AAOF Craniofacial Growth Legacy Collection

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The AAO Foundation Craniofacial Growth Legacy Collections Project is available on a complimentary basis to whomever would wish access to this valuable resource of untreated cases. However, this costs the AAO Foundation, the owners of the collection, $50,000 annually to maintain this site. Consequently, we are asking you, the users of this web site, to help fund its continued existence. Please DONATE NOW to help preserve this important legacy of orthodontics. We thank you in advance for your support.

Welcome!

With support from the American Association of Orthodontists Foundation (AAOF), nine of the eleven known collections of longitudinal craniofacial growth records in the United States and Canada have joined together to create this web site and its underlying numerical database. Our purpose is to make representative materials from the participating collections available for viewing and further investigation by clinicians, craniofacial investigators, students of human growth, and interested members of the public.

These collections represent the work of hundreds of investigators. They have been gathered, cataloged, and studied over a period of more than seventy-five years. The materials they contain are literally irreplaceable. Each of the collections is independent from the others and has pursued its own sampling and data collection strategies. Taken together, these different and complementary strategies have produced a rich longitudinal record of craniofacial development among children who did not receive orthodontic treatment. Available documentation of the growth process in the several collections includes skull x-ray images of various sorts, hand-wrist films, dental radiographs, facial photographs, and study casts as well as written records on the physical and educational development of children of varied ethnicities and growth patterns.

The contributing collections, working individually, have produced most of the information that is available in the contemporary orthodontic literature on longitudinal craniofacial growth in untreated children. Now, by merging data from the several collections, we hope to make possible further collaborative studies that will enrich and refine our knowledge of craniofacial growth in untreated children and adolescents.

During the initial phase of this project, which is now nearing completion, we have confined ourselves primarily to the collection of lateral and frontal cephalograms. Presently available on the site are more than 13,000 digital images including 8700 lateral cephalograms and over 3000 frontal (PA) cephalograms generated at different ages from 704 cases, gathered from 9 different Collections. Summary statistics on case distribution by sex/gender, age and Angle Class may be found by clicking on " Statistics" in the About menu.

This entire site is a continually developing resource for orthodontic teaching and research. Its primary role is to serve as a repository for longitudinal records of all types with sufficient numerical documentation to facilitate useful search and querying.

Getting Started

Clicking on a Collection Name in the Collections menu takes you to a page with three tabs, where you can see a description of the Collection, a detailed Inventory, and a condensed Inventory. This is the place to start if you want to browse through the images. The items on the Help menu provide more information on browsing and selecting images for your own research project.

The choices on the Search menu allow you to search for Subjects by Collection, Age, Sex, and Angle Class. You can also select from a subset of Subjects by Cephalometric measurements and Changes in Measurements.

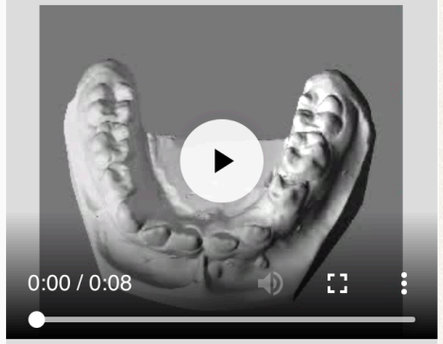
Use of Materials from This Site

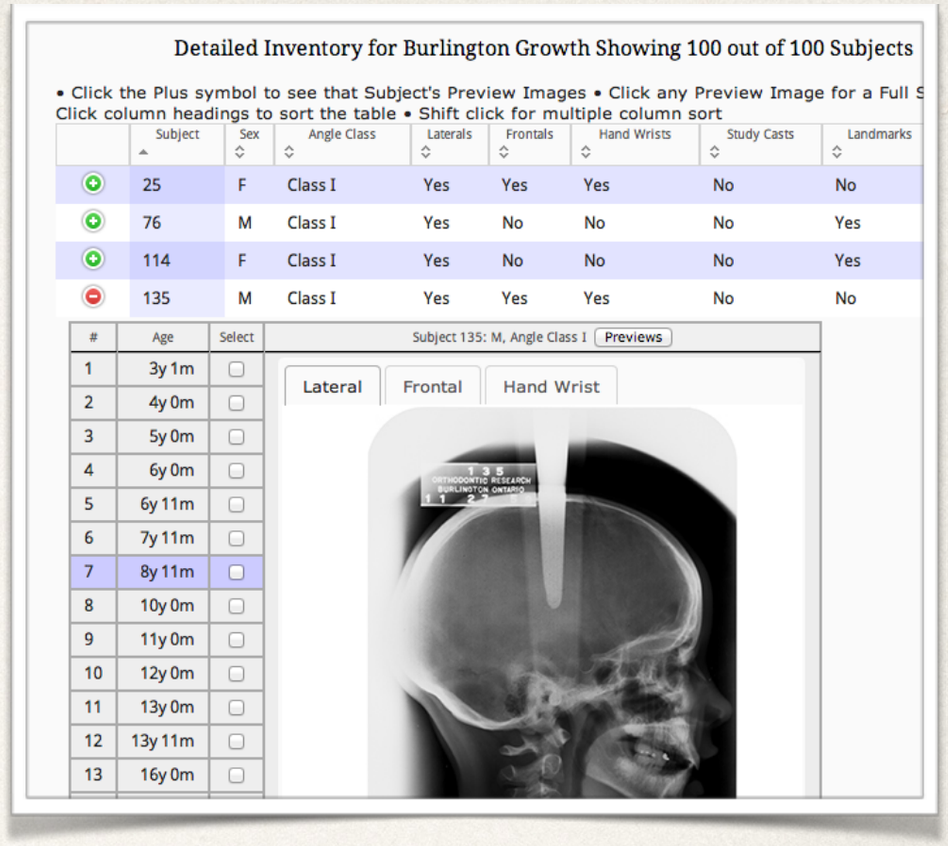
In creating and sustaining this site, AAOF and the participating collections seek to make possible the widest use of its unique materials in education and research. To that end, the entire content of the site is made available without cost for on-line use and downloading by all members of the orthodontic community. Other investigators and members of the public may also request permission to download site materials contingent upon agreement by the collection that was the original source of the materials in question. The pixel resolution of the images on the site is considered sufficient for most practical uses and equals or exceeds that at which clinical head film analyses are usually performed on digital images.

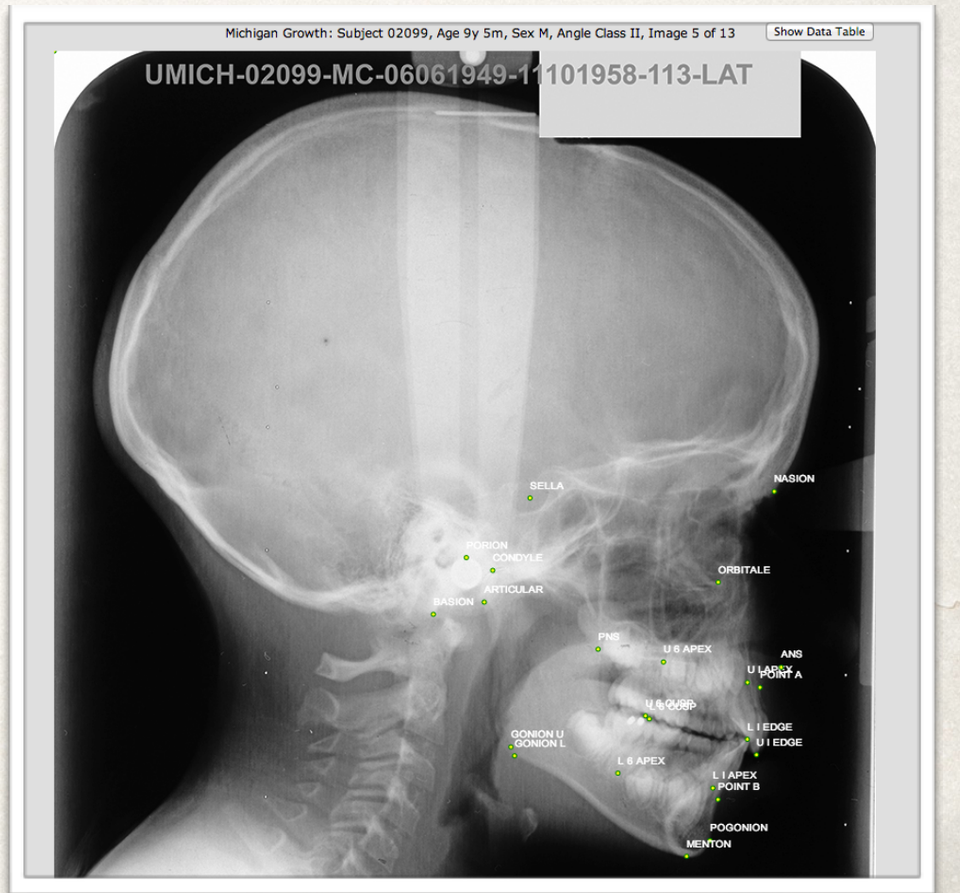
- Now available - The Forsyth Twin Collection has had 90 additional subjects added. The new records available now!
- Note that the Burlington Growth Collection requires completing an additional form for access to the full resolution images. Please use the Contact Form for additional information.

Michigan Growth Subject 02101
Animation of 12 Timepoints Over 12 Years

Landmark Overlays and Locations







AAOF Craniofacial Growth Legacy Collection

2018 Annual Report

Sean Curry, December 2018

AAOF Legacy Collection Status

- Collection Status
- Website Infrastructure
- Usage Statistics
- Image Requests
- Future Priorities

Legacy Collection Status

- Year 1 of the Five Year Ongoing Support is complete - thank you AAOF!
- The Collection had 90 additional Forsyth Twin Collection subjects added in 2018
- Two major technical enhancements were made to the website and FTP server
- Website and database are stable, and software being updated as new versions become available
- Requests are being filled on a routine basis

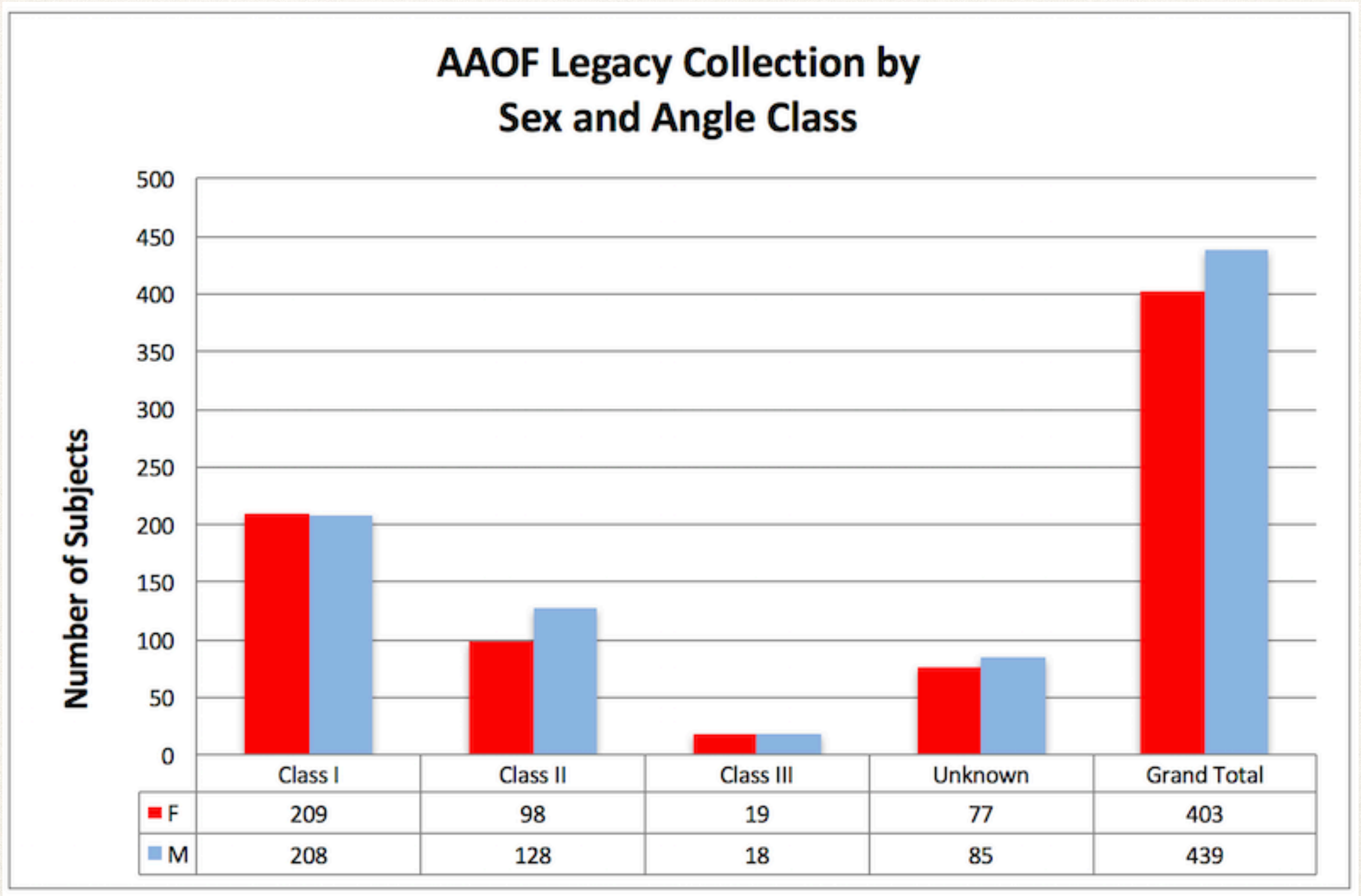
Legacy Collection Image Counts

	Nov 2011	Nov 2012	Nov 2013	Nov 2014	July 2015	Dec 2018
Collections	9	9	9	9	9	9
Subjects	194	566	696	752	752	842
Lateral Cephs	2000	6200	8700	10200	10200	11100
Frontal Cephs			3200	5800	5800	6000
HandWrist						1800
Total Images	2500	8900	12500	16000	16000	18900

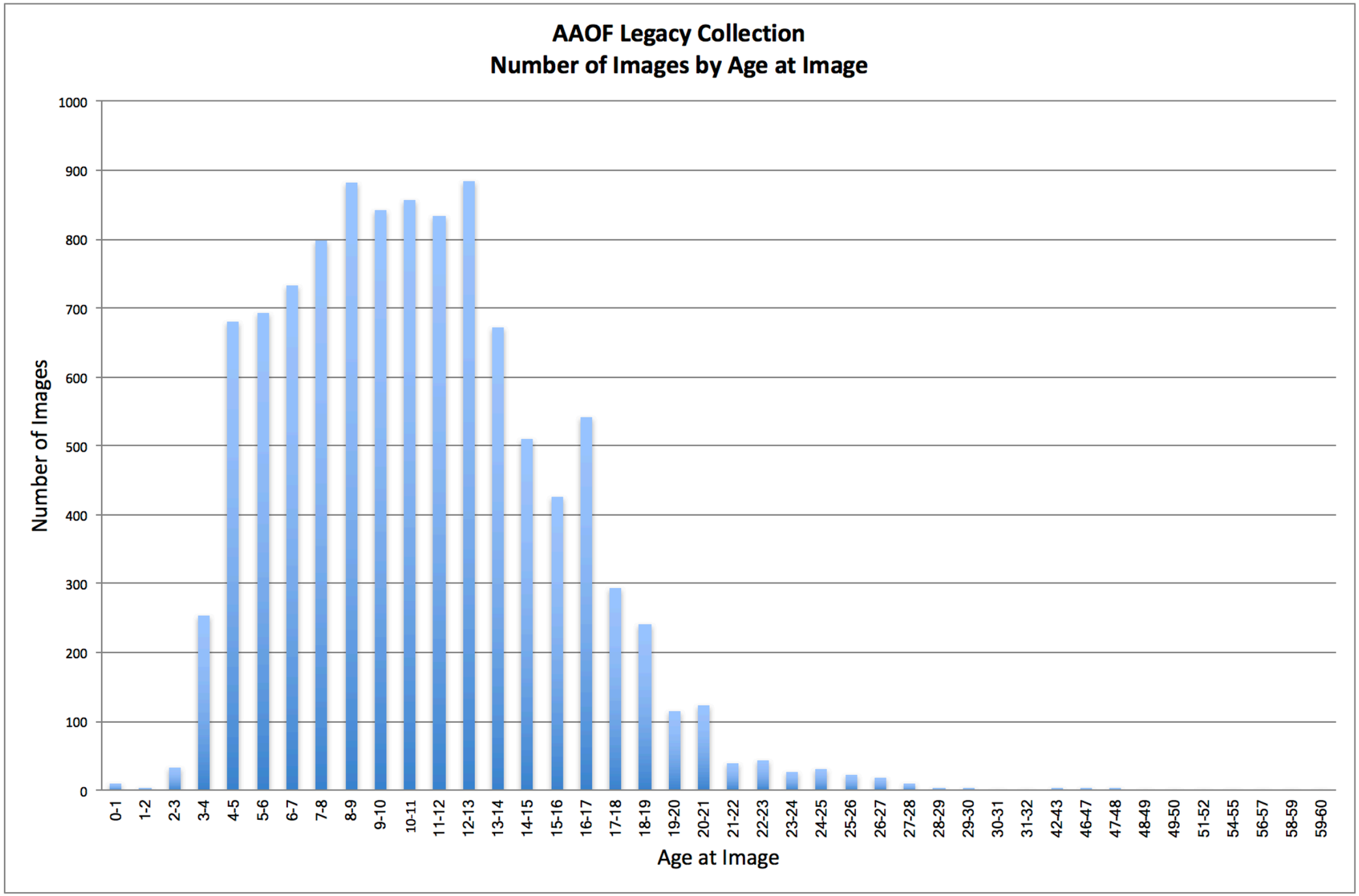
Subjects Per Collection

Collection	Subjects
Bolton-Brush Growth	102
Burlington Growth	100
Denver Growth	94
Fels Longitudinal	102
Forsyth Twin	100
Iowa Growth	100
Mathews Growth	35
Michigan Growth	102
Oregon Growth	107

Subject Distribution



Subject Images by Age



Website Infrastructure

- Website and database are hosted on Amazon AWS EC2
- Has been extremely reliable and fast, with very few uptime interruptions
- PostgreSQL Database - Version 11.1 upgrade being planned for early 2019
- Node.js Web Server - Version 10.13.0 upgrade being planned for early 2019
- Various Javascript libraries for web pages
- Security patches are applied immediately

Website Server Improvements

- All websites should now use HTTPS rather than HTTP for their communication protocol
- HTTPS is the secure version of HTTP
- The browser and the website encrypt all traffic between them with HTTPS
- The AAOF Legacy Collection website does not use any sensitive information
- However, HTTPS prevents the possibility of someone hijacking the site with a man-in-the-middle attack, in a public location like Starbucks
- We are using Cloudflare, a US based security company, to provide HTTPS for the website
- Cloudflare also provides content caching and other web server benefits, and it's free

Typical Cloudflare Month Stats

Web Traffic

Last month

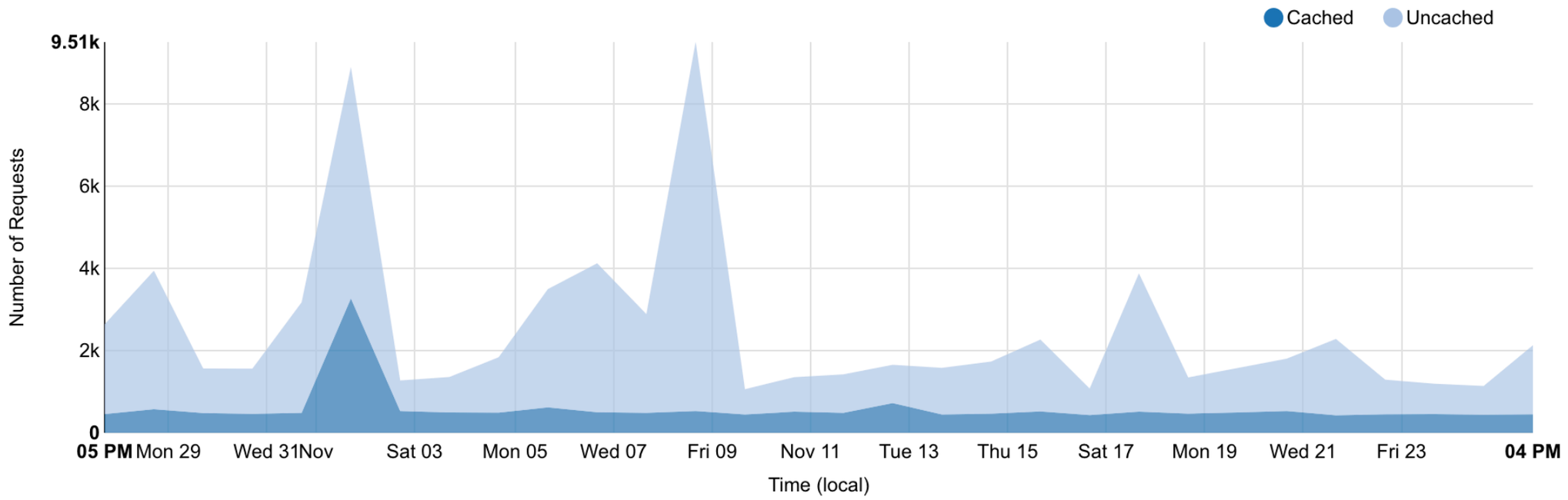
Requests | Bandwidth | Unique Visitors | Threats

Requests Through Cloudflare

Total Requests
Last month
75,019

Cached Requests
Last month
17,619

Uncached Requests
Last month
57,400



Help

Cloudflare Threats Blocked - 1 Month

Threat sources | Web Traffic

Top Threat Countries

Last month

Country	Requests
Ukraine	33
United States	9
Brazil	4
China	1
United Kingdom	1

Help

Top Traffic Countries

Last month

Country	Traffic
United States	34,057
United Kingdom	9,264
Austria	6,198
Chile	5,369
China	4,547

Help

Top Crawlers / Bots

Last month

Crawler/Bot	Pages Crawled
Google	1,348
Bing	310
applebot	156
Yandex	71
Baidu	22

Help

New FTP Server

- Until recently, full resolution images were supplied using an FTP server supplied by CRIL
- This was done for ease of setup at the beginning of the project
- Starting in November 2018, a new secure FTP server has been configured on the AWS (Amazon Web Services) server that runs the AAOF Legacy Collection Website
- Several successful transfers have been completed using the new FTP server
- The documentation for the users has been updated to reflect the new server: ftp.aaoflegacycollection.org

Ongoing Maintenance Tasks

- Website monitoring - I get automated emails and text messages if site is unavailable
- Current site has been up for 1 Year - forced AWS update to a new Linux version in late 2017
- Web server and database technical documentation - offsite copies as well as logins/passwords
- Miscellaneous bug fixes
- Request logging
- Website and database backups

Backup Strategy

- For data security, 3 backups are needed
    - Local
    - Offsite
    - Different media
- Local backup is on Amazon AWS itself
- An offsite backup on a USB hard drive is stored in Portland, OR
- Third backup on a different drive in my office plus a backup on Google Drive
- Another full backup on hard drive was delivered to Dr. Oh at UOP

Fiducial Document

This document describes the fiducial mark locations and values for all 9 collections. These data are used for making accurate scaled measurements from the full resolution images.

A copy of the document is sent with the images for each request. The document is updated as new information becomes available.

Website Usage 2018

- Results from Google Analytics Data
- Approximately 34,400 Pageviews in 2018
    - Up from 32,000 Pageviews in 2017
- 2130 Users, 4275 Sessions vs. 2100 Users, 4100 Sessions a year ago - a few more users and they are doing more
- Most visited Collections, same as 2017:
    - Bolton-Brush Growth
    - Burlington Growth
    - Michigan Growth
    - Denver Growth

Audience Overview

SAVE EXPORT SHARE INSIGHTS

All Users
+0.00% Users

+ Add Segment

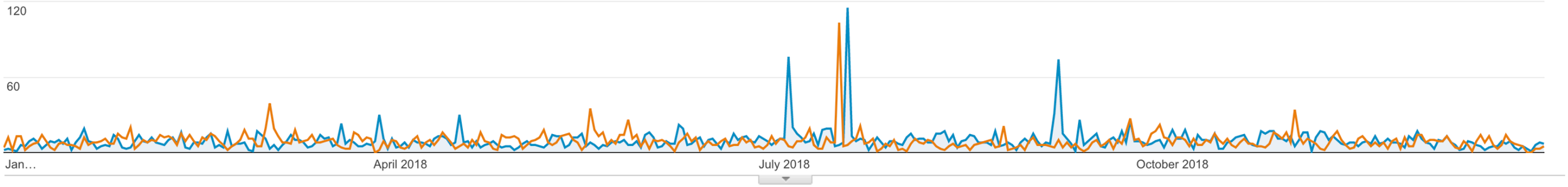
Dec 28, 2017 - Dec 28, 2018
Compare to: Dec 27, 2016 - Dec 27, 2017

Overview

Users vs. Select a metric

Hourly Day Week Month

Dec 28, 2017 - Dec 28, 2018: Users
Dec 27, 2016 - Dec 27, 2017: Users

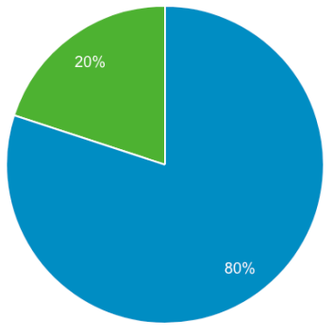


Users	New Users	Sessions	Number of Sessions per User	Pageviews
3.20%	3.07%	8.40%	5.04%	10.03%
2,130 vs 2,064	2,084 vs 2,022	4,273 vs 3,942	2.01 vs 1.91	34,415 vs 31,279

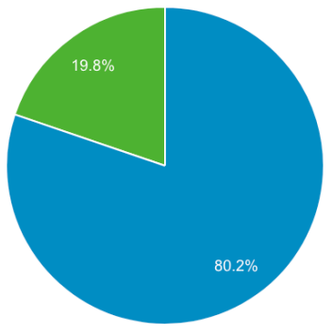
Pages / Session	Avg. Session Duration	Bounce Rate
1.50%	-3.26%	-3.11%
8.05 vs 7.93	00:06:37 vs 00:06:50	27.40% vs 28.29%

New Visitor Returning Visitor

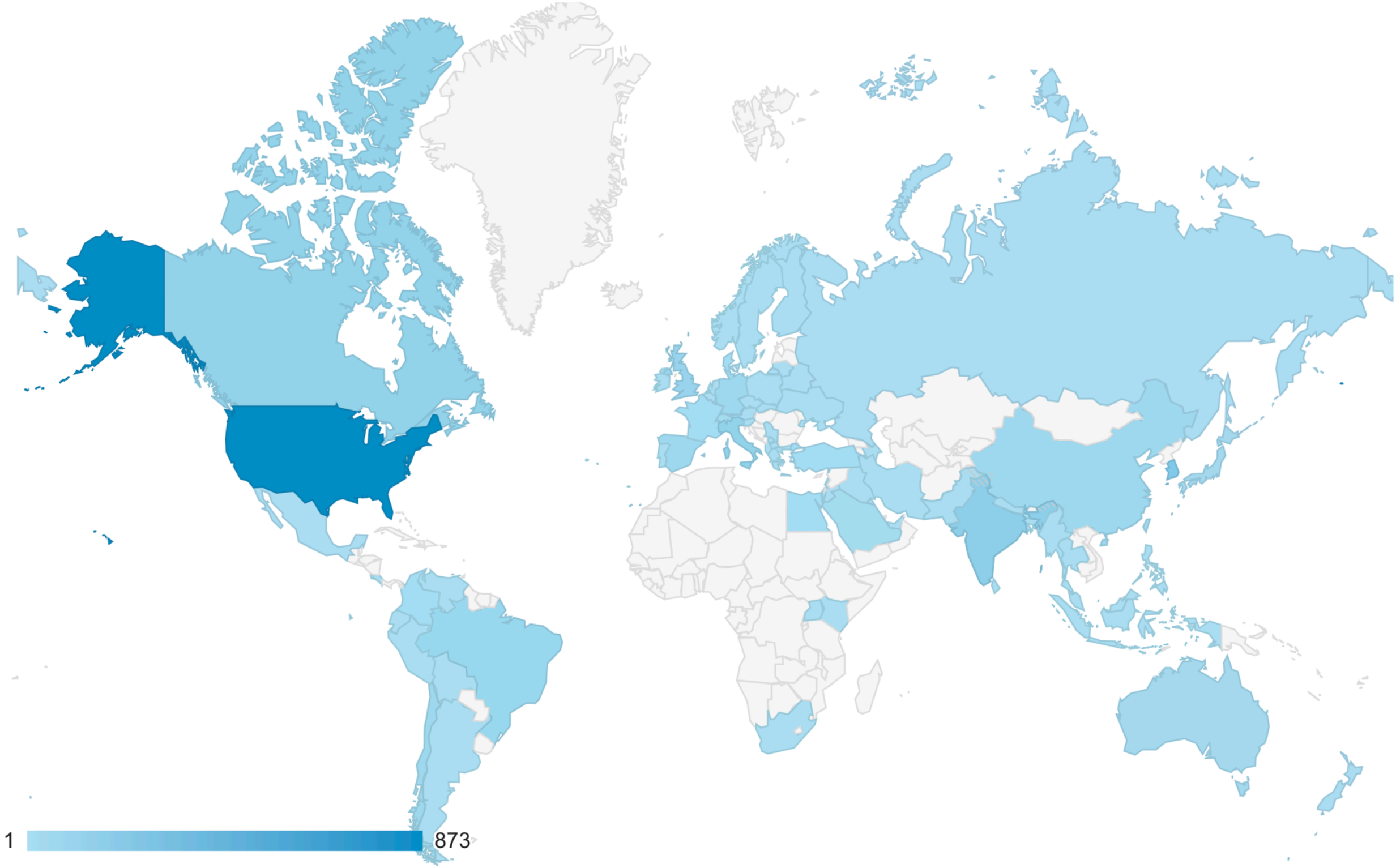
Dec 28, 2017 - Dec 28, 2018



Dec 27, 2016 - Dec 27, 2017



Website Usage 2018 vs 2017



World Wide Interest - Google Analytics Website Visits 2018

Country	Acquisition	
	Users	
	2,130 % of Total: 100.00% (2,130)	
1. United States	**869**	(40.48%)
2. South Korea	**206**	(9.59%)
3. India	**142**	(6.61%)
4. Canada	**116**	(5.40%)
5. Italy	**109**	(5.08%)
6. United Kingdom	**89**	(4.15%)
7. Brazil	**70**	(3.26%)
8. Chile	**49**	(2.28%)
9. Spain	**47**	(2.19%)
10. China	**44**	(2.05%)

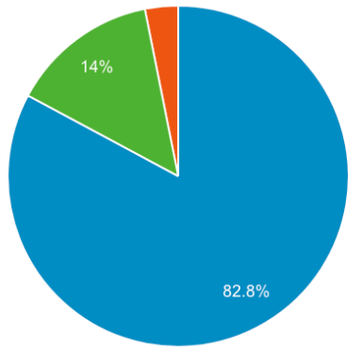
Users From Top 10 Countries 2018

Source / Medium	Acquisition Users ↓
	2,130 % of Total: 100.00% (2,130)
1. (direct) / (none)	**993** (45.16%)
2. google / organic	**982** (44.66%)
3. aaofoundation.net / referral	**95** (4.32%)
4. bing / organic	**31** (1.41%)
5. com.google.android.googlequicksearchbox / referral	**10** (0.45%)
6. aaofoundation.televox.west.com / referral	**8** (0.36%)
7. com.google.android.gm / referral	**7** (0.32%)
8. yahoo / organic	**7** (0.32%)
9. facebook.com / referral	**6** (0.27%)
10. outlook.live.com / referral	**5** (0.23%)

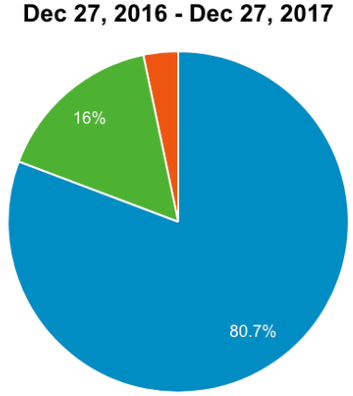
How do Users Find the Website?

Device Category	Users	Users	Contribution to total: Users
	3.20% 2,130 vs 2,064	3.20% 2,130 vs 2,064	
1. desktop			
Dec 28, 2017 - Dec 28, 2018	**1,765**	82.82%	
Dec 27, 2016 - Dec 27, 2017	**1,669**	80.75%	
2. mobile			
Dec 28, 2017 - Dec 28, 2018	**299**	14.03%	
Dec 27, 2016 - Dec 27, 2017	**330**	15.97%	
3. tablet			
Dec 28, 2017 - Dec 28, 2018	**67**	3.14%	
Dec 27, 2016 - Dec 27, 2017	**68**	3.29%	

Dec 28, 2017 - Dec 28, 2018



Dec 27, 2016 - Dec 27, 2017



Mobile and Tablet Usage

High Resolution Image Requests - 2018

- 53 raw Image Requests in 2018, some consist of multiple parts and duplicates
- Approximately 26 unique Image Requests in 2018, compared to 24 in 2017
- Approximately 3900 images requested, over 42 GB of data
- Mostly Lateral Cephs, some PA and HandWrist
- As in prior years, many international requests
- A wide variety of research projects
- These statistics cover only requested high-resolution images - Users are free to download the low-resolution images without a formal request

Low Resolution Image Usage - 2018

- Users can right-click and download the low resolution images directly from the website without submitting a request

- From one user: “We are in the final stage in our study. We found that it was easier to search directly in the open gallery, so we use even more images for our study. “

- Difficult to track how many images are downloaded this way

- O the 34,000 page views, approximately 13,000 are views of a specific low resolution image

- If we assume 25% were subsequently downloaded, this totals approximately 3,250 additional downloads

- I am still investigating better methods for tracking low resolution image downloads, possibly using Google Analytics

Requests by Collection

Collection	Requests
Bolton-Brush Growth	10
Burlington Growth	7
Denver Growth	2
Fels Longitudinal	4
Forsyth Twin	0
Iowa Growth	4
Mathews Growth	4
Michigan Growth	3
Oregon Growth	9

Note: A single request often involves multiple Collections

Sample Image Requests 2018

- Jacksonville University - It is assumed that rigid fixed functional appliances (ffa) present with more skeletal effects and less relapse of the treatment outcomes when compared with semi-rigid ffa. However current literature lacks a direct comparison between the aforementioned treatment methods. Hence our aim is to evaluate the skeletal and dental long-term outcomes using Functional Mandibular Advancer (rigid ffa) and Forsus Fatigue Resistant Device (semi-rigid ffa). We have the aforementioned treatment groups followed longitudinally but our study population lacks the control group. Legacy collection will be used to form the control group in our study. Thank you for your time and consideration.
- Eastman Dental Institute - For research of mandibular growth rotation. Many thanks.
- Ortodoncia y Ortopedia Dentimaxilofacial - University of Chile - Hi, We are requesting this collection to use it for an investigation about Delaire's findings. He describes differences in facial angle between children, man and woman but his methods to get this results are not quite clear. We think this is the right collection for our investigation.
- Fachhochschule Wedel, Hamburg - I am working on my bachelors thesis and am currently experimenting with synthetic medical image data generation using Generative Adversarial Networks. The goal of my project is to find out if such a network is capable to generate realistic-looking radiographs.

Usage Analysis

- Once an Institution makes use of the Legacy Collections, there tend to be additional users from the same Institution in the following months and years.

- Most users are extremely grateful for access to the full resolution images.

- We are now tracking Department Chair contact information and will follow up with requests for Resident and Researcher publications that use the Legacy Collections

- Some users ask for an unreasonable number of images (ie All Class II images from all Collections). I work with them to reduce their request to what is really required.

- The website also receives a number of requests for technical information on image specifications, demographic data, etc

Some Feedback…

The purpose of our research project is to validate the cervical vertebral maturation (CVM) method in detecting the pubertal growth spurt in mandibular growth. We will also compare the agreement between the visual CVM method versus the Objective CVM method in assessing the CVM stage.
We selected only those subject who presented a series of consecutive lateral cephs of good quality with annual intervals from stage 1 (7-8 years) through stage 5-6 (15-18 years) in CVM. According to these inclusion criteria, we found 26 subjects of the Oregon Growth Study, 3 from the Mathews Growth Study, 2 from the Iowa Growth Study, and 7 from the Fels Growth Study who are eligible for our study. We just started the digitization of the lateral cephalograms with a cephalometric software (Viewbox 4.0, Kifissia, Athens, Greece).

Thank you again for your very precious help.

A Recent Submission to AJODO

Comparison of two treatment protocols using fixed functional appliances in Class II malocclusion: Treatment results and stability

ABSTRACT

Introduction: To compare the two treatment protocols including Functional Mandibular Advancer (FMA) followed by multibracket appliances (MBA) vs Forsus device in combination with MBA concerning treatment outcomes and posttreatment stability. Methods: This study was conducted using lateral cephalograms of patients who were treated with MBA which was used either after FMA or concurrently with Forsus device, and of a control group having untreated Class II malocclusion. Each group consisted 19 subjects included in CS2 or CS3 stages according to cervical maturation index. Cephalograms were taken for the treated groups at T1 (pretreatment), T2 (completion of MBA treatment), T3 (at least 2 years after T2). Results: Significant intergroup differences at T1-T2 period were observed in favor of the FMA concerning mandibular advancement, intermaxillary relationship and mandibular elongation. In Forsus treatment, restrained maxillary growth and slightly improved intermaxillary relationship rebounded after treatment ($p<0.05$). At the end of treatment, mandibular incisor protrusion and occlusal plane rotation were greater in the Forsus group than in the FMA group ($p<0.05$), and maxillary incisor retroclination was significant in the Forsus group. During the posttreatment period, while no significant changes were present in incisors' inclination, relapses of the T1-T2 improvements in overjet and overbite, as well as the recidive of the occlusal plane rotation were significantly higher in the Forsus group. Conclusions: Treatment protocol including FMA was found to be more effective with mandibular skeletal effects and was more stable with lesser degree of relapse in overjet and overbite compared with the Forsus protocol.

Legacy Collection In the News

American Association of Orthodontists Foundation Craniofacial Growth Legacy Collection in the orthodontic literature—use and trends: A systematic review

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a Department of Orthodontics, School of Dental Medicine, State University of New York, Buffalo, NY.
b Health Sciences Library, State University of New York, Buffalo, NY.
c Private Practice, Vernon Hills, Ill.
January 2018 Vol 153 Issue 1 American Journal of Orthodontics and Dentofacial Orthopedics

Introduction: The American Association of Orthodontists Foundation (AAOF) Craniofacial Growth Legacy Collection is a digital repository of records from 9 craniofacial growth study collections in the United States and Canada. The purposes of this article were to describe the use of materials from the AAOF Craniofacial Growth Legacy Collection in the orthodontic literature in comparative and follow-up studies, and to analyze trends before and after the project's launch in 2009.

Conclusions: The overall numbers of published studies in the comparative and follow-up categories increased after 2009, reflecting the efforts of the AAOF team and collection curators to make the records available worldwide. Further research should consider studying each collection to identify utilization predictors.

AAOF Press Release 2018

ORTHODONTIC NEWS

AAOF Craniofacial Growth Legacy Collections Project Announces Major Records Addition

Published on June 18, 2018

The American Association of Orthodontists Foundation (AAOF) announced a major addition to its Craniofacial Growth Legacy Collections Project. The growth records of 752 children who did not have orthodontic treatment have been digitized and are now available to researchers, clinicians, craniofacial investigators, students, physical anthropologists, and other interested persons at no charge.

The AAOF Craniofacial Growth Legacy Collections Project serves as a repository for longitudinal records that document development of children who did not receive orthodontic treatment and as a resource for teaching and research.

Materials in the Legacy Collections are representative samples from nine of the 11 known longitudinal craniofacial growth collections in the United States and Canada. Records were taken between 1930 and 1985. According to the AAOF, the materials are literally irreplaceable. Radiographic (x-ray) images were deteriorating with age. Such detailed longitudinal radiographic images could not be repeated today because of the possibility of overexposing subjects to radiation.

The children studied were measured at least annually, beginning as young as age 2, and continuing, in many cases, until subjects were in their mid-20s. The records include x-rays of the head and hand-wrist, plaster study casts of the teeth, photographs, and written records charting through time the physical development of children of different ethnicities and growth patterns such as their height, weight, dietary information, and medical history.

According to the AAOF, Dr Mark Hans, Professor and Chair of the Department of Orthodontics at Case Western Reserve University in Cleveland, Ohio, and member of the AAOF Legacy Collections Project steering committee, was

Dental Hygiene | Headlines | News

Researchers encouraged to access free craniofacial growth data at AAOF website

[ad_1]

A collection of growth records of 752 children who did not have orthodontic treatment has been digitized and is available to researchers, clinicians, craniofacial investigators, students, physical anthropologists, and other interested persons at no charge. Known as the AAO Foundation (AAOF) Craniofacial Growth Legacy Collections Projectusbsqxzsuqztvv, it serves as a repository for longitudinal records that document development of children who did not receive orthodontic treatment and as a unique resource for teaching and research.

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Dr. Mark Hans, professor and chair of the department of orthodontics at Case Western Reserve University in Cleveland, Ohio, and member of the AAOF Legacy Collections Project steering committee, said that the Legacy Collections project was a dream of the late Dr. Sheldon Baumrind "...that started in the 1970s. He was a prescient leader in orthodontic imaging whose immense intellect and contagious enthusiasm was an inspiration to all academic orthodontists."

Dr. Baumrind served as the curator and principal investigator for the Legacy Collections Project until his death in 2017. Case Western houses records from the Bolton-Brush Growth Study and the Broadbent-Bolton Growth Study, which now comprise a portion of the AAOF

Great Lakes Association of Orthodontists News Aug 2018

AAO Foundation

CRANIOFACIAL GROWTH LEGACY COLLECTIONS PROJECT OFFERS ONLINE DATABASE OF IMAGES, PHYSICAL RECORDS FREE TO RESEARCHERS

Website Houses Irreplaceable Collections of Detailed Growth Records of Children Who Did Not Have Orthodontic Treatment

St. Louis, June 19, 2018 - A rich and irreplaceable collection of growth records of 752 children who did not have orthodontic treatment has been digitized and is available to researchers, clinicians, craniofacial investigators, students, physical anthropologists, and other interested persons at no charge. Known as the AAO Foundation (AAOF) Craniofacial Growth Legacy Collections Project, it serves as a repository for longitudinal records that document development of children who did not receive orthodontic treatment and as a unique resource for teaching and research.

Click here to read more.

Future Priorities

- Continue updates and maintenance of the website and database

- Continue to fulfill image requests and answer questions about the Collection

- Improve analytics for downloaded low-resolution images

- Ongoing question of the Study Casts

- Improve tracking of publications

Summary

- All current images have been loaded to the website and database
- The AAOF Legacy Collection Website and database are stable
- Usage has increased over the prior year
- Researchers are very appreciative of the AAOF providing access to the Collection