

Model predicts 'shelf life' for library and archival collections

December 22 2015

Heritage scientists at UCL have developed demographic models of decay and loss to predict when a large library or archival collection might age beyond repair.

Lead author, Professor Matija Strlic (UCL Institute for Sustainable Heritage) explained: "Although some library materials might easily survive thousands of years some have internal clocks triggering faster decay. Using the demographic models we can now easily predict how much more degradation will be induced by a hotter and more humid climate in the future, and perhaps more importantly, how this can be mitigated."

The three part report 'Damage Function for Historic Paper' published today in *Heritage Science* explores what makes an historical paper unfit for use, the degradation of historical documents due to handling, and how [heritage](#) resources can be managed and stored with more economical and environmental sustainability.

The team developed an equation describing how the length of cellulose, the dominant macromolecule in paper, decreases with time depending on the acidity of paper and the environmental conditions during storage. Another model described how wear and tear accumulates with instances of reading of a book or an archival folder.

The scientists looked at more than 600 historic documents from all over Europe to arrive at a general demographic model describing how ageing

progresses and fitness is lost. Professor Strlic said: "We considered a heritage [collection](#) as a population of people and used census methods and ageing models to predict how a large library or archival collection might age beyond repair.

"In relation to the outcomes of the recent COP 21 [climate change conference](#) in Paris, the projected average increase of 2 degrees centigrade in the global climate will increase the rate of degradation of some heritage collections by around 50%, and a 4 degrees centigrade increase would halve their lifetime. We can either pump more energy into indoor climate control, which is evidently unsustainable, or use our demographic models to improve collection conservation and reduce energy use at the same time."

In addition to looking at the wear and tear of historic paper the reports also looked at the public's perception of the documents' fitness for use. Almost 800 members of the public in the UK, the Netherlands and the US were surveyed on what ageing and damage to heritage collections meant to them. Only 10% of those asked believe it is necessary for collection items to remain in a usable state for more than 500 years and about 50% think 100 years is enough. The level of acceptance of degradation was dependent on whether the object had an historical or personal value.

Professor Strlic added: "The public can be quite forgiving, and they often consider that if there are signs of degradation these are signs of the 'good life' the object has had."

Nancy Bell, Head of Collection Care for the National Archives, UK said: "We have shown that it is possible to optimise the preservation of a collection while reducing energy consumption, and meeting carbon reduction targets. Using the developed demography models we can manage heat and humidity more smartly during long-term storage."

Provided by University College London

Citation: Model predicts 'shelf life' for library and archival collections (2015, December 22)
retrieved 20 April 2024 from <https://phys.org/news/2015-12-shelf-life-library-archival.html>

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