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Saving the World, One Effect at a Time

About Quiet Chernobyl

Quiet Chernobyl: The Aral Sea is the thesis project of me, Stephen G. Tucker, which I created in my final year of college. It began as a rebellious attempt to create a Digital Visual Effects film while enrolled in a curriculum designed for classically trained character animators. Before any other sort of concept had been developed, I decided flat out: there would be no characters in this film.

I originally had no other concept to work with, just that I knew I would be making a short, and that I wanted an absence of characters. I turned to a book that I have, which is a dictionary of quotes... it is a rather massive book, but I thumbed through the pages until I found one that caught my eye, a quote by Ovid that reads: "The drop of rain maketh a hole in stone, not by violence, but by oft falling." This simple phrase really stuck out in my mind for some reason and so I decided that I would make a film that had to do with water, the passing of time, and cause/effect relationships.

One week later, I remembered a paper I had written back in high school on an often overlooked topic called, the Aral Sea. I grew excited as I realized that it would be perfect for my short and so immediately began searching for music I felt would represent the mood of my film. After sampling some really atmospheric stuff, I began boarding, and in no time at all I had a finished leica reel that was ready to go. Or so I thought.

I couldn't seem to find the motivation to go any further than my leica. It was done, really early into the semester, and I felt it worked. I began the R&D phase since I felt that this would be the final product. It was reasonably abstract, but I felt that the symbolism would all ring clear for anyone that knew the topic... but the more I looked at it, there was just something about it that wasn't working. As I showed the rough work to people, I began to realize that no one else was getting it. Finally it dawned on me that it was too interpretive. I was spending too much time explaining my ideas to people. I then decided that if it took more time to supply background information so that the audience could enjoy the short, then to actually watch it, I needed to re-board it.

I developed narration, and then chose new music and started back at square one. I re-boarded the film and kept in mind that I needed it to be clear and concise. I feel that I've done this now. When I finished the new leica, I once again entered the R&D phase and tried to figure out what would be necessary to complete production of the film. I ended up using Maya, Houdini, and the Terragen 2 Technology Preview, as well as Adobe After Effects, Premiere, and Photoshop during the production. Nine weeks of production later, and I've got a completed film!

I hope that you find my film to be entertaining and this documentation, enlightening. For more in depth information about the Aral Sea, please continue to read the below paper which I wrote after the completion of my film. The Aral Sea is a serious topic, which demands more attention than it currently receives.

- Stephen G. Tucker

2007-04-20

Nature's Mistake

Imagine a place full of rich alluvial valleys that are home to more than 70 kinds of mammals, and more than 379 kinds of birds. These valleys abound with apples, apricots, grapes, melons, pistachios, rice, walnuts, and wheat. Imagine that this region is believed to be the birthplace of irrigation and that for close to ten thousand years, millions have thrived in this region trading animal pelts, cotton, silk, and wool. Imagine that the industry that began in this region became so great that it opened an age of enlightenment and trade so wide spread, that it connected China and Britain during the middle ages and became a major hub for Islamic culture. Now, try to imagine what kind of impact removing a body of water approximately the size of Costa Rica would have on such a region. The reality is that this is not a hypothetical situation, and that one can get a perspective on such poor water management by turning to one of the greatest environmental disasters in recorded history, the Aral Sea in Central Asia. Unfortunately it looks as though while this is a human-caused catastrophe which has taken less than a century to unfold, nothing will be done to prevent the loss of what was formerly the world's fourth largest sea.

The Aral Sea basin is not quite as unfamiliar with war as the above may have lead you to believe. Of course when a region is plentiful, there will always be those who wish to get their hands on the riches. Alexander the Great waged war in the region in 329 BCE. Islamic armies then forced their way in around 700 CE, only to once again be conquered in 1220 by Genghis Khan. The region was again thrown into turmoil in the mid 19th century until it finally fell to the Russians. This fluctuation between turmoil and

peace is not remarkably dissimilar any other region's history; however the 20th century held new things in store for Central Asia.

Ferguson (2003) describes that shortly into World War I, the tsar had requisitioned men, cattle, cotton and food for the war. When Central Asia attempted to revolt, they were quenched and Moscow transformed the region into collectivized farms (20). Those in charge felt that the sea's very existence was evidence of their lack of efficiency in utilizing available resources, and plans were made to transform the region into rich fields of nothing but cotton. Collectivized agriculture left no elbow space for the farmers, and so an area which once was able to sustain itself on local fruit and vegetables now grew nothing but cotton. Farmers were forced to import food from Russia to survive. While certainly unsettling for residents of the region to change their way of life, the change did not make things unbearable. Canals were dug, crops were grown, the fishing industry continued, and the region brought in millions of Rubles from their deals with Moscow. The situation never became truly drastic until the Cold War, or as the Soviets called it, "The Tournament of Shadows."

The Cold War brought new regulations and a new state of mind to the people of Central Asia. Despite the millions of hectares of cotton already in production for [amongst other things] the Red Army, the Cold War demanded even *more* production. More and more canals were dug to feed the fields of white gold, and more land was being ploughed to create new crops, however old crops were not being rotated. Year after year, when the same crops are grown they begin to rape the soil of their nutrients and kill the fertility of the soil, combined with the constant flooding of the fields resulted in devastating effects. Ferguson (2003) points out that almost as fast as new lands were

opened up, older arable lands were being lost (24). In fact, two million hectares of fertile lands disappeared as a result of over-watering (State of environment, 2000).

During the Tournament of Shadows, Moscow had little concern for the region, and ultimately wanted nothing more than to show up the West as the world's greatest producer of cotton. This did not rest well with Central Asia and so in a time when East and West began their devious cloak and dagger battles of one-up-manship, the East was also forced to operate this way when dealing with its own government. In an interview with Antelava (2007) Nazhbagin Musabaev, the governor of the Aralsk mentions that in the late 60's the Soviet government held a plenary session in the Uzbek capital Tashkent. At this session, the Deputy Minister of Irrigation and Water Resources of the USSR spoke of new plans to divert even more water from the Amu Darya and Syr Darya [the two contributors of water to the Aral Sea] to grow yet more cotton in Kazakhstan and Uzbekistan. When questioned about how this would affect the Aral, the deputy minister responded "The Aral will have to die off gracefully." (Dam project aims, 2007). This sparked a brand new version of the Great Game.

Production continued, and the Union of Soviet Socialist Republics did indeed become the world's largest producer of cotton. Ferguson (2003), mentions that in 1975, when production peaked; it became impossible to grow any more cotton in the basin as all the available land was in production (26). This over-harvesting came at a cost however: NASA's Earth Observatory describes that as recently as 1965, the Sea received 50 km³ of water per year, yet by the early 1980's this number fell to 0" (New images, 2000). Lack of incoming water meant that the sea began to evaporate. This brought the shoreline further and further from the fishing harbours leaving some, such as Moynak and

Aralsk, more than 100 km from the sea. Fishing ships were abandoned to rust in the newly created desert and the fishing industry which employed over 60,000 came to an end (not that the ability to get boats to and from port was the largest problem). As the sea evaporated, it became increasingly saline. Jones (2003) points out that in fact, the salinity has increased ten times, becoming 2.4 times as salty as the ocean. This, of course, brought the annihilation of the 24 species of fish inhabiting the Aral Sea.

So how exactly is this, a new Great Game? Well, the reality is that while the region certainly could do little but move forward with Moscow's plans for irrigation, it was no where near as proficient with it production as Moscow was lead to believe. Ellis (1990) mentions that:

Eventually some Uzbeks and Moscow officials became involved in a scam to inflate production figures and divert government payments for recorded, but non-existent cotton. One such official, Yuri M. Churbanov is in prison for having accepted more than \$1 million in bribes (81).

Ferguson (2003) adds that The Soviets fired thousands of officials, but the ringleader, Sharaf Rashidov, was never charged and to date is considered an Uzbek national hero (27).

It was not until Mikhail Gorbachev began his policies of glasnost and perestroika that the international public became aware of this regional problem affecting 35 million people. The international community was aghast at the damage that had been wreaked in a mere twenty years. The devastation was compared by many to a Quiet Chernobyl. The

Soviet Union invited the World Bank and the United Nations to find a solution, but by then it was too late. Ferguson (2003) states:

In '91, Supreme Soviet passed a resolution outlining a plan to reclaim the Aral land, but it was never carried out. Weeks later the Soviet Union was history and Central Asia, unexpectedly sovereign. Russia backed away and shirked any responsibility (30). Almost broke and desperate to bring in hard currency, the five states turned to cotton, their biggest export and demanded even more production despite expert's warnings (32).

With the collapse of the Soviet Union, the Aral Sea basin now consists of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. Each nation of course has their own government, trade, international policies, but all are reliant on the waters from the Amu Darya and the Syr Darya and all are intertwined in the Aral Sea catastrophe. To paint a picture of the region, in 1960, the Aral Sea was had a surface area of 68,000 km². By 2004, the Aral Sea had lost approximately 51,000 km² from the surface [approximately 900km³ of its volume] and for the most part was replaced with a human-made desert known now as the Aralkum. In 1987 the Aral Sea split into two separate identities: Bolshoi Aral [the larger, southern sea] and Maly Aral [the smaller, northern sea]. Bolshoi Aral is now dangerously close to splitting into a Western and Eastern sea. With the lack of the moderating effects of the water, summers are hotter and winters are colder. Climate changes have reduced vegetative season to 170 days, air moisture has been reduced by 10%, and productivity has decreased by half in the past 5-

10 years (State of environment, 2000). Exposed salt from the former seabed, human waste, and toxic chemicals used as pesticides / defoliants have contaminated the soil to the point where almost nothing except cotton or rice will grow. The dust has also contaminated the very air due to the fierce dust storms that are native to the region. Despite maps in Edwards' (1998) article that indicate the water ways have been polluted due to Cold War detonation of nuclear weaponry and the testing of biological weaponry (81), it is the pesticide laden salts which are blown about and crest the once fertile soil like snow banks in winter, which are believed to be the to the leading cause of health problems in the region. The region now has the highest rate of child mortality (7.5%) in the former USSR (State of environment, 2000). There are extremely high levels of tuberculosis, infections and parasites, typhus, hepatitis, and paratyphoid, not to mention the increasing rates of anaemia, dysfunction of the thyroid – blood, heart, lung, and liver disease, asthma, blindness, and cancer. According to Fipps (2002) some estimate that in Karakalpakstan, the region immediately south of the sea, 70-90% of the population suffer from some form of environmentally induced malady (4). The best part is that:

The Aral Sea is located along a powerful air stream running west to east. This means that the same toxic dust believed to be causing these problems have also been found on Greenland's glaciers, in Norway's forests, Byelorussia's fields and in the blood of penguins in the Antarctic (State of environment, 2000).

Ellis (1990) adds that an estimated 43 million tons of salty grit is whipped up from the dry seabed each year (88). Further depletion of the Aral Sea means that problems will only intensify if unresolved. Fortunately there are some who acknowledge this and have been making strides toward action.

The Global Environment Facility has helped to fund the Aral Sea project and left it under the supervision of the World Bank. Unfortunately Ferguson's book "The Devil and the Disappearing Sea" illustrates a Central Asian political game where a Cold War attitude leaves little room for progress. The same Central Asian mindset that convinced Moscow to pay millions for non-existent cotton continues today in an embarrassing match of "you-scratch-my-back-I'll-take-your-money" where those with the power to make a difference seemingly refuse to act. If it is any consolation however; there has been progress at restoring Maly Aral.

In 1991, the Kazakh government received a loan which they used to build a dam that would separate the Maly Aral and Bolshoi Aral. Antelava (2007) writes:

The south is still shrinking, but in Kazakhstan, officials say 40% of the sea has returned. Communities in the area are already feeling the impact. The fishermen are back in their boats [due to the introduction of saltwater fish into the habitat], the clouds and rain have returned, and many feel the future is no longer so hopeless (Kazakhs get loan, 2007).

Aralsk, a former fishing port which before the construction of the dam had been estranged from the sea by over 100 km, is now back within 25 km of the sea (Miraculous

catch, 2006). Kazakhstan has also just been permitted a new \$126 million loan that will be used to build a second dam. This means that the sea can be expected to return to Aralsk as early as 2010, but what lies in store for Bolshoi Aral? The way it looks at the moment, Ellis' (1990) "worst-case" scenario that the Aral will shrink into two lakes, each 4-5 times more saline than the ocean is not too far from the truth (92).

Obviously, the major problem with the Sea's desecration is the poor water management. One recommendation for solving the Aral dilemma would be that Kyrgyzstan, with only 7% of its land arable in the first place could help to reduce water waste if it were to charge the other countries for access to the water which flows from its mountains to the seas. Western perspective may make this seem like a great remedy; however things are never so simple. Ferguson (2003) explains that:

The Kyrgyz hydroelectric power station can generate 10 billion kilowatt hours a year, yet each winter the Kyrgyz are forced to hoard water and leave the turbines idling, creating country-wide blackouts. They are obliged to open their sluices in the summer to provide water for the other countries' cotton crops (86).

This is because they signed agreements which will keep trade open with the other countries for gas and oil. Local politics make it so that it is perfectly reasonable for Uzbekistan, Kazakhstan and Turkmenistan to leave the Kyrgyz broke as they demand hard currency for their trade; however the region is heavily Muslim and there is strong belief that no one has the right to control access to *water* as it is a gift from Allah. There is already tremendous stress between the nations over water, and there would be

dangerous backlash if the Kyrgyz were to attempt to restrict water to the downstream nations.

So how about the other nations, could they do anything to conserve water? For a region with such a huge water shortage, the inhabitants sure love to waste it. The way the irrigation canals are set-up, it is estimated that more than half of the water goes to waste. Kamalov (2003) points out that:

There is a total flow of 2222 m³ per capita per year. This is greater than anywhere else in the world. Israel has 1/7 m³ per capita. It would be more logical to install drip irrigation and other technologies in the two Daryas. Covering canals could increase water supply by half immediately (The Aral Sea, 2003).

In fact, Israeli engineers have been experimenting on an Uzbek cotton farm, where they claim that they had increased yield by forty percent, while reducing water consumption by two-thirds (Aral Sea loss, 1995). So what is the problem? If replacing irrigation pathways has proven to make such a drastic difference, why has so little been done? Ferguson (2003) mentions that the states spend on average less than \$10 US a hectare on maintenance, a drop of \$15 from what the Soviets spent (50). These are some of the poorest nations of the former Soviet Union, and there is little incentive for farmers to spend money on improving their methods. In Uzbekistan, the government buys cotton from the farmers at a very low price so that they can sell it globally. The farmers are unable to sell their product to anyone else, and so have little to splurge on such things as rebuilding infrastructure.

Due to the government's cotton monopoly, many Uzbek farmers have tried to switch to growing rice as a way to bring in more income. The switch to rice has increased water consumption almost five times. Seeing as cotton is Uzbekistan's sole agricultural export [and makes up more than 40% of its net product], the government is not pleased with this and so has instated an obligation for each farmer to grow a mandatory minimum quantity of cotton. It would be in the Sea's best interest for the Uzbek government to eliminate its monopoly. With open trade, farmers could earn fair prices for their cotton; they would be less reliant on the even heavier consumer of water, rice, and could have more money with which to upgrade their irrigation infrastructure. The governments have no room for such manoeuvres however, for as Kamalov (2003) puts it, both the Uzbek or Turkmen governments feel the water will "uselessly" flow to the Aral and there will be no profit (The Aral Sea, 2003). The Uzbeks also appear to have abandoned any notion of saving the sea, in the hopes that there will be rich oil fields under the seabed (Uzbekistan signs, 2005). Perhaps this is the reason there has been very little vocalization from the Uzbeks against the Kazakh's dam which is quickening the depletion of the Bolshoi Aral.

There is one final option that the Soviets themselves came up with before their demise. Of course, as Ferguson (2003) points out, at the time they had no intention whatsoever of actually trying to save the sea (27). Ring (2005) describes the solution quite in depth; a plan to construct 25-50 billion dollars worth of canals to reroute waters from the Siberian Ob and Volga rivers to the Aral Sea (Arctic to Aral, 2005). The Volga is presently flooding the Caspian Sea and endangering its local residents, while the Ob is adding unsettling amounts of fresh water into the Arctic Ocean. Fixing three major

global water issues could definitely have its merits. Kamalov (2003) adds his two cents to the issue though by pointing out that any crops that were created along these new canals would be too highly priced to be competitive with other crops in the region. Additionally, such canals would cross several countries where there is no stable government (The Aral Sea, 2003).

There is little likelihood of successfully pulling off a venture of this size without a whole new set of problems arising. Kamalov (2003) further mentions that these arctic rivers have unstable conditions: many Siberian rivers dry in the summer, when they will be needed most (The Aral Sea, 2003). He finishes his argument by presuming that if these new waterways are opened, it will only serve to supply a new place for the younger generation to move to; birth rates will increase, causing a shortage of water – creating a cycle (The Aral Sea, 2003). His various hypotheses aside, the real reason this cannot work is the reluctance of *anyone* to put 25-50 billion dollars toward such a venture.

Though recent developments in Kazakhstan may preserve the estranged northern segment of the sea; it is a sad, but safe presumption that the southern sea will disappear within the next century. There are too many hands in the cookie jar, which has created too much reluctance from those intimately involved to take responsibility and attempt to solve the problem. Unless the inhabitants of the region become inspired to change their ways of life [which they can hardly financially afford to do] little *can* be done. Despite efforts of international aid, nothing can be done to help those who still hold onto a Cold War mentality where no deal can be made without immediate profit. The Russians may have sealed the Aral's fate when they deemed it "Nature's mistake," but if the sea is allowed to disappear, clearly the mistake is ours.

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