
Rising Temperatures, Rising Tensions: Climate Change and Power Transition Theory

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Rising Temperatures, Rising Tensions: Climate Change and Power Transition Theory

Abstract

Two of the biggest issues in international politics today are climate change and the ongoing power transition between the United States and China. However, very few works examine the way these issues interact with each other. This paper attempts to resolve this by integrating climate change into power transition theory (PTT), which attempts to capture the behavior of states in the midst of transition to or from global power. This paper first analyzes the literatures on the (tenuous) links between environmental degradation and interstate conflict as well as PTT. Opportunities for integration are then examined, especially focusing on climate change's impact on the central variables of power and state satisfaction. These theoretical links are then applied to the looming US-Sino transition and highlight how climate change opens up new arenas of great power competition, exacerbates tensions and impacts relative power in unpredictable ways.

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Introduction

One of the biggest issues in the contemporary global order is the possible power transition between a declining American hegemon and rising China. Power transitions are not unique in history and they have the potential to unleash massive global conflict.¹ What is unique about a potential United States-Sino transition is that it will unfold concurrently with increasing global shocks due to climate change. Climate change poses many threats—ecological, economic, sociological—including security. With the climate expected to warm between one and two degrees by midcentury, the environment is going to significantly shape how states relate to one another.²

The goal of this article is to make an initial foray into understanding how climate change may impact power transitions, especially a possible United States-Sino transition. This article focuses on building and expanding theory, primarily power transition theory (PTT). Given the uncertainties about climate change, it is difficult to make definitive statements about what exactly will unfold. As a result, this article cannot make concrete predictions at this point. Rather, this article aims to identify and draw attention to the ways that climate change impacts the central variables of PTT—power and state satisfaction—in the hopes that as climate models improve with more data, theories that rely on these variables are better able to anticipate and explain great power transitions in an era defined by climate change.

By doing so, this article hopes to impact existing theory in three ways. First, it is an initial foray in merging the growing body of environmental security literature with existent theories of international conflict, especially great power conflict. Second, it augments PTT's explanatory and predictive power about a coming transition between China and the United States. No previous great power transition occurred during such a prolonged period of significant environmental change. By folding climate change into the calculus of transitions, PTT becomes better able to explain contemporary events. Finally, this article helps bridge a gap between earth science and political science. There is a growing call from those in the hard climate sciences for social science to study the political and social ramifications of climate change and attempts to mitigate its effects.³

External and global forces are already having a profound impact on state power and capabilities. For the last two years states have had to

grapple with COVID-19 and its numerous consequences. The virus has spawned economic crises due to global supply chains stretching to the breaking point; countries are reeling to recoup losses from locked down economies and significant increases in social spending and international ties are straining due to vaccine nationalism. Should the predictions about climate change come true, the crises of COVID-19 may be but a small harbinger of global shocks to come.⁴

Climate change will profoundly shape any transition between the United States and China because it has the potential to significantly influence the two variables central to PTT: power and state satisfaction. Though power remains a difficult concept to operationalize, contemporary measures utilize some amalgam of material military capabilities, economic strength, and demographics.⁵ Climate change will substantially impact these factors by stunting a state's economic growth, slowing its eventual rise to prominence, and by threatening critical civilian, economic and/or military infrastructure and facilities. Furthermore, states may attempt geoengineering projects to mitigate the impacts of climate change in their region at the expense of possibly deleterious effects in other states, making climate modification a new arena of great power competition. Climate change may also alter a state's satisfaction with the status quo, primarily by opening new areas, sea lanes and resource deposits, prompting new negotiations over their exploitation.⁶ These new resources, coupled with the potential rising costs of food, water and energy resources, may make it prohibitively expensive for the exiting status quo power to continue to provide goods to its allies, thus influencing their satisfaction.

This article begins by reviewing the literature on PTT, with a special focus on its main variables of interest: power and satisfaction. The literature on the relationship between climate change and conflict are also briefly examined. The next section then outlines ways that climate change may impact the central variables of PTT, with examples drawn from contemporary China, United States, and other locales. A look at possible avenues for future research and theory-building concludes.

Power Transition Theory and Environmental Security

First outlined by Organski, PTT shares many of the common assumptions of neo-realism: the international system is anarchic, states are the primary actors and power is the predominant force in international relations.⁷ At both the global and regional level, states are

organized into numerous hierarchies based upon their material, industrial, economic, and military capabilities as well as their satisfaction, or level of contentment with the existing global system. At the apex is the dominant status quo state, which creates a global system in its own image, spreading values and institutions to maintain the system. The next tier of major powers is mostly satisfied with this system as well, either by virtue of being allies with the dominant power or wooed by the goods provided by the dominant state—namely shared defense, economic benefits through trade, and shared values and diplomatic expectations.⁸ Over time, a rising challenger emerges which may threaten the existing status quo. These challengers rise due to their rapid economic, industrial and/or military development. They are dissatisfied because they did not play a significant role in the crafting of the existing order and now, with their newfound power, want to either make changes to the system or create a new one in their own image. Examples of such challengers include Wilhelmine Germany, post-Meiji Japan and the Third Reich, and their attempts to alter the existing structure resulted in two World Wars.

Conflicts between the rising challengers and the status quo bloc are especially likely if the dominant status quo state believes (rightly or wrongly) that its power is waning and that the revisionist bloc will soon eclipse it. When this occurs, the status quo state has two options: either find a way to incorporate the revisionist state into the existing system (if possible) or fight a preventative war before the revisionist bloc becomes too powerful. Revisionist states also feel pressure to engage in conflict, either out of a fear that their own rise may soon peak or concerns that the dominant state will pre-emptively attack.

In most PTT works, a state's power is often operationalized as some amalgam of its economic, military, demographic and/or resource capabilities, with the National Material Capabilities (NMC) dataset and Gross Domestic Product being the most popular measures.⁹ For PTT the relative power between the states in transition is essential. Organski and Kugler argue power transitions begin when the dissatisfied challenger is at 80 percent of the dominant state's power, and the transition is only over once the challenger's power is 120 percent of the dominant status quo state.¹⁰

Power transition theory's relevance today is seen most clearly in the relationship between the United States and China. China's meteoric rise in economic, industrial and military power spawned a cottage

industry of scholars attempting to discern if China is satisfied with the status quo or not.¹¹ Though these articles come to a wide range of conclusions from China being satisfied to China seeking global domination, the recent consensus in the literature views China as a revisionist power seeking regional hegemony in East Asia.¹² As a result, China and the United States may not be locked in a struggle for global supremacy but the odds of a more localized conflict in East Asia remain high. The question about China's satisfaction is more than mere academic concern; it has real implications for U.S. foreign policy and global stability. If China is a dissatisfied state, even on a regional level, then it is a quintessential example of the rising challenger about which PTT cautions. Rather, if it is a satisfied state, it could be a potential stakeholder to help the United States maintain the global system.

Like other systemic realist theories, PTT treats the physical global environment as static—a flat, unchanging billiard table on which the balls of states careen into each other.¹³ What matters is the difference in size of those billiard balls (their state power) and for PTT whether they are striped or solid (revisionist or status quo). State power and satisfaction fluctuates due to domestic capabilities and interactions with other states. The theory ignores the table itself as it has no impact on these characteristics. However, such assumptions create a blind spot for PTT and other neorealist theories. The physical environment—the table in this metaphor—will exert exogenous influence on both the power and satisfaction of states, something the theory currently fails to account for. It is therefore important to understand how climate change might alter and inform the assumptions and core tenets of PTT without overly burdening the theory. Doing so will also help another area of research, the growing field of environmental security.

Building from the foundational work of Thomas Homer-Dixon, works in environmental security examine the linkage between environmental degradation and international conflict.¹⁴ Though most of these works reside within comparative politics and examine domestic outbreaks of violence and civil war, or look back at history to examine linkages, other works attempt to identify prospective pathways between climate change and international conflict.¹⁵ The findings are mixed. In general, there is yet no direct, causal relationship between climate change and international conflict.¹⁶ However, when environmental factors interact with other variables, such as economic growth, regime type, demographic changes or shared rivers, then international conflict may emerge.¹⁷ Triggering events like famine, precipitation anomalies or

extreme weather events may also increase the chances of international conflict by imposing pressures on states.¹⁸ These pressures are more acute when basic resources like water and food are in short supply.¹⁹ It is worth stressing though that these linkages so far are speculative in that no international conflict has yet emerged solely due to environmental pressures. However, given the rising number of environmental pressures and disasters and the already numerous civil conflicts caused or exacerbated by climate issues, it is reasonable to assume that such international conflicts are a matter of when, not if.²⁰

Despite the earlier work of Homer-Dixon, contemporary work merging the climate security literature with realist theory is sparse, leading to some to call for a better incorporation of climate change into security concerns.²¹ There are opportunities for the environmental security literature to inform the assumptions and variables of PTT. Such an exercise benefits both areas. It would increase PTT's explanatory potential for the contemporary world. Environmental security, on the other hand, gains the ability to explain how environmental pressures could lead to great power conflict, something which is currently underdefined.

Climate Change and Power Transition Theory

Power transition theory rests upon the twin pillars of power and satisfaction. Climate change will exogenously influence both variables in important ways. Rising seas, changing crop patterns, natural disasters and other environmental challenges put a significant strain on a state's economic, logistical, and military infrastructure, creating both short-term and long-term relative power fluctuations. Furthermore, technology is rapidly approaching the point where individual states can engage in cheap, feasible forms of geoengineering. This is a new arena of competition and power, where one state's efforts to control the climate or mitigate warming could cause deleterious effects in other areas. Climate change holds the potential to also alter a state's satisfaction. States seemingly content with their allotment of goods, such as territory and resources, may reconsider their support for the status quo if climate change degrades these goods, or if the hegemon is no longer able to maintain the integrity of these goods due to climactic pressures, such as rising costs or disasters. The changing climate will also require renegotiating existing institutions and treaties that regulate common resource areas, a process that may get contentious.

Climate Change and Power

Power transition theory operationalizes power by looking at the state's NMC score or GDP, though the efficacy of these measures is a continual source of debate.²² A state's NMC score is based upon its total population, economy, military strength, and industrial capacity. Climate change's effects can quickly and adversely affect these capacities and thus ability to utilize them to project power. Studies show that higher temperatures detrimentally impact a state's GDP through many channels, such as decreased agricultural output, poorer worker health and slower investment.²³ Natural catastrophes or a series of natural disasters could overleverage the insurance markets of states, triggering a financial collapse similar to the 2008 global recession and cripple a state's economy.²⁴ Climate change's impacts are predicted to lower global GDP by more than 7 percent by 2100, with the bulk of that decline being felt in developing states, though even the United States and Europe will experience detrimental effects.²⁵

The costs of environmental damage and natural disasters are increasing and billion-dollar disasters are becoming more common.²⁶ Longer-term threats like sea-level rise, drought, famine, and crop loss will put tremendous pressure on states, impacting economic development. States facing immediate crises related to food, water, shelter, and other basic needs will not have as much to spend on their military, or their military will be too focused on internal recovery, rescue, and resettlement programs to counter international threats. By stifling economic growth, straining infrastructure, and diverting resources away from the military, both short-term and long-term climate change impacts can significantly affect a state's power.

States are not equally vulnerable to climate change. States with more economic resources, more responsive governments and better existing infrastructure may adapt quicker to emerging climate threats. Those with abundant land and resources, especially water and food, may better weather climate change. For the United States, the main challenges climate change poses are sea-level rise, eventual decrease in crop production due to extreme temperatures and localized water shortages.²⁷ Economically, climate change projects to cause trillions of dollars' worth of damage to infrastructure and housing. For example, sea level rise alone will cause anywhere between \$1 trillion and \$3.5 trillion in damages to coastal property by the end of the century.²⁸ In this new world, the United States must provide for its domestic base

and respond to disasters in its heartland while also continuing to maintain a global system of free trade and delivery of resources like security guarantees, cheap goods, and international leadership. The United States may have the resources to deal with the former, but ignoring the latter means essentially ceding its role as a global leader.

China is already facing environmental challenges due to its crash program of industrial development. Smog chokes numerous urban centers on a consistent basis, resulting in shortened life spans and an increase in asthma and other respiratory illnesses.²⁹ Of larger concern is the water supply of China. Due to pollution, irrigation, industrialization and urbanization, China currently experiences water stress as defined by the United Nations.³⁰ What water there is heavily polluted, with more than 140 million Chinese lacking access to drinkable water and most China's river basins containing water unfit for human consumption.³¹ Due to rising populations and lower availability of water, China's water demand will exceed its supply by 25 percent by 2030.³²

The water crisis manifests in different ways across China.³³ In southern China, floods and pollution run-off pose the biggest threats. In the Pearl River region, home to Hong Kong, Shenzhen, Macao and other urban centers that account for roughly 10 percent of China's GDP, climate change is expected to significantly increase the occurrence of major river flooding, tidal flooding and severe typhoons.³⁴ Farms and cities in northern China, which produces the vast majority of China's agriculture, suffer from droughts and water shortages, raising concerns about the country's food security.³⁵ To address this spatial disparity, China employed megaprojects like the Three Gorges Dam and the South-North Water Transfer project, though even these massive projects will not solve China's water issues in the long-term.³⁶ China recently announced plans for a massive dam along the Brahmaputra River which flows from Tibet into India.³⁷ This raised tensions with India, which fears decreased flows into their own country due to the dam or possible future projects that transfer the water into northern China.³⁸ Furthermore, increasing temperatures will diminish rice production, pushing more rural Chinese to the already overtaxed urban centers in search of jobs and food.³⁹ Coupled with demographic challenges, increasing debt burden and the impact of the COVID-19 pandemic, these environmental pressures are a significant reason why some believe China's economic, industrial and military ascendancy has stalled.⁴⁰

Climate change does not just impose economic costs. It potentially degrades and destroys a state's military infrastructure, logistical channels and exerts pressure on overseas commitments. This is especially true of a state with global reach like the United States. In the Eastern Pacific alone the U.S. Department of Defense has more than 40,000 buildings on more than 1,400 square miles, with an estimated replacement cost of \$180 billion.⁴¹ These sites are increasingly vulnerable to sea level rise, storm surge, drought, wildfire and melting permafrost. Among the vulnerable facilities include the essential airbases and logistical hubs of Diego Garcia and Guam, as well as the missile defense base on Kwajalein Atoll.⁴² However, the Department of Defense is not budgeting for these impacts in their base planning, even though these threats are already presenting. This significantly raises costs for base repair and replacement and could lead to the loss of some bases completely.⁴³

Climate change challenges not just overseas U.S. bases and infrastructure. Domestic bases face similar threats. A recent Department of Defense report found that that half of America's domestic bases are vulnerable to climate change, primarily in the form of drought, flooding, severe storms, wildfires, melting permafrost and other effects.⁴⁴ These events will cause loss of buildings, limited training days, recurrent flooding and destroyed base infrastructure. For example, in October 2018 Hurricane Michael hit Tyndall Air Force Base with Category 4 winds. The base is home to one of the U.S. Air Force's (USAF) precious few F-22 squadrons. Seventeen of the state-of-the-art aircraft, almost ten percent of the entire F-22 fleet, was undergoing maintenance on the base and could not fly out before the storm hit. The storm significantly damaged the hangars holding the aircraft, causing roofs to collapse and dropping debris onto them. Fortunately for the USAF, they repaired all seventeen aircraft and brought them back into service. If the storm destroyed all the jets, it would be the single largest loss of American aircraft since the Vietnam War and would decimate America's stealth fighter fleet. As of 2021, Tyndall Air Force Base is still undergoing costly repairs and may not be fully mission ready until the mid-2020s.⁴⁵

Great powers like the United States or China may try to mitigate these threats to their power by engaging in geoengineering projects. Dozens of proposals exist for different types of geoengineering strategies, from mirrors in space to cloud seeding.⁴⁶ The most feasible and off-the-shelf

ready strategy is solar radiation management (SRM) which involves dispersing significant amounts of cooling or reflective agents into the stratosphere, usually from aircraft, with the goal of radiating heat back out into space, cooling the region it covers.⁴⁷ This may help a state keep a region or even its whole territory somewhat cooler, but it is unknown if such an action would then cause more rain or hotter weather or extreme events in neighboring countries or even halfway around the world.⁴⁸

Solar radiation management requires only a simple modification to military or civilian aircraft and is within the realm of capabilities of most states as well as wealthy and technically proficient nonstate actors or even individuals.⁴⁹ As a result, a lone actor can unilaterally embark on these projects with little or no cooperation with other states. None of these proposals have yet to move off the drawing board at a large scale, but as the climate changes and states try to address the consequences, geoengineering may quickly become a booming industry. This is especially problematic because most geoengineering strategies are thus far merely theoretical, and the larger, global ramifications of these practices are little understood.

If SRM or other geoengineering strategies prove to be cheap, technologically feasible and effective in locally mitigating the worst effects of climate change, it is not too much of a leap to assume states will employ these tools offensively. Or, alternatively, if one state sets a cooling goal at a certain temperature but another state wants to nullify those efforts or has a different temperature goal in mind, they can engage in counter geoengineering. For example, if a state uses SRM to cool the world or region to a certain degree, another state could launch their own fleet of aircraft to flood the air with chemicals or other particles that offset the actions of the original state.⁵⁰ This could create a tug of war between states over what the proper degree of warming should be.⁵¹ New realms of power competition can profoundly change the nature of state relationships and offer another avenue for rising challengers to seek supremacy. One need only to look at Russia, China, Iran, or North Korea's development of offensive weapons in the realm of cyberwarfare to see these forces at work. Geoengineering could quickly become another such arena, triggering another arms race, and creating another realm for conflict and escalation.

China is already embarking on smaller-scale geoengineering projects, including efforts on the Tibetan plateau in to increase rainfall in the

region and testing artificial upwelling of deep ocean water to increase the ocean's CO₂ absorption.⁵² Given China's history of massive infrastructure projects, from the Three Gorges Dam to the Belt and Road Initiative (BRI), geoengineering is a logical extension of current patterns.⁵³ However, going this route would be hugely disruptive and problematic for China or any state. First, no state has ever attempted geoengineering on such a scale, and its impacts on both the immediate surrounding area and broader global climate are unknown. Second, if a state goes down this path it may spark a global arms race in geoengineering techniques and expertise in which the powerful states protect their own citizens and may even seek to engage in offensive geoengineering. Or, if another state believes that its relative power would benefit from a warmer world, it may engage in counter-geoengineering, turning the stratosphere into a battleground of aerosols and chemicals. Thus, while the temptation may be especially acute for states most at risk of food insecurity, water stress or sea level rise to engage in these kinds of projects, committing to them opens a whole new, unexplored arena of great power conflict.

Climate change threatens the economic and military aspects of state power, even among the great powers. While the impacts so far are relatively localized and small, costs will increase in the future.⁵⁴ What remains unknown is the level of relative impacts across states. In PTT, state power fluctuates due to domestic capabilities of generating wealth and power or success or defeat on the battlefield. Power transition theory needs to expand and adapt to better incorporate exogenous forces' ability to profoundly alter relative power dynamics in the global system.

Climate Change and State Satisfaction

While climate change will alter state power, its effects will spur states to reconsider their stance vis a vis the status quo. States that once supported the status quo division of territories, resources and other goods may reconsider their position if those goods become scarcer or new partitions are necessary. Competition over common resource areas like watersheds, rivers, fishing grounds and forests may increase, upending existing agreements and causing states to re-examine their contentment with the status quo.⁵⁵ Climate change is also making areas that were once geopolitically or economically worthless, such as the Arctic, into desirable and contested regions.

Increasing warmth has dramatically limited the extent and presence of sea ice in the Arctic, opening new sea-lanes and making hitherto-unreachable mineral and oil deposits accessible.⁵⁶ As a result, the area is a hotbed of activity, as Norway, Canada, Russia, and other countries all vie for control.⁵⁷ The changes to the Arctic are already causing both China and the United States to re-evaluate their position in the region. The economic and resource potential of the region has risen significantly in recent years. A northern sea lane will decrease the travel time for ships from the east coast of China to the United States and Europe and put less reliance on the chokepoint in the Strait of Malacca.⁵⁸ China lacks a direct coastline with the Arctic Ocean and as a result has only an observer status in the existing treaty regime. In 2018 China released its Arctic Policy in which it proclaimed itself a near Arctic state, a term that has no legal meaning but hints at China's desire to have more of a say. The Arctic Policy continues by calling for equal access for research, collaboration by "all stakeholders—including states from both inside and outside the Arctic" and the possibility of a multinationally-backed "Polar Silk Road."⁵⁹ To pursue these aims, China is expanding its icebreaking fleet, deploying numerous research teams to the region and investing heavily in international infrastructure projects.⁶⁰ These moves and others signal that China is clearly not satisfied with its current place in Arctic relations and wants to exert more influence in an increasingly valuable region.

Given these realities, the U.S. Department of Defense's Arctic Policy in 2019 clearly outlines the risks in the region and the need for more money and resources to deal with infrastructure loss as well as counter growing Chinese and Russian forces. The Arctic Policy states the United States "does not recognize any other claims to Arctic status by any state" other than the eight states with immediate coastlines on the Arctic Ocean.⁶¹ It further clarifies that "despite China's claim of being a 'Near Arctic State,' the United States does not recognize any such status."⁶² The report outlines that one of the main goals of the United States should be to counter Chinese influence, not let them get a foothold or expand its pattern of global "predatory economic behavior."⁶³ The Arctic is therefore "vulnerable to 'strategic spillover' from tensions competition or conflict" between rivals.⁶⁴

The Arctic example highlights how climate change is altering the priorities and satisfaction of a state. Now that the world is warming and sea ice is retreating, the region has tremendous economic and resource potential, especially for states that rely on overseas exports and

shipping. Given this rise in the value of the Arctic, China is no longer content to be a mere bystander in the governance and access to the area and wants to have more influence. This raises suspicions and concerns from the stakeholders of the existing status quo. With the United States refusing to recognize Chinese attempts at expansion in the Arctic, tensions between the states will continue for the near future. Should other areas become more valuable because of a changing climate—such as more fertile farmland, new waterways and coastlines, a decline in impenetrable foliage—then these forces will likely play out again, further ratcheting up United States-Sino tensions.

Geoengineering could also play a role in changing (or responding to) state satisfaction. If a state or group of states engages in geoengineering to keep the globe at a certain temperature, it will trigger a global debate over what temperature to set the thermostat. Furthermore, since geoengineering's effects are so little understood, it is not hard to imagine blame falling on the geoengineering state for every meteorological disaster or negative effect of climate change. For example, any disruption to the monsoon that India and Pakistan rely upon will trigger significant anger from those states, and another state's geoengineering project could be the culprit.⁶⁵ The state or group of states engaging in geoengineering thus risks becoming a scapegoat for every hurricane, drought, famine, shift in rainfall and other disaster. If these outcomes are severe enough, it may result in a suffering state significantly reconsidering its priorities and satisfaction with the status quo.

States may also face immediate or long-term existential threats that profoundly alter their outlook on the world. A status quo state may find itself dissatisfied due to barren lands, inundated coastlines, or starving people. China's water crisis is especially salient here. An increasingly thirsty China may embark on risky and provocative measures to quench its people, possibly resulting in further tensions with India or seeking claims on the abundant water resources of eastern Siberia. As more states begin to grapple with the deleterious impacts of climate change, the dominant status quo state and its fellow maintainers will need to keep its partners content by helping shoulder the burden of recovery. This may prove prohibitively expensive, as the dominant state itself deals with its own issues or the sheer quantity of impacts makes it impossible to adequately respond to all of them.

For the dominant status quo state, climate change raises the costs of maintaining the system. This dominant state creates and defends the international system, but PTT assumes this system rooted in unchanging geophysical foundation. As the climate changes the face of the Earth, that foundation begins to crack, putting tremendous pressure on the system overall and the states in charge of maintaining it. The global military commitments necessary to project power increase the hegemon's vulnerability to climactic shocks. The existing distribution of goods may need a complete overhaul. The relative power of allies may fluctuate or degrade significantly in the face of climate-driven disasters. Economic, military and/or humanitarian aid may require massive outlays. In short, rising sea levels, melting polar caps, refugee movements, increasing tempo of natural disasters and debates over GHG emission levels all make it more difficult for the dominant status quo state to hold the system together.

Conclusion

Climate change is already exerting pressure on the economic and military power of states and changing the calculus of state satisfaction, even for great powers. This article seeks to expand theory by highlighting PTT's need to recognize these developments and incorporate climate change as a critical exogenous force to better explain the contemporary world, especially a possible United States-Sino transition. Continual improvement of models and projections for climate change should spur a re-examination and assessment of the arguments made in this article, as well as neo-realist theories of great power politics in general.

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