatlined in the past decade or so, but in recent years surfers once again have begun to push the boundaries on rotations, turns, and airs. In addition to skill, it is likely that wave pools will begin to be used to host many more surfing competitions. There is already an event added to the Championship Tour which takes place in Kelly Slater's Surf Ranch. With the addition of surfing to the Olympics in 2020, wave pools are a likely candidate for where the Olympics will have their competitions, considering not all Olympics can be in countries with good waves. This means the direction of competitive surfing will likely be to artificial waves, to many surfers' distastes. Outside of competitions, it is likely that wave pools will become much more widespread for surf tourism. There are countless projects across the world aiming to develop resorts with wave parks as the main attraction, similar to amusement parks.

Right now, the technology is young, and the main inhibitor to its spread is the social backlash of the surf community, consistent with the concept of social construction of technology. The surfing community is worried about the future of the sport, but ultimately the impact that the collective social outlook has is significant and can shape how wave pools are implemented in order to better fit surfing ideals. On the contrary, this social power over the technology may just be because the technology is so new. As the technology grows and becomes integrated with professional training, according to the idea of technological momentum it is possible that wave

pool technology becomes so integral that it begins to shape the surf community itself, as opposed to the other way around. As wave parks become more widespread over time, their acceptance within the community might also increase, leading to a cultural shift away from spiritualism and toward more industrialization, consistent with technological momentum.

Another way to predict the impact this technology will have on the surf community is to analyze other sports that went through similar revolutions, such as climbing, skiing, or skydiving. These are all outdoor “lifestyle” sports which have gone through some level of “indoorisation”, where the previously exclusively outdoor activities become offered in safe, predictable and controlled indoor centers (van Bottenburg & Salome, 2010). For example, rock climbing is a sport that was considered to be extrinsically linked to the outdoors (Loynes, 1998), until indoor rock gyms were developed. When indoor gyms became available, the climbing community went through a similar debate. Since climbing was exclusively outdoors, people questioned the authenticity of indoor climbing. All the routes are pre-set by humans, losing the added challenge that outdoor faces have. Also similar to surfing, outdoor climbing is heavily influenced by counterculture and has spiritual and natural ties, both of which are absent in indoor gyms. Now that climbing gyms have been around for a while, looking at their implementation in the climbing community now is a good predictor of how wave pools will be implemented in the future of surfing. Currently, climbing gyms do not replace outdoor climbing, but are instead supplemental to it. This means that indoor gyms are popular for training, especially for those who do not live near a good natural rock face, and some competitions. However, climbers still hold the outdoor setting to a higher esteem and can be considered the ultimate goal for most climbers who train indoors. Based on this example, it is safe to assume that the future of wave pools takes a similar role for surfing. For those who do not live near the ocean or who want

training, wave pools are a great resource, but real waves will always be the proving grounds for skill, and will always maintain its role as the true surfing experience.

While the collection of academic papers used in this study paint a comprehensive picture of the current and future impacts of wave pool technology, there are still limitations to this research. Although growing, the surf community is still fairly small, so the pool of research done on the topic of surfing technology is relatively limited. A larger pool of research to pull from would increase the likelihood that all facets of the topic are studied and covered adequately. Along the same lines, the fact that wave pool technology of this caliber is so new further limits the pool of information at my disposal.

If I were to continue research on this subject, it would be beneficial to delve deeper into case studies on other lifestyle sports such as skiing, skydiving, and kayaking. The more that is understood about how these outdoor sports dealt with “indoorisation” and industrialization, the clearer the picture becomes on how the surf community will be affected. It would also be beneficial to conduct interviews on important members of the surf community to get a more accurate reading on the opinions of the community. These two additions would allow for a much more comprehensive study on the topic.

### **Conclusion:**

The lack of authenticity that wave pools have inherently diminishes the surf experience to a strictly physical one, to the point where it should not be evaluated on the same level that natural surfing is. Wave pool technology will most likely continue to develop and be used more widely, leading to significant industrialization and commercialization of the sport, but will also act as a catalyst in surf maneuver progression, bringing the top surfers to the next level. While the

possibility of this future will most likely decrease the relevancy of soul-surfers in the community as a whole, those traditional ideals will never fully go away as there will always be a subset of surfing that stays true to those roots. In the end, it is most likely that we will see artificial wave parks make a large impact on training and landlocked regions, but it will never fully replace the experience that is surfing in the ocean.

### **Works Cited:**

Alderson, A. (2015). The new wave: Are artificial waves the future of surfing? *Engineering Technology*, 10(7–8), 82–85. <https://doi.org/10.1049/et.2015.0726>

Anderson, J. (2013). *Cathedrals of the surf zone: Regulating access to a space of spirituality. Social & Cultural Geography*, 14(8), 954–972.  
<https://doi.org/10.1080/14649365.2013.845903>

Booth, D. (2013). History, Culture, Surfing: Exploring Historiographical Relationships. *Journal of Sport History*, 40(1), 3–20. <https://doi.org/10.5406/jsporthistory.40.1.3>

Colarossi, A. (n.d.). *Summary and critique of Technological Momentum by Thomas P. Hughes*. Retrieved October 26, 2021, from  
[https://www.academia.edu/1881558/Summary\\_and\\_critique\\_of\\_Technological\\_Momentum\\_by\\_Thomas\\_P\\_Hughes](https://www.academia.edu/1881558/Summary_and_critique_of_Technological_Momentum_by_Thomas_P_Hughes)

Hughes, T. P. *Technological Momentum*. (1994). Cambridge, Massachusetts. London, England. The MIT Press.

*Is Kelly Slater's artificial wave the future of surfing? - Los Angeles Times*. (n.d.). Retrieved October 24, 2021, from <https://www.latimes.com/local/california/la-me-artificial-wave-20160504-story.html>

- Kelly Slater's Lemoore Surf Ranch [2022 Update] Pricing & Insights. (n.d.). Retrieved March 20, 2022, from <https://centerforsurfresearch.org/surf-ranch/>
- Klein, H. K., & Kleinman, D. L. (2002). The Social Construction of Technology: Structural Considerations. *Science, Technology, & Human Values*, 27(1), 28–52.  
<https://doi.org/10.1177/016224390202700102>
- Loynes, C. (1998). Adventure in a Bun. *Journal of Experiential Education*, 21(1), 35–39.  
<https://doi.org/10.1177/105382599802100108>
- Pinch, T. J. (1977). What Does a Proof Do if it Does Not Prove? In E. Mendelsohn, P. Weingart, & R. Whitley (Eds.), *The Social Production of Scientific Knowledge* (pp. 171–215). Springer Netherlands. [https://doi.org/10.1007/978-94-010-1186-0\\_8](https://doi.org/10.1007/978-94-010-1186-0_8)
- Ponting, J. (2017). Simulating Nirvana: Surf parks, surfing spaces, and sustainability. In *Sustainable Surfing*. Routledge.
- Roberts, M., & Ponting, J. (2020). Waves of simulation: Arguing authenticity in an era of surfing the hyperreal. *International Review for the Sociology of Sport*, 55(2), 229–245.  
<https://doi.org/10.1177/1012690218791997>
- Rodriguez, K. (2020, August 6). Are Wave Pools Sustainable? *SURFER Magazine*.  
<https://www.surfer.com/features/are-wave-pools-sustainable/>
- Stranger, M. (1999). THE AESTHETICS OF RISK: A Study of Surfing. *International Review for the Sociology of Sport*, 34(3), 265–276. <https://doi.org/10.1177/101269099034003003>
- Surfing History and Origins of Surfing. (n.d.). Retrieved October 25, 2021, from <https://www.centralhome.com/Surfing-History.htm>



van Bottenburg, M., & Salome, L. (2010). The indoorisation of outdoor sports: An exploration of the rise of lifestyle sports in artificial settings. *Leisure Studies*, 29(2), 143–160.

<https://doi.org/10.1080/02614360903261479>

Warren, A., & Gibson, C. (2014). Chapter 6. Global Stoke: The Commercialization of Surfing. In *Surfing Places, Surfboard Makers: Craft, Creativity, and Cultural Heritage in Hawaii, California, and Australia* (pp. 174–192). University of Hawaii Press.

<https://doi.org/10.1515/9780824838294-009>