

OPUNTIA

309

World No Tobacco Day 2015

Opuntia is published by Dale Speirs, Calgary, Alberta. My e-mail address is: opuntia57@hotmail.com When sending me an emailed letter of comment, please include your name and town in the message.

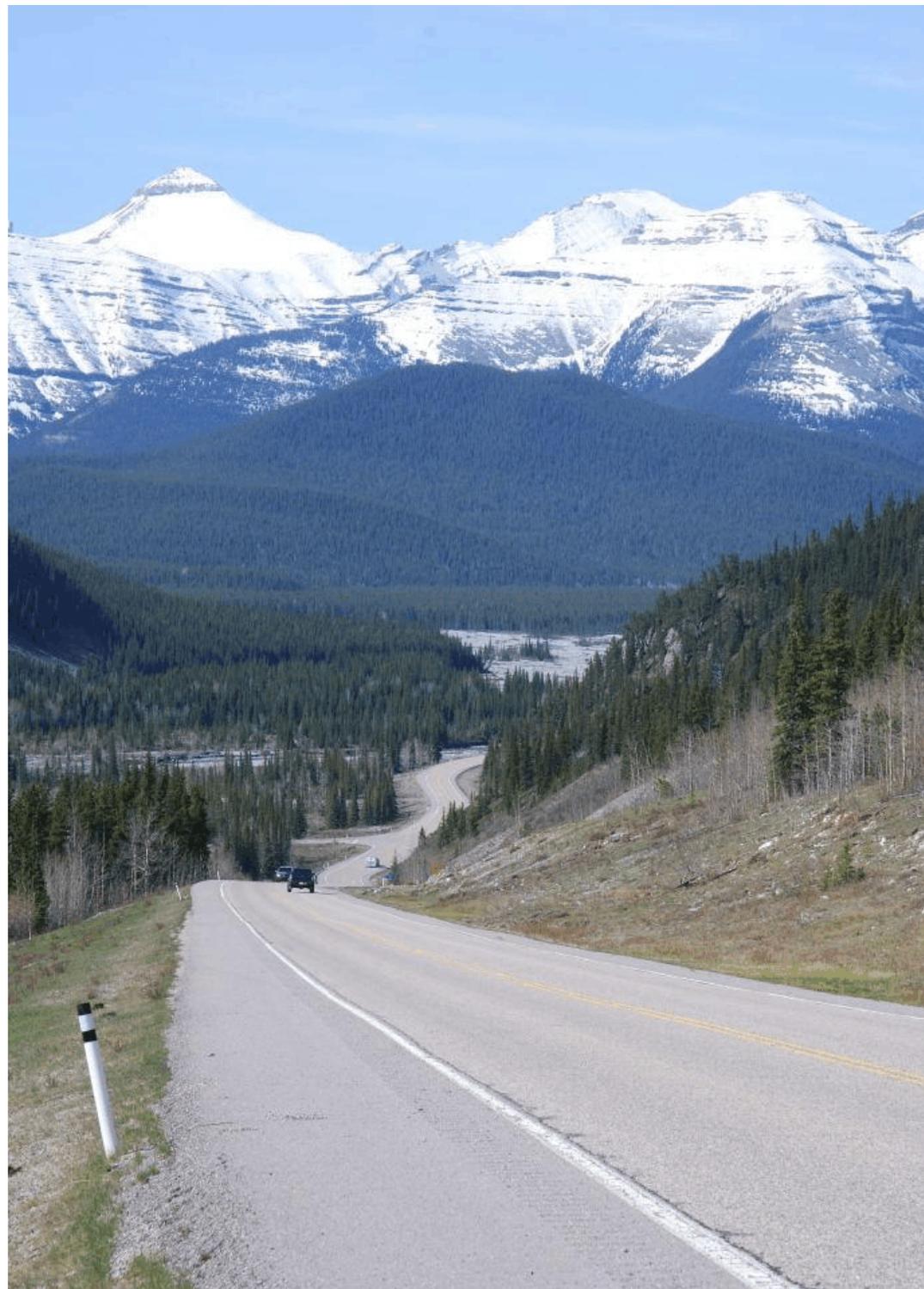
LITTLE ELBOW RIVER

2015-05-18

photos by Dale Speirs

I made my first hike of 2015 in the Rocky Mountains on Victoria Day, the weather being perfect. The Little Elbow River headwaters on the eastern slope of the Kananaskis range are a half-hour drive from my house. The photo at right shows the entrance into the watershed. Mount Cornwall is the pyramidal peak, and Mount Glasgow is the double-peaked mountain. Both are named after WW1 battleships. Kananaskis wasn't surveyed until after WW1, so many mountains there are named after people and ships of that war.

On the next page is a closer view from the north bank of the river.



Left to right: Mount Glasgow, Mount Romulus, Mount Remus (in front of others), Mount Fullerton. The middle two are named after Roman mythology

because Wolf Creek (not visible in photo) separates them, and Fullerton after a local pioneer homesteader.



This view is downstream just before the Little Elbow River merges into the Elbow River. The former is down in the bottom of the valley between the road and the mountain. The Elbow River comes around from behind the distant

side of the mountain. Forget-me-not Mountain is named after the wildflowers common to the area. The peak at right is a ridge of the same mountain. Too many spruce trees in the way to get a decent photo of the river junction.

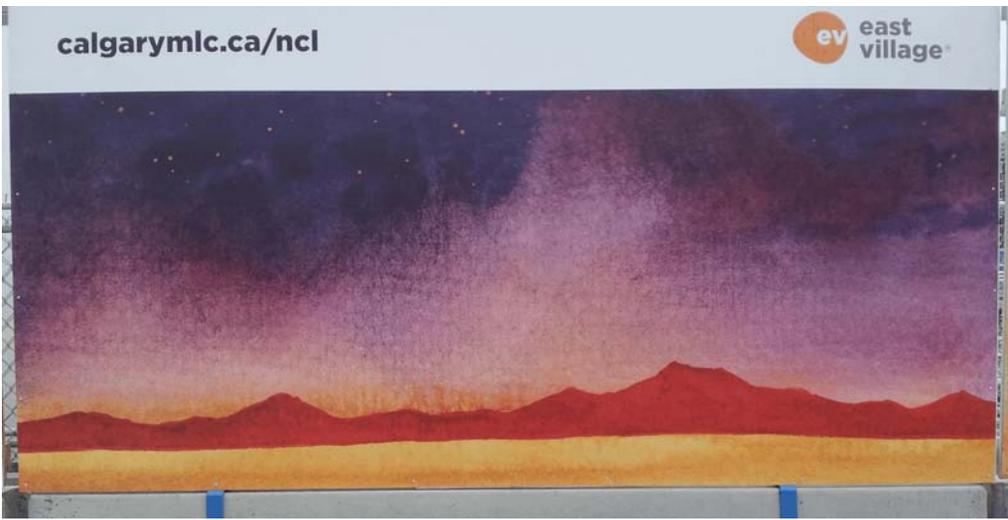
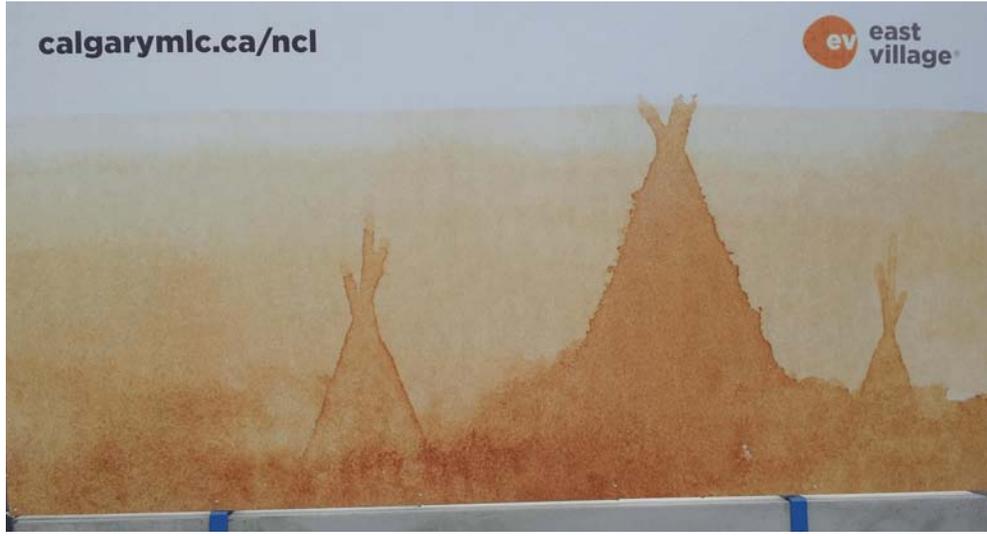


COWTOWN PUBLIC ART



The new library being constructed behind City Hall has a series of paintings on the hoardings that recapitulate the history of Calgary. Close-ups starting below. First the uninhabited land.

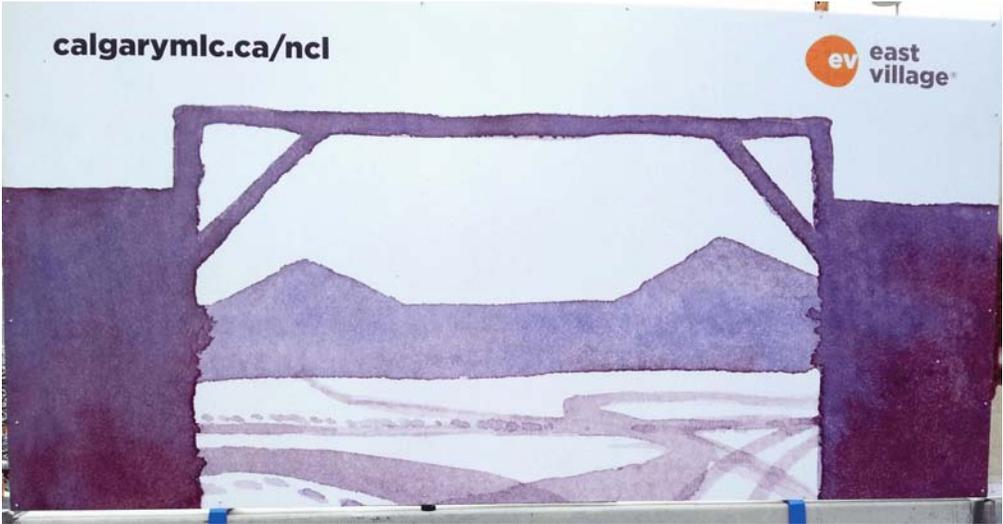
Then the aboriginals arrive, following the melting edge of the ice sheet.



The hamlet of Calgary arises, founded in 1875 by the Mounties.



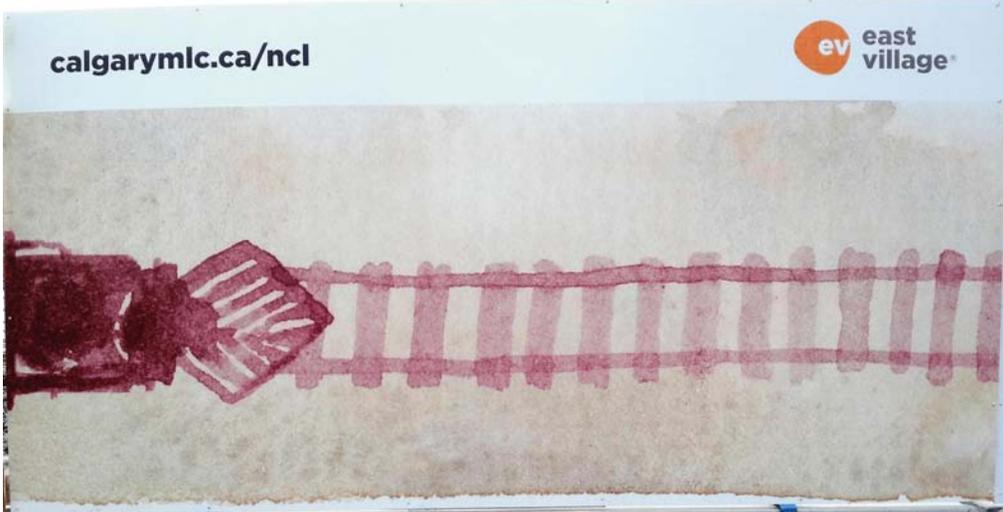
Looking at the mountains through the main gate of Fort Calgary.



Evidently this is supposed to be a view of the main drag in the early 1900s. The faintness is in the original artwork, not the photo.



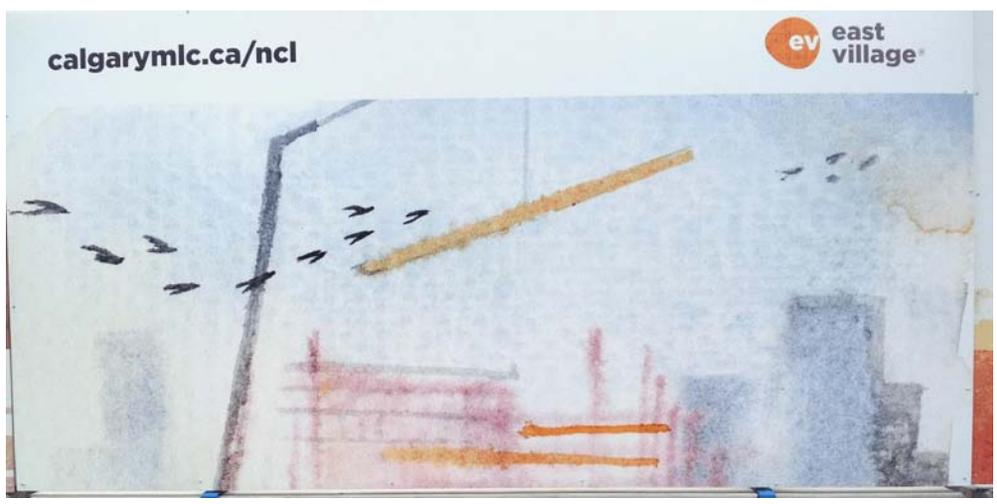
The transcontinental railroad reached Calgary in August 1883 and turned the hamlet into a town.



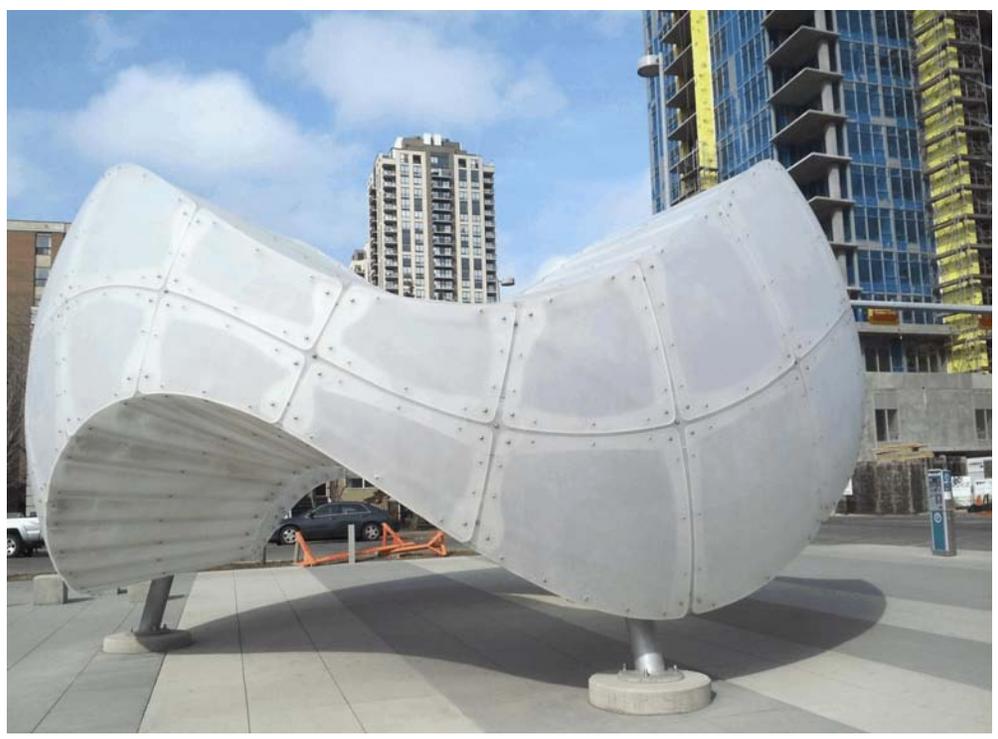
I'm guessing this is supposed to be the town of Calgary before the first oil boom.



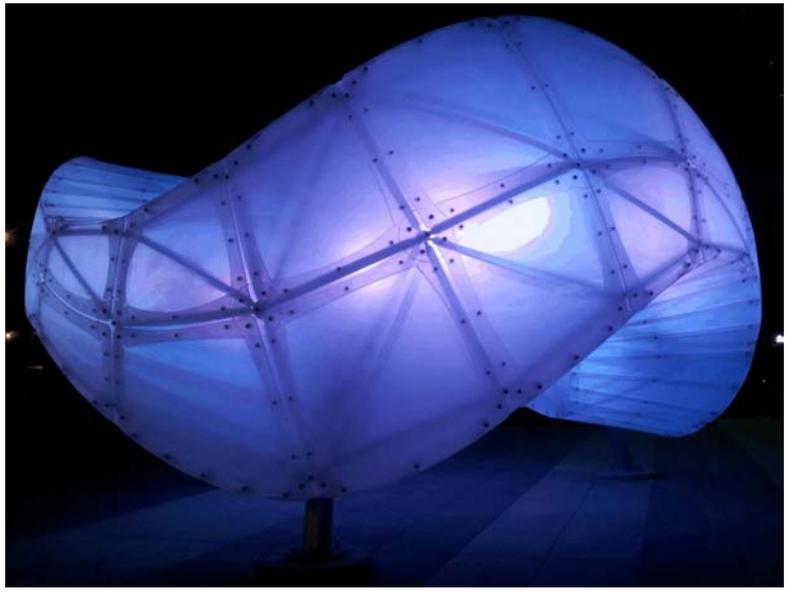
The postwar oil boom turned Calgary into a large city.

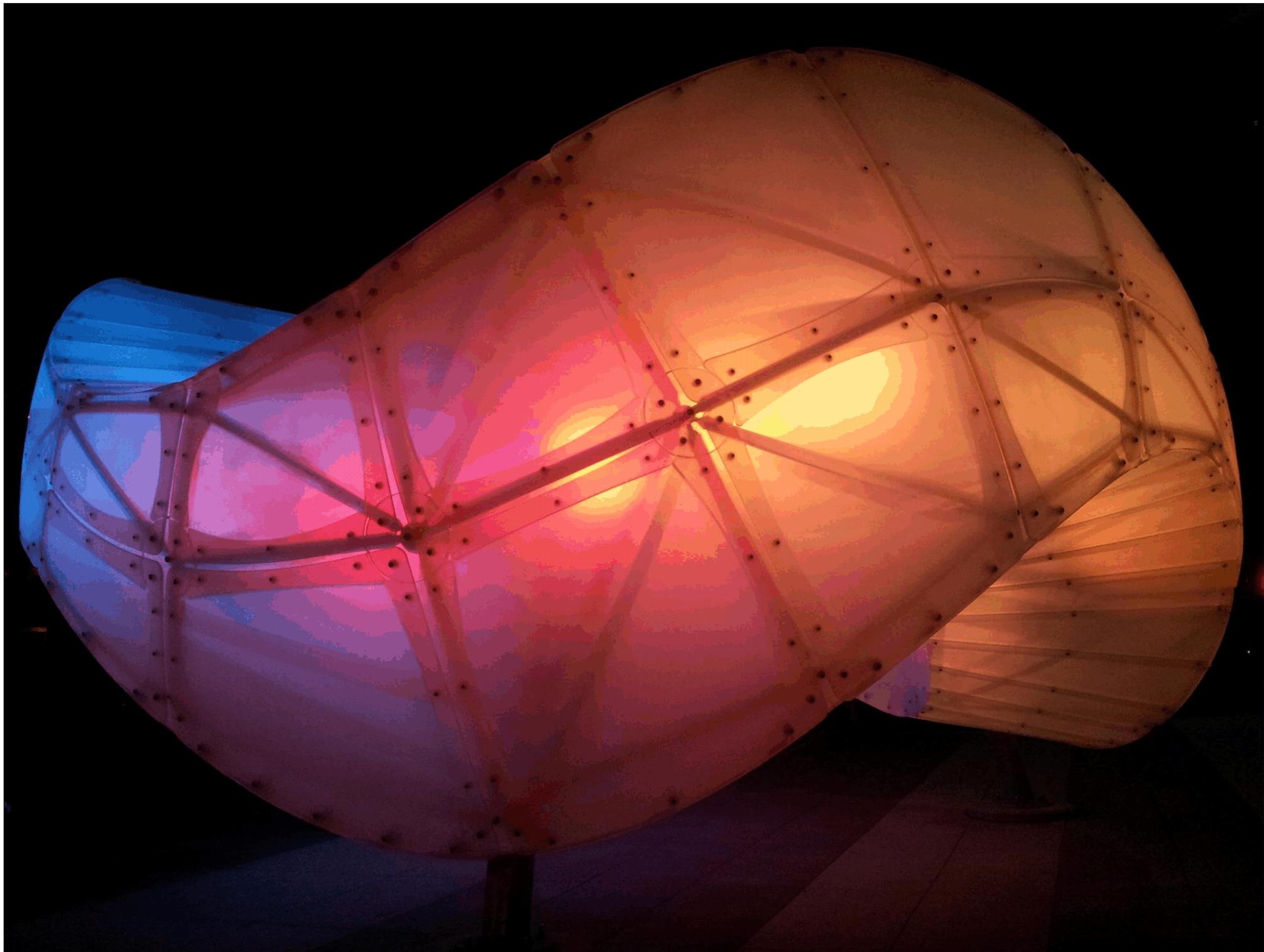


This is a kinetic sculpture in a park on 12 Avenue SW in the Beltline district, called "Chinook Arc". By day it is a bland white piece, but at night it is illuminated from within. It's been there for a couple of years now and every time I go past it, I'm amazed that it isn't covered with graffiti.



Calgary today, population 1.2 million.





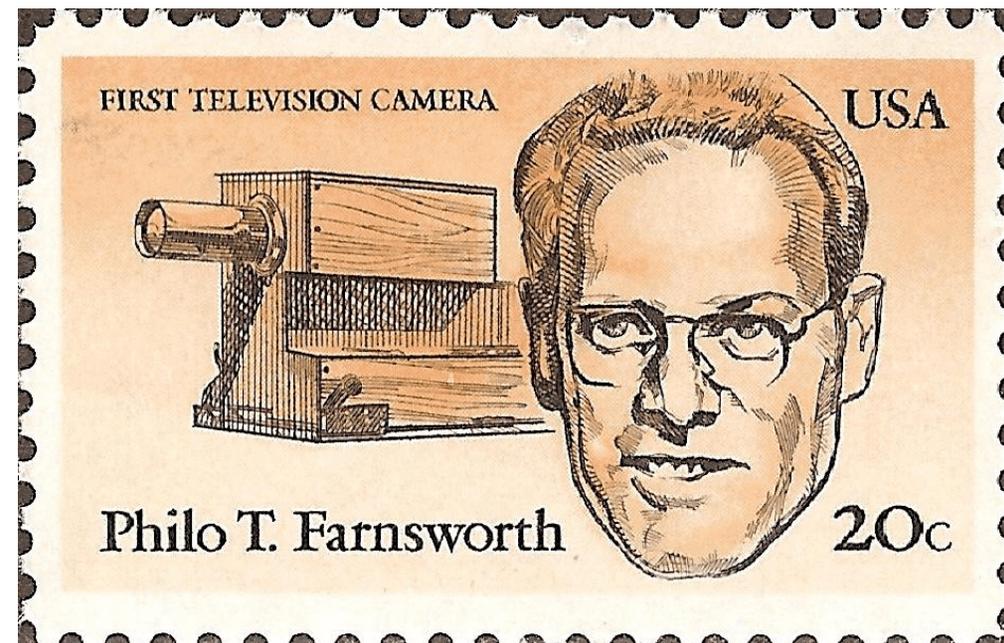
THE DAWN OF TELEVISION

by Dale Speirs

Mass television broadcasting did not become a reality until the late 1940s, but its history could have been different if the Great Depression and World War Two had not disrupted the economy of the planet. Television experiments began in the early 1900s but had to wait for technology to improve. As soon as mass-market broadcast radio became a reality in the 1920s, it did not take long for broadcast companies and myriad inventors to realize that radio with pictures would be worth a fortune.

The Panic of 1929 basically killed funding for the mass market for a decade, although research still went on. From the late 1920s to the start of WW2, there were many experimental television broadcasts around the world and dozens of local television stations that had a few hundred viewers at most, but there was no mass-market broadcasting or widespread adoption.

In 1939, television broadcasting on a wide scale was imminent but the war threw it into the back room. Some military forces funded research into it, and the Germans used television to entertain bedridden soldiers recovering in hospital wards, but there was no question of building sets for the general public. As the world got back on its feet in the late 1940s, television came onto the mass market and destroyed programme radio within a few years.



Had television been allowed to flower in the 1930s, old-time radio as we know it would never have been developed. The vaudeville artists such as Jack Benny would have gone straight to television, and radio would be as it became in the late 1950s, nothing but music and talk shows.

I don't have a television set, having gotten out of the habit in my younger days when I was too poor to afford cable. Today I could buy the fanciest large screen for cash, but instead prefer a stand-alone DVD player. No commercials, no driving to a movie theatre, I play it when I want, pause it for a break, or shut it off completely and come back a day or two later. I buy bargain-bin DVDs and particularly like the 50-movie boxed sets.

When Television Was Science Fiction.

Among those boxed sets, I found a couple of movies from the middle 1930s about television, quite remarkable since the public had heard about it but did not have it in their homes. It was all cutting-edge stuff back then, like personal computers in the early 1980s. These movies could fairly be classed as science fiction films.

MURDER BY TELEVISION (1935) is about an inventor who refuses to sell his new television transmission process to the big broadcasting companies, and intends to go it alone. The corporations are worried because his process is better than theirs. The inventor stages a nationwide demonstration of his device, broadcasting from a soiree at a manor house in White Plains, New York. His television system does not need relay transmitters, and the camera image can reach anywhere in the world from the actual camera. The viewing screen is the size of today's large-screen sets. The camera is a giant mechanism with a whirling gizmo in the centre and a battery of lights in a frame around it.

The big broadcast begins with a music recital, then the inventor begins a lecture about the educational wonders of television. He never finishes his speech, clutching his chest halfway through and falling dead to the floor.

Bela Lugosi slinks through this movie, doing everything but waving a red flag to attract suspicion to himself. There are other suspects though, and the police detective has to sort through them. Another body is found. Lugosi then supposedly becomes the third victim, but reappears in the flesh. It turns out that it was his evil twin brother who took a knife and was the one slinking about.



The Acme Collection Agency sends Rocky O'Neil to collect from Dennis. O'Neil is too softhearted to be a bill collector and is already on warning. He is a science fiction fan, reading POPULAR SCIENCE and other such magazines.

Seeing Dennis's equipment in his laboratory, O'Neil decides to help him out. O'Neil tells his boss that Dennis skipped town. Since the boss had never seen Dennis, O'Neil brings Dennis into the Acme offices under a fake name and convinces the boss to hire him. The men are sent out to another job, at the Blake company, run by two women, Barbara Blake and Mae Collins. The women bamboozle the men (not what you think it is) and promise to raise the cash.

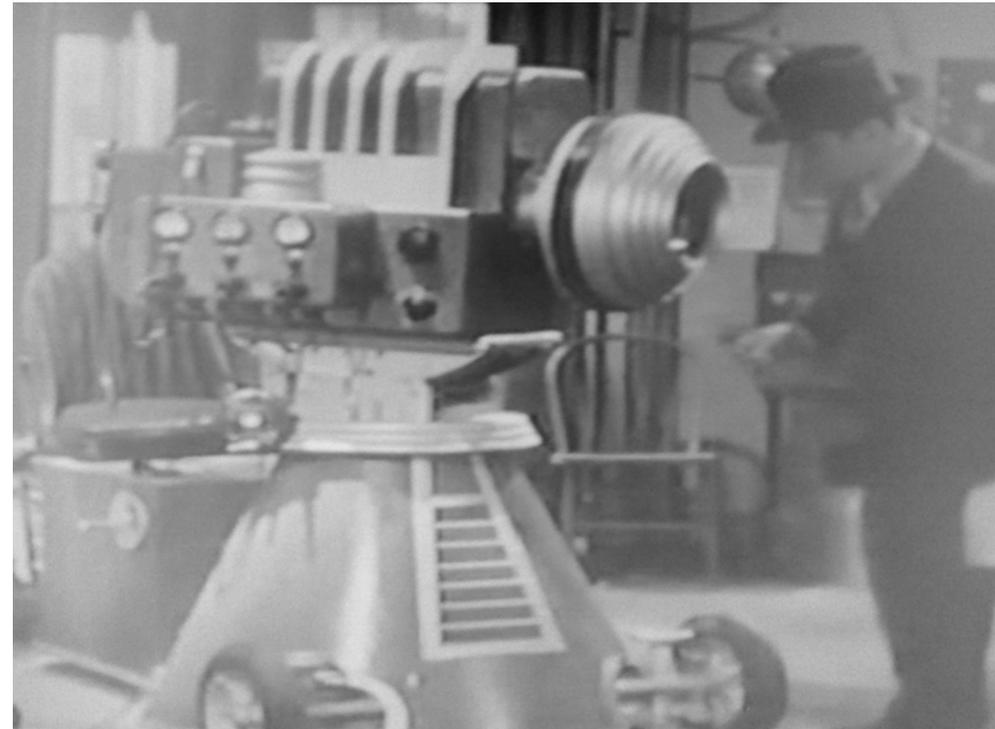
A sub-plot kicks in. Two men have disappeared from Paragon Broadcasting's research laboratory, Paul Turner and his assistant Frank Griffin. Turner is actually a kidnap victim, and Griffin is holding Paragon to ransom to get their plans back for a television broadcasting system that Turner was working on. Paragon is facing bankruptcy if they don't get into television broadcasting, and the Board of Directors are in a tizzy.

Staring into the maw of the television camera.

As the movie slowly moves to its finish, Lugosi stages a J'accuse! meeting in the drawing room with all the surviving guests. Despite a thick Hungarian accent that you could cut with a knife, he is an American federal agent chasing spies who want to steal the television and rule the world with it. He lectures the assembly about how the murderer killed the inventor with a remotely controlled death ray hidden in the camera.

And so to the close. The plot was absurd in several places, but the actors comported themselves with dignity. Lugosi wasn't half bad. I always thought of him as a short man, like his fellow Hungarian Peter Lorre, but he towered over everyone else.

TRAPPED BY TELEVISION (1936) took a different tack, with the television inventor Fred Dennis being hounded by creditors, bill collectors, rival engineers, landladies, and organized crime. His camera was a monstrous thing that looked like a spaceship ray gun from a Buck Rogers movie. Again, the receiving screen did not need an antenna. The receiver was a box about the size and shape of a coffin, with the screen at one end of the coffin and a dozen dials and switches on the side.



Staring into the maw of the television camera, a la Dennis.

Blake finds out from Dennis about his television system and becomes his agent. She sells an option to Paragon, which raises the ire of Griffin when he finds out about it since his ransom demand is now worthless. Sabotage is the first step, then misinformation, then a raid on Dennis's laboratory with criminal intent. During the raid Griffin doesn't realize the television camera is on and broadcasting to the Paragon directors at a demonstration. He and his henchmen are brought to justice. Shortly thereafter the next broadcast is the wedding of Dennis and Blake. And so to the end credits.

SHERLOCKIANA: PART 17

by Dale Speirs

[Parts 1 to 16 appeared in #63.1B to 63.1D, 67.1D, 68.1C, 69.1E, 70.1A, 71.1B, 251, 253, 256, 261, 269, 270, 276, and 288. The original stories about Sherlock Holmes written by Sir Arthur Conan Doyle are referred to as the canon, while stories written by other authors are called pastiches.]

Sir Arthur.

THE REICHENBACH PROBLEM (2013) by Martin Allison Booth is not a pastiche but a novel about Sir Arthur Conan Doyle. The doctor is feeling harassed by his public and is constantly annoyed by fanboys. (Yes, they had them back then.) Doyle decides to take a vacation at a Swiss mountain village near Reichenbach Falls where he will decide what to do about that annoying Sherlock Holmes. Doyle feels trapped by the detective and he wants to concentrate on his historical fiction, which he believed would be his literary legacy. (And which is seldom read today and only then because of his name. Had it been written by a no-name author, it would be completely forgotten.)

There is no surcease. He meets an obnoxious Holmes fan named Richard Holloway and can't shake him loose. At the hotel, various characters are introduced, one of whom is an Englishman named Peter Brown who will not make it to the end of the chapter. He is found dead at the bottom of the falls.

Doyle doesn't want to become involved but gets dragged in. His fame precedes him and all the villagers and tourists are expecting him to solve the case. The situation changes when Holloway blunders about the village trying to be a detective and makes things so bad that the villagers end up suspecting Doyle to be the murderer.

The list of suspects is the usual laundry list. In the denouement, previously unknown facts are suddenly brought out. This is a sign of a bad mystery novel since the reader should be given all the clues to have a fair chance of solving the case. The culprit is a woman who found out that Brown had helped another man who inadvertently sabotaged her husband's life work and drove him insane. Although the novel reads well, the improbable twists and withheld clues distract from it.

Pastiches: Novels.

SHERLOCK HOLMES AND THE CASE OF SABINA HALL (1988) by L.B. Greenwood sees Holmes and Watson invited to Sabina Hall, a gloomy rundown manor house in Bristol, owned by the elderly miser Silas Andrew. He is dying and by the time Holmes and Watson arrive, is dead. Holmes suspects foul play and so the plot begins. The usual suspects include the dead man's nephew Aubrey Tyson, sister-in-law Bertha Garth, distant relations Belle and Joel Harper, the young maid Sally Kipp, and the Vicar Witherspoon, all of whom have pasts to hide.

The old geezer was helped into the next world by poison in his daily medication. The suspects all stood to gain one way or another by his death. Suspicion is thrown around like salt on an icy road. Garth, named as the heir in the will, is soon deleted from the list by virtue of becoming the second poisoning victim, in her daily wine which she did love to look upon even when it was red.

The novel takes about 90% of its pages to set everything up, and then rushes to a conclusion in the last twenty pages with enough alarums and excursions to fill an action-adventure movie. Kipp becomes the third deceased, and Holmes uses evidence from her death scene, not by poison, to identify the greedy nephew as the culprit. Holmes believes in justice, which is not synonymous with the legal system, and deliberately drives Tyson to suicide. The epilogue is grimmer than what has gone before, and elevates the novel from a routine pastiche.

SHERLOCK HOLMES AND THE THISTLE OF SCOTLAND (1989) is another pastiche by Greenwood, about the theft of a jewel once owned by Mary, Queen of Scots. It became the heirloom of Lady Caroline Mowbray, betrothed to shady businessman Adolphus Stanley in an arranged marriage. The condition of the marriage is that the Thistle gem will be sold for £5,000 as a dowry, which Stanley will use to pay off a property acquisition. In exchange, he will settle some of the property on Lady Caroline. The Mowbray family, with pretensions to the aristocracy, are in reduced circumstances and need the deal.

The Thistle jewel is stolen at the post-wedding brunch and Holmes is called in to investigate. Lady Caroline was wearing it in a silver clip on the back of her hair, which was piled high in the fashion of the day. Sometime during the meal it vanished, but because it wasn't visible to the guests, no one noticed exactly when it disappeared. Holmes suggests that Lady Caroline loosened it previously, then palmed it at the brunch and hid it in her mouth. This entitled Stanley to begin annulment proceedings, which was fine by her since she didn't want the marriage.

But that was a canard, and further investigation establishes that the theft was done prior to the brunch. The stone was removed and replaced by coloured ice. Lady Caroline having full-length hair done in an upsweep, the ice could melt into her hair without anyone noticing. The whole thing is hushed up to avoid scandal, for whatever you do, don't frighten the horses.

Pastiches: Short Stories.

Recently there was a brief kerfluffle over a newly-discovered Sherlock Holmes story supposedly written by Sir Arthur Conan Doyle but which is now accepted as a pastiche written by an unknown author. It was published in December 1903 in a booklet called THE BOOK O' THE BRIG. The town of Selkirk, Scotland, was raising funds to replace a bridge that had been washed away in a flood, and staged a fete with many distinguished guests, including Sir Arthur himself. "Sherlock Holmes: Discovering The Border Burghs And, By Deduction, The Brig Bazaar" is the long-winded title about a conversation between Holmes and Watson. Holmes uses a series of deductions about Watson's appearance and behaviour to deduce that he is thinking of the Brig of Selkirk. The text is available online, as well as reports on the controversy as to whether or not it was written by Sir Arthur or was a pastiche. An historical curiosity but nothing more than that.

Crossovers.

NIGHT WATCH (2001) by Rev. Stephen Kendrick is a crossover pastiche bringing in another fictional detective, Father Paul Brown. It begins in 1902 with the theft of a ruby which is soon solved and the gem recovered. Holmes hardly has time to catch his breath when the mutilated body of an Anglican priest is found in St. Thomas Church. There was a secret religious conclave underway, and the culprit has to be one of the delegates, since no one entered or left after the murder. One of those attending the interfaith gathering is a young Roman Catholic priest named Brown, who is assisting a Cardinal.

The body count steadily climbs. The list of suspects is narrowed down to everyone, and Holmes gets nowhere. Father Brown is absent from most of the story and doesn't reappear until the final chapters. Holmes and Watson think they have the guilty man, one of the clerics. They seem to be right, as the murderer confessed, then fought to the death on the church rooftop before he falls to his death. Everything is wrapped up neatly in a ribbon.

A couple of weeks later, Father Brown visits Baker Street. He has been puzzled by discrepancies in the case and concluded that there were two separate murderers. The murder of the priest was done by the victim's half-brother, and the other murders were done by the one Holmes and Watson struggled with on the church roof for reasons that had nothing to do with the dead priest. The three detectives visit the first murderer and get his confession, so the case has been solved twice.

As is a common problem in pastiches, Watson's character is drawn a little too naive and too easily shocked. He had served as a battlefield surgeon and seen many times the worst in human behaviour, so he would not be as easily perturbed as written. This is the Nigel Bruce effect, the old duffer who played Watson as a fool in so many Sherlock Holmes movies and who altered the perception of Watson from the canon. Another problem is withheld clues that cheat the reader out of a chance to guess the murderer, a common problem in mysteries of all kinds.

WORLD WIDE PARTY ON JUNE 21

Founded by Benoit Girard (Quebec) and Franz Miklis (Austria) in 1994, the World Wide Party is held on June 21 every year. 2015 will be the 21st year of the WWP.

At 21h00 local time on June 21, everyone is invited to raise a glass and toast fellow members of the Papernet around the world. It is important to have it exactly at 21h00 your time. The idea is to get a wave of fellowship circling the planet. Rescheduling it to a club meeting or more convenient time negates the idea of a wave of celebration by SF fans and zinesters circling the globe. At 21h00, face to the east and salute those who have already celebrated. Then face north, then south, and toast those in your time zone who are celebrating as you do. Finally, face west and raise a glass to those who will celebrate WWP in the next hour.

Raise a glass, publish a one-shot, have a party, or do a mail art project for the WWP. Let me know how you celebrated the day.

WHEN WORDS COLLIDE 2015

Calgary's annual readercon When Words Collide returns on the weekend of August 14 to 16, 2015, at a new and bigger location, the Delta Calgary South Hotel on Southland Drive SE, just east of Macleod Trail. There have been SF conventions at this hotel in previous years, and the building is a good venue. More details at: www.whenwordscollide.org

This is a literary convention designed to cross genres, with author Guests of Honour from fantasy, science, fiction, mystery, romance, and young adults. The convention has become very popular with literary agents, editors, and publishers, who take rooms for pitch sessions and private negotiations.

The panels are mostly literary but there is a strong science track. The dealer bourse is almost entirely small-press publishers and a couple of book dealers. The convention Website has some selected podcasts available as free mp3s at: <http://whenwordscollide.libsyn.com>

LETTERS TO THE EDITOR

[Editor's remarks in square brackets. Please include your name and town when sending a comment. Email to opuntia57@hotmail.com]

FROM: Joseph Nicholas
London, England

2015-05-19

[Re: OPUNTIA #308 comments] that the origins of the twentieth century's major conflicts can be traced back to the Thirty Years War. This claim strikes me as a good example of the fallacies of infinite regression, in this case in looking for the first instance of an event involving the same protagonists as a much later event and claiming that first instance as the spur for all the later iterations. In the case of the Thirty Years War, this is not at all likely. The underlying causes of the war were religious rather than political. The opening dispute over the rulership of then-Protestant Bohemia was settled by the victory of the Catholic Austrians at the Battle of the White Mountain in 1621. The war was continued by northern Protestant powers, and latterly France, concerned about the extent of Habsburg power in Europe (an issue of concern since Charles V of Spain's accession as Holy Roman Emperor in 1519). The Holy Roman Empire of the German Nation was a means to manage the competing ambitions of the various statelets rather than group them into a cohesive unit (and was starting to fragment anyway). Germany as a nation-state did not of course exist at that time; I could go on.

In any case, I certainly disagree with your assertion that the Thirty Years War should be regarded as the real World War One, since it was fought mostly in the German lands and had no impact on populations elsewhere. Some historical researchers have suggested that the German lands lost 40% of their then population as a direct consequence of the war, mostly from famine and disease rather than death in battle. The real first global war, in my view, is the Seven Years War of 1754-1763 (it has different names and periods depending on the states involved and the spheres of conflict) between Britain and its allies and France and its allies, which was fought on a global stage. It was not just in Europe, but also in India, where the East India Company's army succeeded in largely excluding French commerce from the sub-continent, and of course in North America, where the British drove the French armies from Quebec and took Florida from the Spanish.

The next global war would therefore have been that fought against Napoleon, which again was conducted in other parts of the world in addition to Europe, in Egypt for a brief time, but also on the high seas, where British naval dominance eventually told against Napoleon's Continental System. The First World War would therefore be the Third. As you're doubtless aware, it did not acquire a number until the Second; until then, it was known simply as the Great War, reflecting its status as the biggest conflict that the world's powers had ever fought. It was certainly the one with the biggest death toll, even if the associated slaughters of the Russian Civil War, the Armenian Genocide, et al are omitted.

SEEN IN THE LITERATURE

Putnam, Robert D. (2007) **E Pluribus Unum: Diversity and community in the Twenty-first Century. The 2006 Johan Skytte Prize Lecture.** SCANDINAVIAN POLITICAL STUDIES 30:137-174

Author's abstract: "*Ethnic diversity is increasing in most advanced countries, driven mostly by sharp increases in immigration. In the long run immigration and diversity are likely to have important cultural, economic, fiscal, and developmental benefits. In the short run, however, immigration and ethnic diversity tend to reduce social solidarity and social capital. New evidence from the US suggests that in ethnically diverse neighbourhoods residents of all races tend to 'hunker down'. Trust (even of one's own race) is lower, altruism and community cooperation rarer, friends fewer. In the long run, however, successful immigrant societies have overcome such fragmentation by creating new, cross-cutting forms of social solidarity and more encompassing identities.*"

Speirs: Putnam's most famous work is BOWLING ALONE, about the decline of volunteerism and social groups. I reviewed it in OPUNTIA #292.

ZINE LISTINGS

[I only list zines I receive from the Papernet. If the zine is posted on www.efanzines.com or www.fanac.org, then I don't mention it since you can read them directly.]

[The Usual means \$5 cash (\$6 overseas) or trade for your zine. Americans: please don't send cheques for small amounts to Canada or overseas (the bank fee to cash them is usually more than the amount) or mint USA stamps (which are not valid for postage outside USA). US\$ banknotes are still acceptable around the world.]

FOR THE CLERISY #84 (The Usual from Brant Kresovich, Box 404, Getzville, New York 14068-0404) Reviewzine of older books and obscure sources, but with a few modern touches such as THE BIG BANG THEORY Season 9.

OSFS STATEMENT #433 (The Usual from Ottawa Science Fiction Society, 1568 Merivale Road #304, Ottawa, Ontario K2G 5Y7) SF clubzine with reports on their local comic con, convention reports, news and notes, and astronomy news about the Hubble telescope.

Llewellyn, G.T., et al (2015) **Evaluating a groundwater supply contamination incident attributed to Marcellus Shale gas development.** PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES USA 112:6325–6330

Authors' abstract: "*New techniques of high-volume hydraulic fracturing (HVHF) are now used to unlock oil and gas from rocks with very low permeability. Some members of the public protest against HVHF due to fears that associated compounds could migrate into aquifers. We report a case where natural gas and other contaminants migrated laterally through kilometers of rock at shallow to intermediate depths, impacting an aquifer used as a potable water source. The incident was attributed to Marcellus Shale gas development. The organic contaminants, likely derived from drilling or HVHF fluids, were detected using instrumentation not available in most commercial laboratories.*"

"... *High-volume hydraulic fracturing (HVHF) has revolutionized the oil and gas industry worldwide but has been accompanied by highly controversial*

incidents of reported water contamination. For example, groundwater contamination by stray natural gas and spillage of brine and other gas drilling-related fluids is known to occur. However, contamination of shallow potable aquifers by HVHF at depth has never been fully documented. We investigated a case where Marcellus Shale gas wells in Pennsylvania caused inundation of natural gas and foam in initially potable groundwater used by several households. With comprehensive 2D gas chromatography coupled to time-of-flight mass spectrometry (GCxGC-TOFMS), an unresolved complex mixture of organic compounds was identified in the aquifer. Similar signatures were also observed in flowback from Marcellus Shale gas wells. A compound identified in flowback, 2-n-Butoxyethanol, was also positively identified in one of the foaming drinking water wells at nanogram-per-liter concentrations. The most likely explanation of the incident is that stray natural gas and drilling or HF compounds were driven about 1–3 km along shallow to intermediate depth fractures to the aquifer used as a potable water source. Part of the problem may have been wastewaters from a pit leak reported at the nearest gas well pad—the only nearby pad where wells were hydraulically fractured before the contamination incident. If samples of drilling, pit, and HVHF fluids had been available, GCxGC-TOFMS might have fingerprinted the contamination source. Such evaluations would contribute significantly to better management practices as the shale gas industry expands worldwide.”

Huang, H.H., et al (2015) **The Yellowstone magmatic system from the mantle plume to the upper crust.** SCIENCE 348:773-776

Authors' abstract: “The Yellowstone supervolcano is one of the largest active continental silicic volcanic fields in the world. Using a joint local and teleseismic earthquake P-wave seismic inversion, we revealed a basaltic lower-crustal magma body that provides a magmatic link between the Yellowstone mantle plume and the previously imaged upper-crustal magma reservoir. This lower-crustal magma body has a volume of 46,000 cubic kilometers, ~4.5 times that of the upper-crustal magma reservoir, and contains a melt fraction of ~2%.”

Speirs: Regular volcanoes are produced by tectonic plate movements, hence the Pacific Ring of Fire. Supervolcanoes occur when a continental plate drifts over a magma hotspot that is not tied to a tectonic plate edge, hence the presence of the Yellowstone supervolcano in the middle of the North American plate instead of the leading edge along the Pacific Ocean. By definition, a supervolcano

blows out 1,000 cubic kilometres or more of ash. For comparison, Mount Saint Helens erupted 1 cubic kilometre, Pinatubo about 10, and Tamboro about 100. The Snake River Plain in Idaho is the result of occasional eruptions of the Yellowstone supervolcano as it moves east relative to the ground, although it is actually the plate moving west over the stationary hotspot. Yellowstone ejected 2,400 cubic kilometres about 2.1 million years ago and about 1,000 about 640,000 years ago. According to this study, the next time the Yellowstone supervolcano erupts, the Great Plains and the southern Canadian prairies will be buried under ash, roughly 500 to 1,000 cubic kilometres. Assuming prevailing winds are west-to-east, the ash will blanket eastern USA although not as bad as the middle of the continent. If the winds are blowing south at the time, then the Gulf states will get it. If Yellowstone does erupt, get upwind and you should be okay.

Kennedy, C.A., et al (2015) **Energy and material flows of megacities.** PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES USA 112:5985–5990

Authors' abstract: “Our quantification of energy and material flows for the world’s 27 megacities is a major undertaking, not previously achieved. The sheer magnitude of these flows (e.g., 9% of global electricity, 10% of gasoline; 13% of solid waste) shows the importance of megacities in addressing global environmental challenges. In aggregate the resource flows through megacities are consistent with scaling laws for cities. Analysis at the microscale shows that electricity use is strongly correlated with building floor area, explaining the macroscale correlation between per capita electricity use and urbanized area per capita. ... At the pinnacle of the growth of cities is the formation of megacities, i.e., metropolitan regions with populations in excess of 10 million people. In 1970, there were only eight megacities on the planet. By 2010, the number had grown to 27, and a further 10 megacities likely will exist by 2020 (20). In 2010, 460 million people (6.7% of the global population) lived in the 27 megacities. ...”

“Overall energy and material flows vary considerably among megacities. Rates between the lowest- and highest-consuming megacities differ by a factor of 28 for energy per capita, 23 for water per capita, 19 for waste production per capita, 35 for total steel consumption, and 6 for total cement.”