

# First World War Soldier, Killed in Action, Finally Identified with Help of ZPrinting

Soldiers who've gone missing in battle are often forgotten, but not by their loved ones, who agonize over the mystery. That's why the recent identification of a First World War soldier killed in action still matters, even though he died nearly a century ago.

## University of Western Ontario

One of Canada's leading research universities.

### Challenge

- Identifying the remains of a World War I soldier killed in action. DNA testing was not viable in this case.

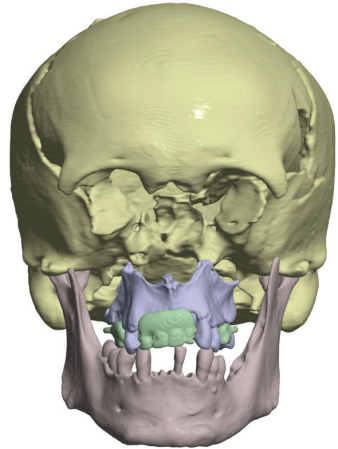
### Strategy

- Using facial reconstruction based on 3D printed skull models to match remains to photographs of known missing soldiers.

### Results

- Remains were identified as Private Thomas Lawless, member of the 49th Battalion, Canadian Expeditionary Force.

His remains were buried at La Chaudière Military Cemetery in Vimy, France, with his family in attendance.



## CHALLENGE

### Identifying the Remains

Two sets of remains were found years ago at a construction site near Avion, France. The first soldier was identified four years later using DNA analysis. Because of difficulty tracking down living relatives for numerous potential matches, DNA was of no use for the second set.

Initially stymied, investigators enlisted a novel combination of identification disciplines, including 3D Systems 3D printing technology, to confirm the identity of the remains and achieve some closure for the family.

## STRATEGY

### 3D Printing, Facial Reconstruction

The identification team had several large skull fragments of the unidentified soldier. They performed CT scans on the fragments and assembled the data into 3D computer models using Amira and 3ds Max computer-aided design software. To narrow the list of possible matches for the remains, they constructed physical models of the skull using a 3D Systems 3D printer. The ZPrinter creates physical composite models from 3D data much as a document printer produces a business letter from a word-processing file.

**Stages in the reconstruction of the face:** computer model based on CT scans (*left*) and plaster reconstruction of the midface on a ZPrinted model (*right*).

Using muscle markings on the 3D printed skull model, scientific tissue-depth tables, and plastilina modeling clay, the team worked with noted artist Christian Corbet to construct a rudimentary face on the model. They photographed that face and superimposed images of it onto existing photographs of soldiers who were potential matches. By assessing how the images lined up – by face height, width and features such as jaw shape – the team was able to narrow the list of potential matches to two. An isotopic analysis of teeth and the jaw bone indicated that the recovered soldier grew up in Dublin – a direct biographical match with a soldier in one of the matching photographs – Private Thomas Lawless.



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### RESULTS

#### Positive ID

The announcement came from the Canadian Department of National Defence. Private Thomas Lawless, born April 11, 1889, was a member of the 49th Battalion, Canadian Expeditionary Force. He was killed in action on June 8, 1917, a few months after the Battle of Vimy Ridge. He was 28.

His remains were recently buried at La Chaudière Military Cemetery in Vimy, France, with his family in attendance. La Chaudière, a Commonwealth War Graves Commission cemetery, currently has 907 servicemen from the First World War buried or commemorated there, including Private Herbert Peterson, the soldier whose remains were found with Private Lawless.

“Anthropological analysis and mitochondrial DNA testing are standard approaches for identification,” explains Andrew J. Nelson, a key researcher on the project and associate dean of research for the faculty of social science at the University of Western Ontario. “However, mtDNA requires material from living family members on the maternal side to make a connection. In this case, we had none of that at our disposal. To the best of my knowledge, this is the first instance in which facial reconstruction and isotopic analysis were added to the mix. It may result in a new protocol, or certainly new tools, for the identification of the missing.”

#### More Applications for 3D Printing

Nelson sees a variety of applications for 3D printing in anthropology beyond the identification of soldiers' remains. For example, his team used 3D Systems 3D printing in the facial reconstruction of an Egyptian mummy housed at the Chatham-Kent Museum in Chatham, Ontario. But that's just scratching the surface, he says.

Final portrait of Private Lawless based, in part, on 3D computer models and 3D printed models.

“Societies who wish to move forward must know their past to better understand who they are now and where they might be going,” he said. “The high variability of cultures of the past – before the internetworking of the world – tells us a lot about the interplay of traits like gender, status, health and wealth in different settings. It's the bones that help us associate those cultural traits with a particular set of human remains. And though CT scans enable us to look inside a mummy, for example, without disturbing the bones, wrappings and so on, 3D printing lets us extract these pieces, figuratively speaking, by creating a physical model from CT scan data. We can thus examine the bones more closely and learn more from them.”

For the descendants of Private Lawless, these investigation methods accomplished something more personal. As Nelson says, “Although it's sad to contemplate the loss of young lives in war, it's rewarding to account for the missing, both for the sake of the deceased and for long-grieving family members.”

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