

We'll go through how to implement complete Drive apps. This is not an introduction to Drive apps, but rather how to build your product into Google Drive, and ensure that the experience is seamless for a user. We will also discuss how to effectively distribute your app in the Chrome Web Store. The example app built in this talk will demonstrate an example use case, but otherwise be production-ready



About Mike Procopio

[View full profile](#)

Mike is a Software Engineer for Google Drive, leveraging his passion for the developer and user experience by working on the Drive APIs. He holds a Ph.D. in CS from the University of Colorado.



About Steve Bazyl

[View full profile](#)

Steve is a Developer Advocate for Google Drive & Google Apps. He enjoys helping developers find ways to integrate their apps and bring added value to users.



Building Polished Drive Apps

How to make your apps rock

June 27, 2012 (Google I/O 2012)

Mike Procopio, Software Engineer, Google Drive SDK

Steven Bazyl, Developer Advocate, Google Drive SDK



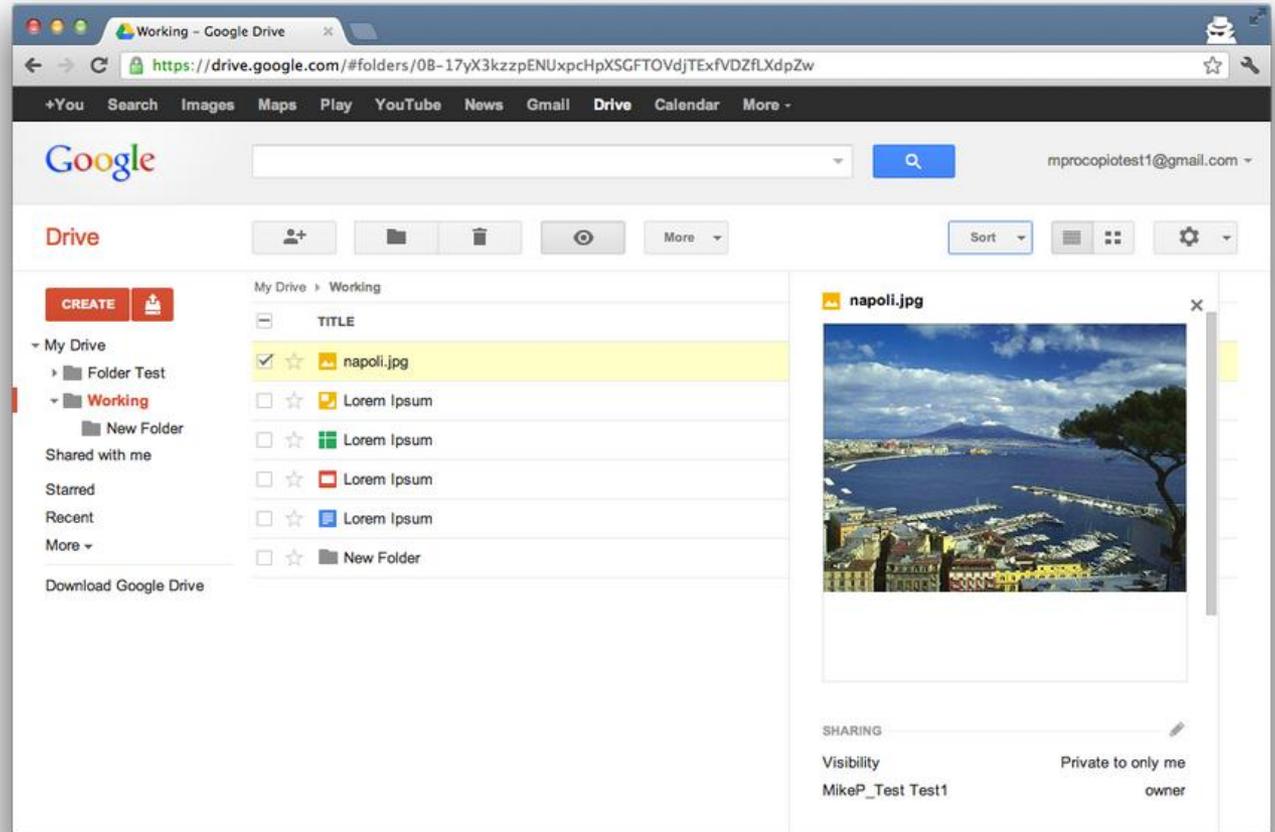
Google Drive

Store files safely in the cloud

Sharing, searching, collaboration, file revisions, OCR, organization...

Keep files in sync across devices

Access files anywhere



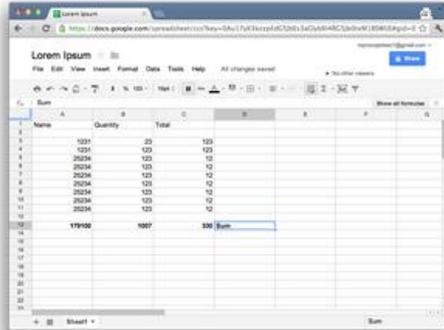
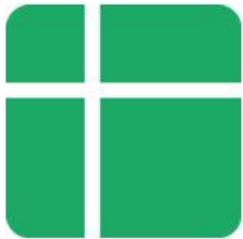
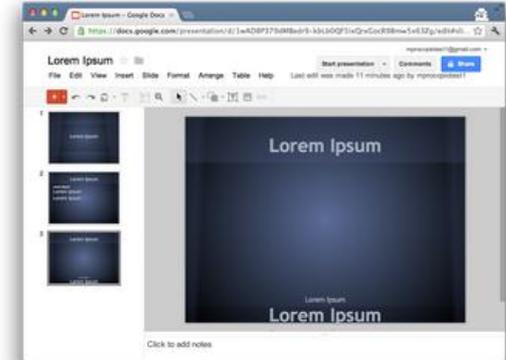
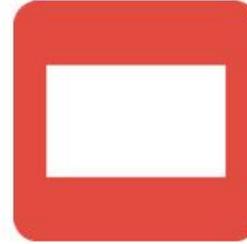
So where are we at today with Drive?

- **Millions** of users have opted in to drive.
- Access **anywhere**: on the web, on mobile devices, and using Chrome OS
- Easy-to-use, fully featured **SDK** with client library support in 8 languages
- 50 third-party Drive apps available in the Chrome Web Store



Built-in first-class, collaborative productivity apps

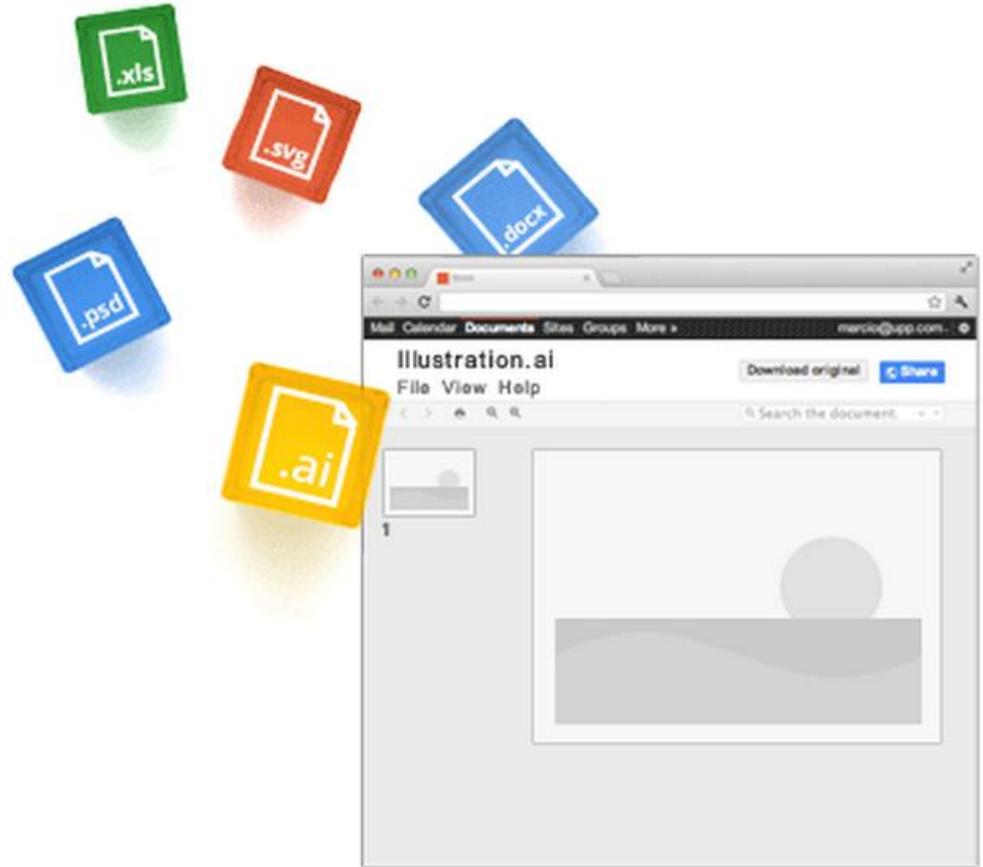
Documents, Spreadsheets, Presentations, and Drawings



Google Drive Viewer

Built-in previewer for many file types

- PDF
- Images
- Videos
- Text
- Some proprietary formats
 - Photoshop
 - Illustrator
 - Microsoft Office
 - etc.
- But...



Google Drive Viewer

Read scintillating scientific publications (PDFs).



The screenshot shows a web browser window displaying a PDF document from Google Drive. The browser's address bar shows the URL: <https://docs.google.com/file/d/0B-17yX3kzppEb3F2RjNkrkQj0N2M/edit>. The document title is "procopio_icra2010.pdf". The document content includes the following text:

2010 IEEE International Conference on Robotics and Automation
Anchorage Convention District
May 3-8, 2010, Anchorage, Alaska, USA

Coping with Imbalanced Training Data for Improved Terrain Prediction in Autonomous Outdoor Robot Navigation

Michael J. Procopio, Jane Mulligan, and Greg Grudic

Abstract—Autonomous robot navigation in unstructured outdoor environments is a challenging and largely unsolved area of active research. The navigation task requires identifying safe, traversable paths that allow the robot to progress towards a goal while avoiding obstacles. Machine learning techniques are well adapted to this task, accomplishing *near-to-far learning* by training appearance-based models using near-field stereo readings in order to predict safe terrain and obstacles in the far field. However, these methods are subject to degraded performance when training data sets exhibit *class imbalance*, or skew, where data instances of one class outnumber those in another. In such scenarios, classifiers can be overwhelmed by the *majority class*, and will tend to ignore the *minority class*. In this paper, we show that typical outdoor terrain scenarios are associated with training data imbalance, and examine the impact of using undersampling, oversampling, SMOTE, and biased penalties techniques to correct for imbalance in stereo-derived training data. We conduct a statistically significant, repeated measures empirical evaluation and demonstrate improved far-field terrain prediction performance when using such methods for handling class imbalance versus taking no corrective action at all.

I. INTRODUCTION

Autonomous robot navigation in unstructured outdoor environments is a challenging and largely unsolved area of active research. The navigation task requires identifying safe, traversable paths that allow the robot to progress towards a goal while avoiding obstacles. Stereo vision allows for obstacle avoidance in the near field (here, within 10m of

Fig. 1: The LAGR robot (left); sample image from an outdoor scene (center); stereo obtained from onboard cameras (right).

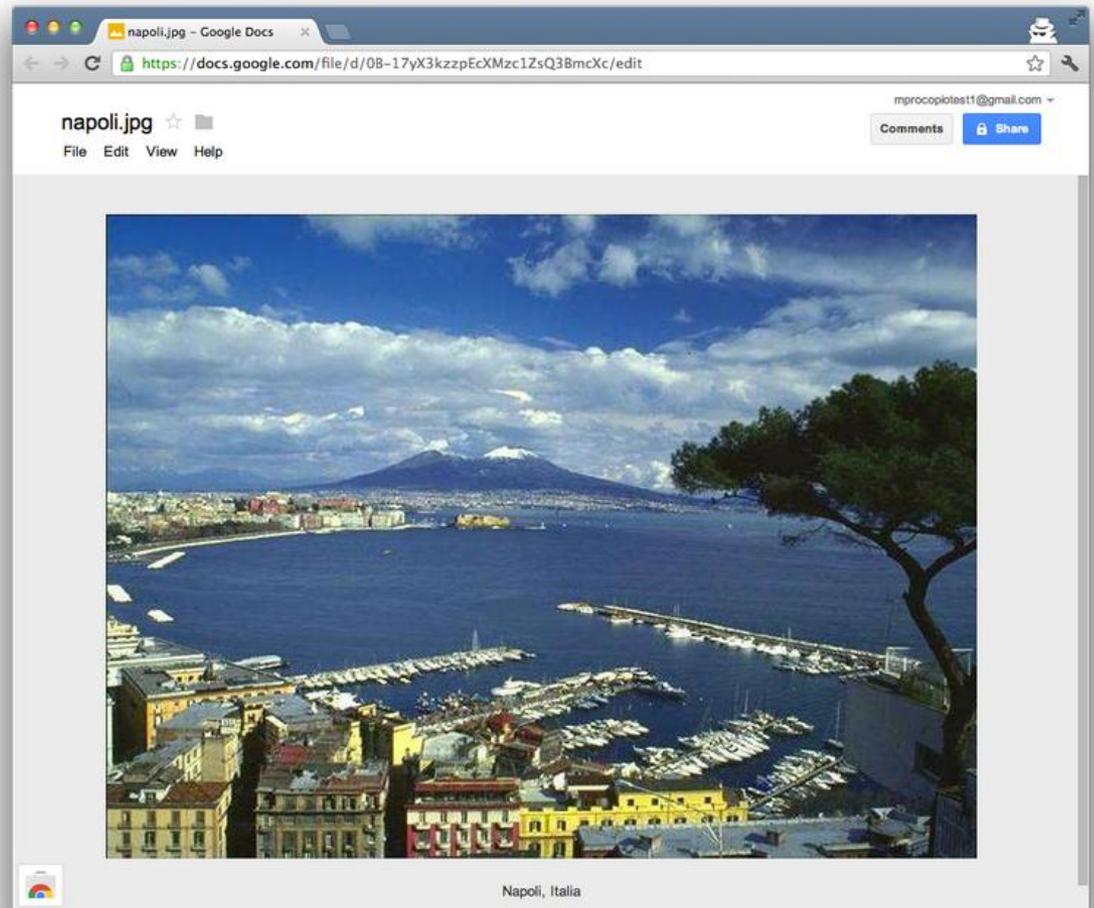
In the example shown in Fig. 1, this approach could be used to predict the geometry of the far field, and hence obstacles and traversable terrain, beyond what stereo readings alone could provide. With such terrain predictions in the far field, the robot would follow a more natural path towards the goal, in this case avoiding trajectories towards far-field obstacles.

In general, supervised machine learning classifier design assumes when training a model that the distribution of the class labels in the training data is uniform, i.e., no skew or *class imbalance* is present in the training set. Often times, however, this is not the case, and classifier performance can degrade significantly as the severity of the imbalance increases. As a result, coping with imbalanced training data is the subject of ongoing research, and includes where class



Google Drive Viewer

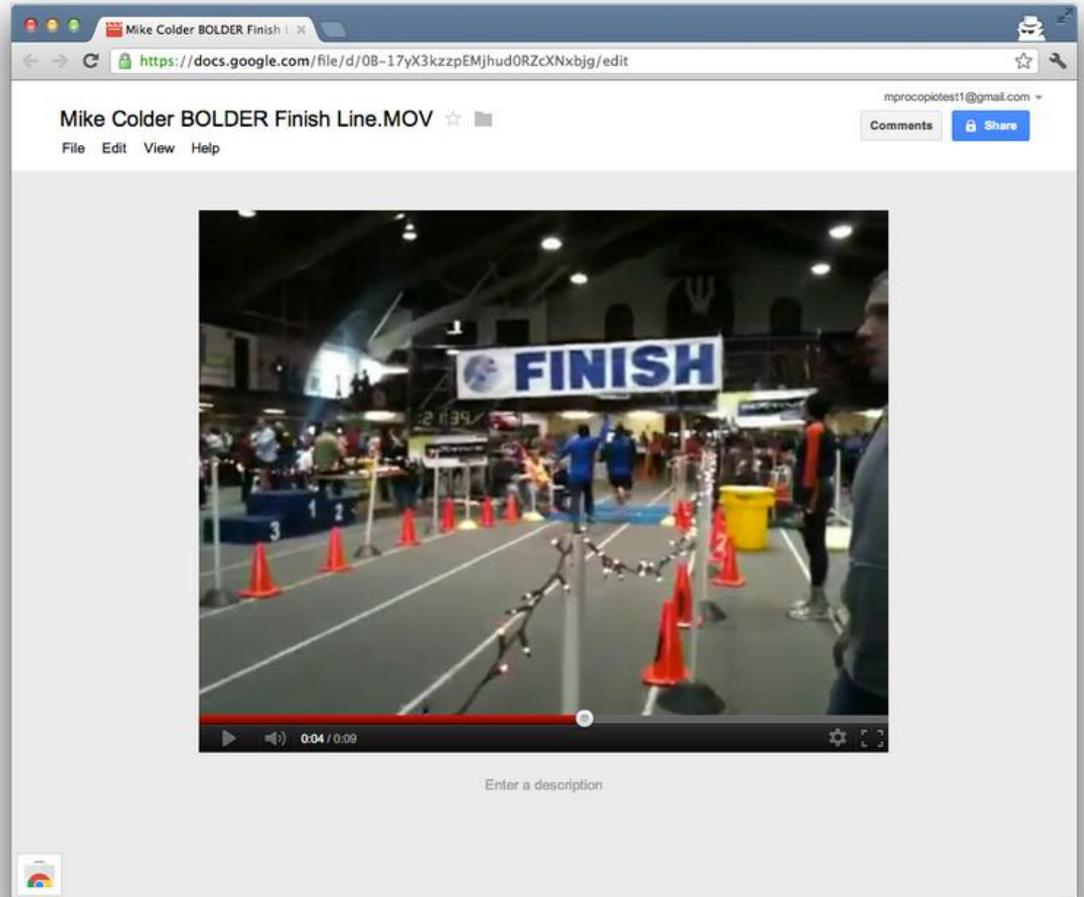
Preview photos of places you wish you were visiting on vacation.



Google Drive Viewer

Watch that video of you getting second place in that 5K over and over.

(But not because you're bitter or anything.)



Built-in Apps and File Previewer - Just a Start

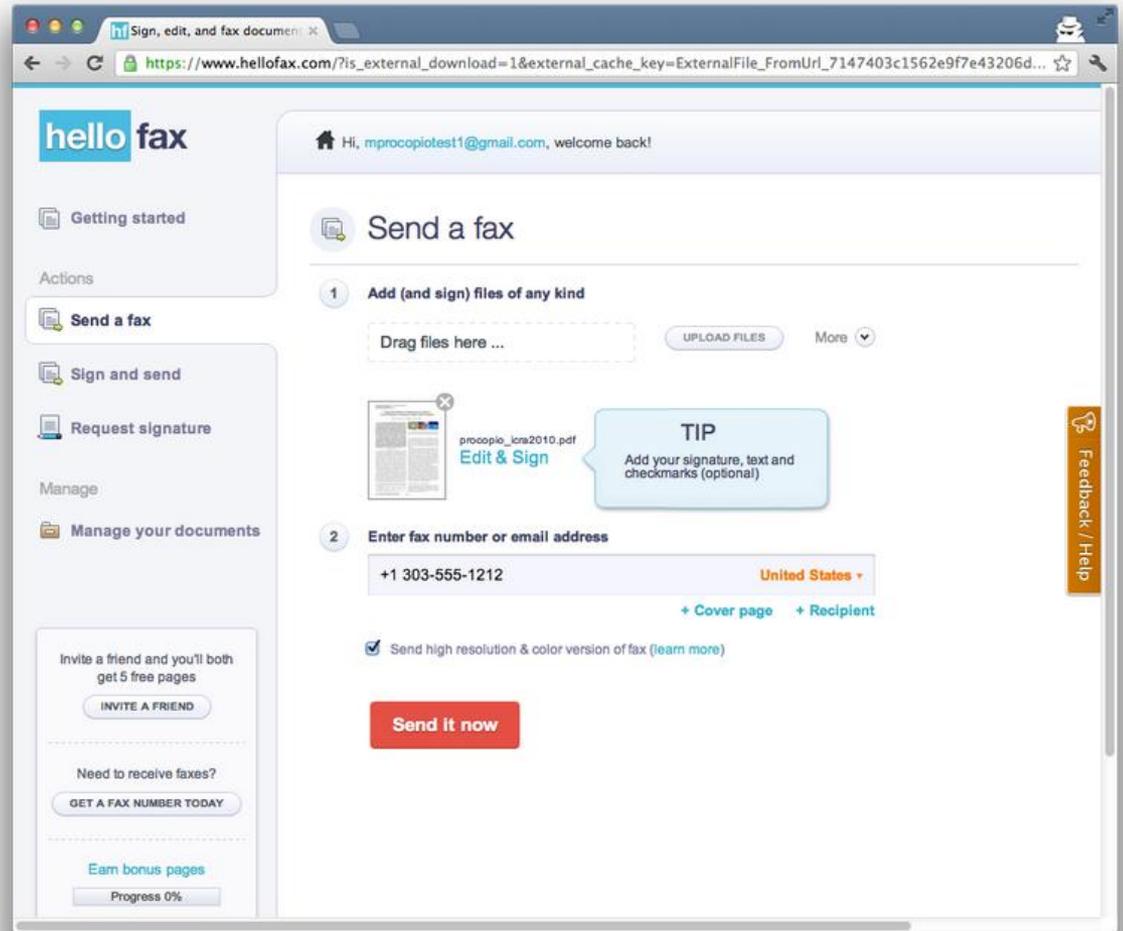
As an ecosystem, we can do better for the user.



HelloFax

Do something useful with that PDF.

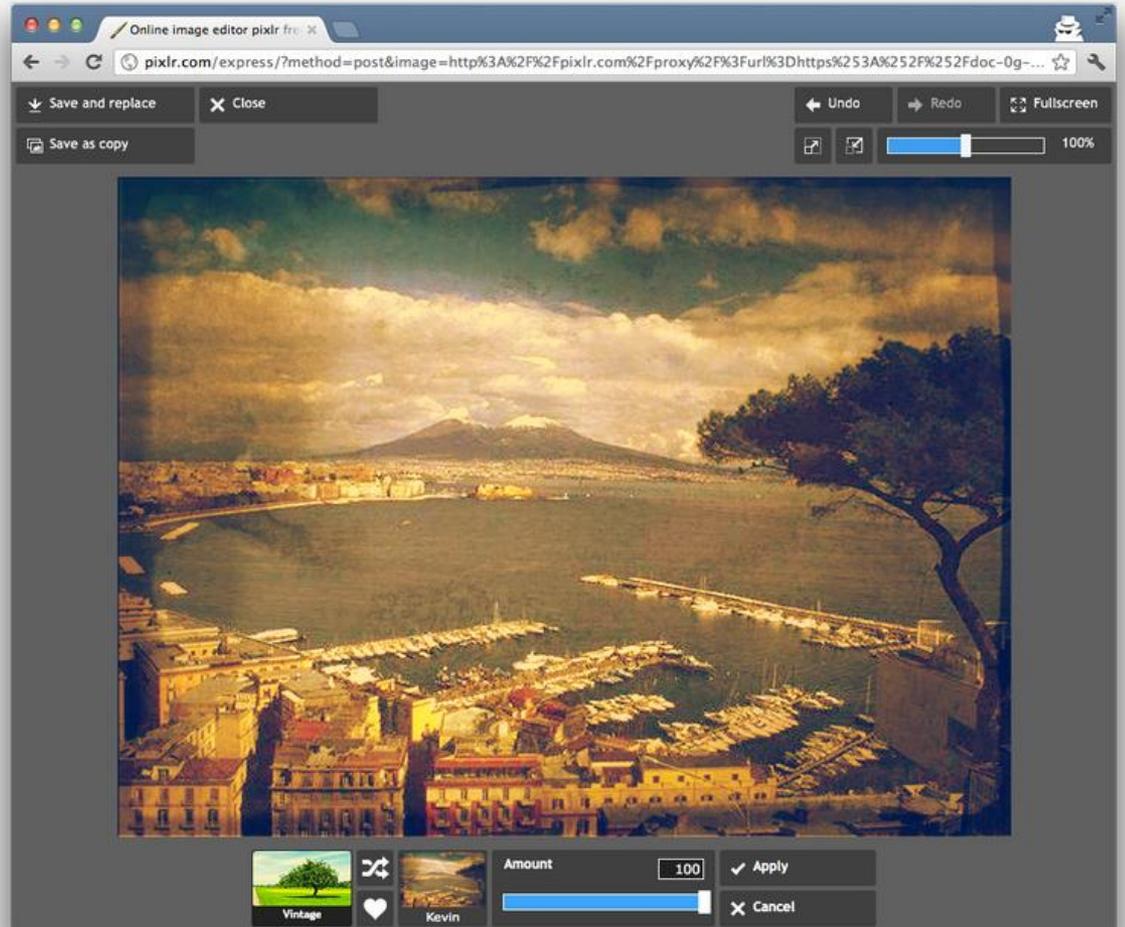
Fax your PDFs to all your friends for that ultimate "offline" consumption experience.



Pixlr Image Editor

Give your photos that vintage look.

(And instantly boost your social networking street cred.)



Pixlr Image Editor

Give your photos that vintage look

(And instantly boost your social networking street cred.)

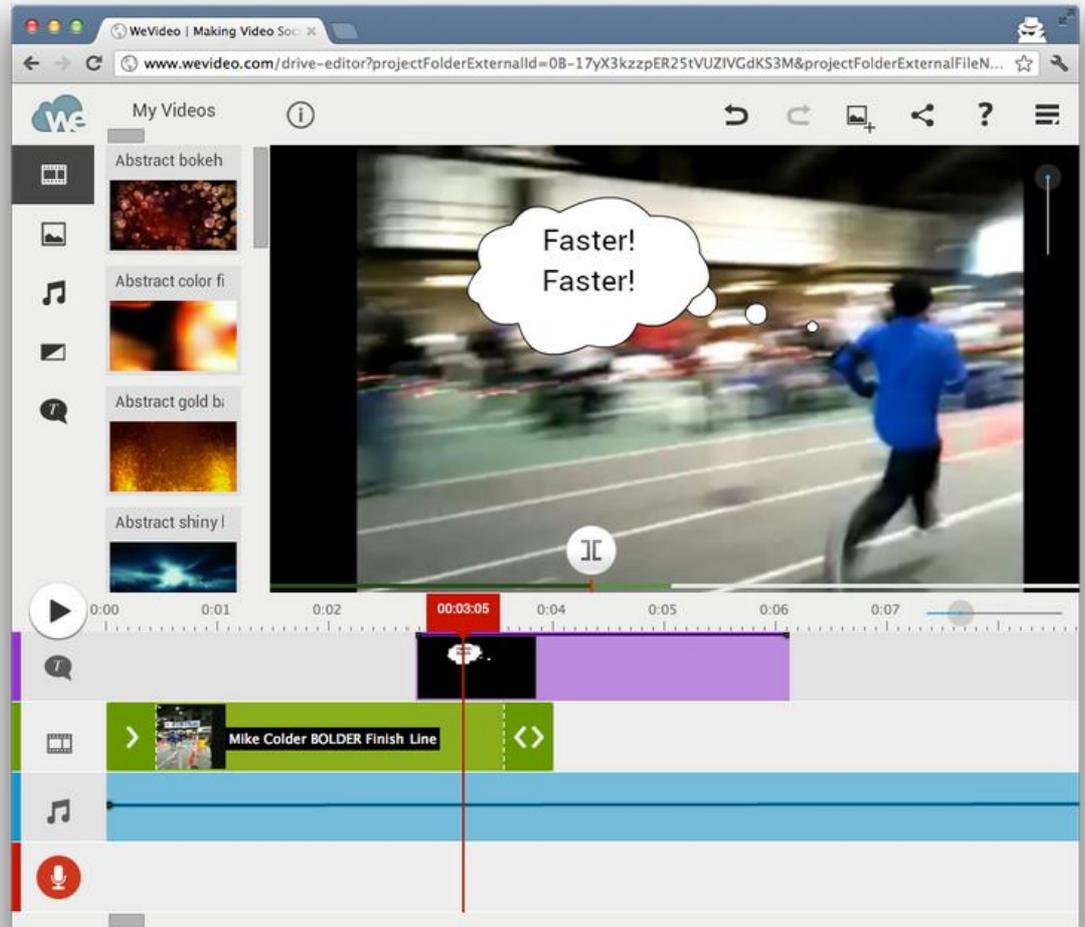
Or make lolcat memes. Your choice.



WeVideo

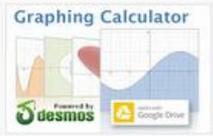
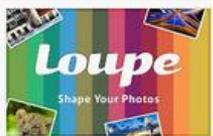
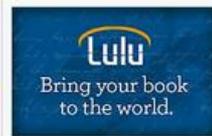
Don't just watch video. Edit it.

(Your friends don't need to know you only got second place...)



Apps bring life to the ecosystem

Fax | Edit | Render | Graph | Draw | Diagram | Sign | Publish | Map | Chart | Listen | Mock | Plan

 <p>AutoCAD WS ★★★★★</p> <p>use AutoCAD wherever you are</p>	 <p>Lucidchart: Diagramming ★★★★★</p> <p>397,018 users</p>	 <p>Graphing Calculator ★★★★★</p> <p>138,340 users</p>	 <p>Pixlr Editor ★★★★★</p>	 <p>Read books ★★★★★</p> <p>12,055 users</p>	 <p>Aviary for Google Drive ★★★★★</p> <p>26,871 users</p>	 <p>Pixorial Video ★★★★★</p> <p>10,838 users</p>	 <p>Maps Jedi ★★★★★</p>
 <p>PicMonkey ★★★★★</p> <p>152,452 users</p>	 <p>SlideRocket ★★★★★</p> <p>247,869 users</p>	 <p>Loupe ★★★★★</p> <p>Shape Your Photos</p>	 <p>Ganttter ★★★★★</p> <p>FREE project scheduling</p>	 <p>Balsamiq Mockups ★★★★★</p> <p>27,934 users</p>	 <p>DocuSign ★★★★★</p> <p>17,978 users</p>	 <p>InstallFree NEXUS with Microsoft Office ★★★★★</p> <p>11,948 users</p>	 <p>GeoGebra ★★★★★</p> <p>GeoGebra is free dynamic mathematics software for all levels of education that joins geometry, algebra, graphing, and calculus.</p> <p>+ ADD TO CHROME</p>
 <p>Floorplanner ★★★★★</p> <p>104,674 users</p>	 <p>WeVideo for Google Drive ★★★★★</p> <p>Powerful collaborative video editing</p>	 <p>Marqueed ★★★★★</p> <p>Collect, and Discuss Images</p>	 <p>HelloFax - Free Online Faxing... ★★★★★</p> <p>80,832 users</p>	 <p>InstallFree NEXUS with LibreOffice ★★★★★</p>	 <p>RightSignature ★★★★★</p> <p>3,571 users</p>	 <p>Diagramly ★★★★★</p>	 <p>DriveTunes ★★★★★</p> <p>1,637 users</p>
 <p>Smartsheet Project Management... ★★★★★</p> <p>64,296 users</p>	 <p>Pixlr Express ★★★★★</p> <p>88,098 users</p>	 <p>MindMeister ★★★★★</p> <p>68,248 users</p>	 <p>OAuth 2.0 Playground ★★★★★</p>	 <p>Revisu ★★★★★</p>	 <p>Lulu One-Click Publishing ★★★★★</p> <p>Bring your book to the world.</p>	 <p>tottepost ★★★★★</p>	 <p>Lucidchart for Education ★★★★★</p> <p>1,854 users</p>



Integrate with the Google Drive SDK

Create | Open | Manage | Search | Share | Add Revisions

Manage apps

The following apps have been added to Drive. [Get more apps](#) [Learn more](#)

-  **AutoCAD WS**
 Use by default Options
-  **Balsamiq Mockups**
 Use by default Options
-  **HelloFax - Free Online Faxing & Signing** Options
-  **Loupe** Options
-  **Pixlr Express** Options

OK

Drive

My Drive > Working

CREATE 

- Document
- Presentation
- Spreadsheet
- Form (Freebird)
- Form
- Drawing
- Folder
- More
- From template...

TITLE
 napoli.jpg
 Lorem Ipsum
 Lorem Ipsum
 Lorem Ipsum
 Table (beta)
 HelloFax - Free Online Faxing & Signing
 Loupe Collage
 Pixlr Express
 Pixorial Video
 WeVideo for Google Drive
 Wireframe (with Balsamiq Mockups)

[Get more apps](#)

Drive

My Drive > Working

CREATE 

TITLE	OWNER
<input checked="" type="checkbox"/>  napoli.jpg	me
<input type="checkbox"/>  Lorem Ipsum	

- Google Drive Viewer
- HelloFax - Free Online Faxing & Signing
- Pixlr Express
- Get more apps

- Open
- Open with
- Share...
- Add star
- Don't show in Activity list
- Organize...
- Rename...
- Mark as unviewed

Download Google Drive



Build Awesome Apps

Vibrant and Polished

- Apps that:
 - Are secure
 - Put the user first
 - Integrate well with Drive
- Let's look at 9 things you can do to get there.





Here's how to make your app rock



UX matters

“A *foolish* consistency is the hobgoblin of little minds”

Ralph Waldo Emerson



2/3

users
struggled with
basic tasks
like renaming
files!



Source: Google Internal UX study on Drive Apps

File Info

Navigation & File operations

Account Info

Collaboration

Content

>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Vestibulum rhoncus, tellus sed porttitor laoreet, sapien velit rutrum urna, et tempor neque arcu a orci. Fusce arcu ante, lacinia vitae mattis non, pulvinar non lectus. Suspendisse justo velit, pellentesque non fermentum nec, sollicitudin nec erat. Sed a magna non ipsum pellentesque sollicitudin. Aliquam erat volutpat. Sed nisl lacus, venenatis ut dapibus a, vehicula vel quam. Aenean mi neque, volutpat vel congue at, rhoncus quis augue. Nulla sed mollis tellus. Suspendisse ultrices ullamcorper sem ac aliquam.

In et leo ac libero faucibus fermentum. Praesent pellentesque mi nec nunc malesuada non ornare libero aliquam. Integer eget posuere eros. Curabitur porta sodales ornare. Duis leo lectus, consectetur vel accumsan ac, luctus ut metus. Suspendisse accumsan lorem id felis iaculis cursus. Aenean laoreet euismod arcu, eget molestie purus congue ac. Curabitur est nisi, lacinia quis suscipit in, interdum vel turpis. Quisque vitae commodo sem. Donec arcu lectus, feugiat ac scelerisque vitae, ultrices non dui. Sed at augue nisi.

Suspendisse aliquet turpis quis elit posuere consectetur. Nam in ultricies diam. In eget massa vel sem feugiat ultricies. Quisque quis vestibulum mauris. Suspendisse eget quam nulla. Donec eleifend sapien sit amet magna porttitor volutpat. Ut bibendum massa sit amet eros tincidunt nec mattis quam mollis. Phasellus enim purus, tempor quis scelerisque ac, elementum ac quam.





Go mobile

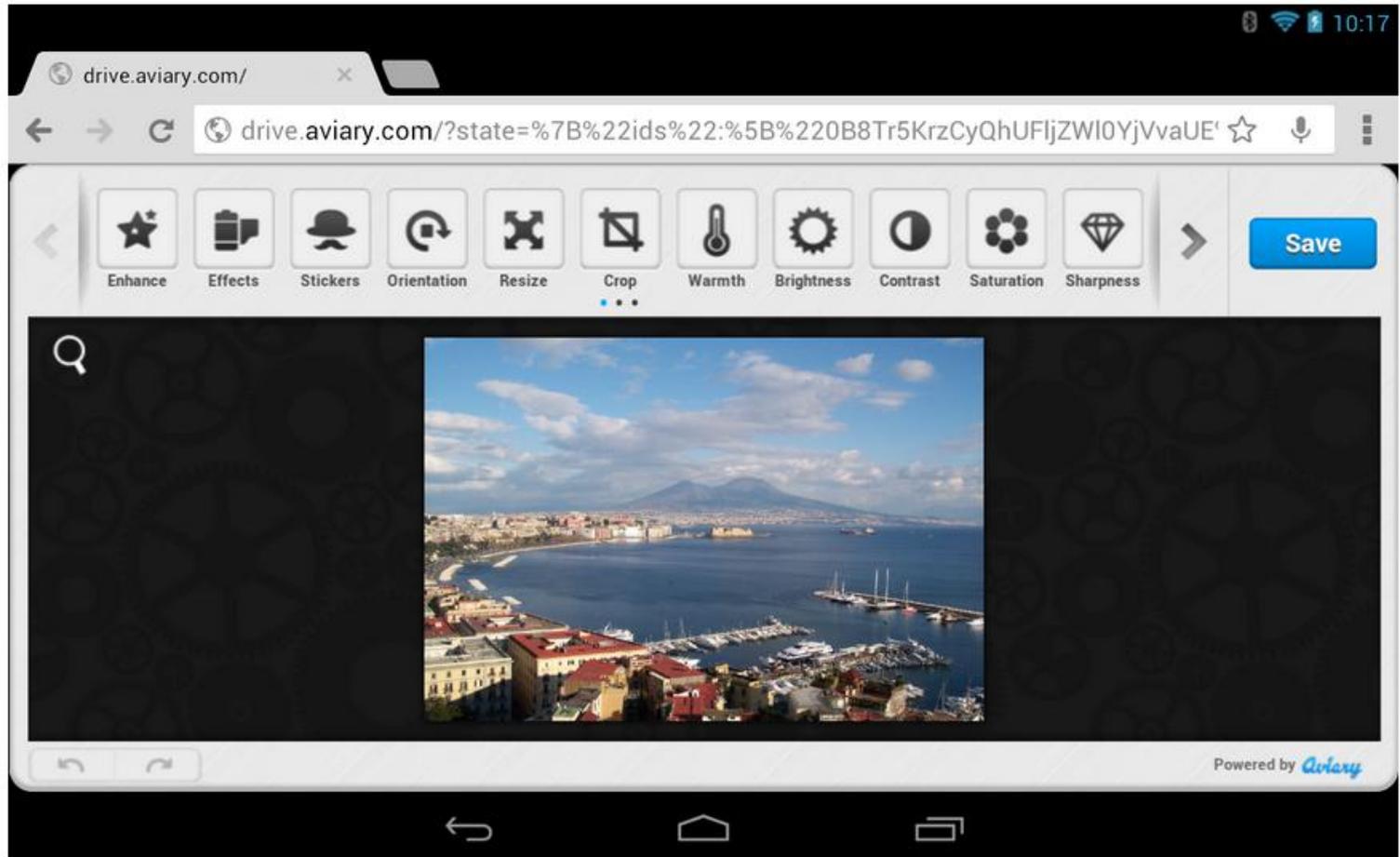
Drive is mobile

Access anywhere. Web, phone, tablet, Chrome OS.



Companion Mobile Apps: Use your app anywhere

Web-based experience on mobile device

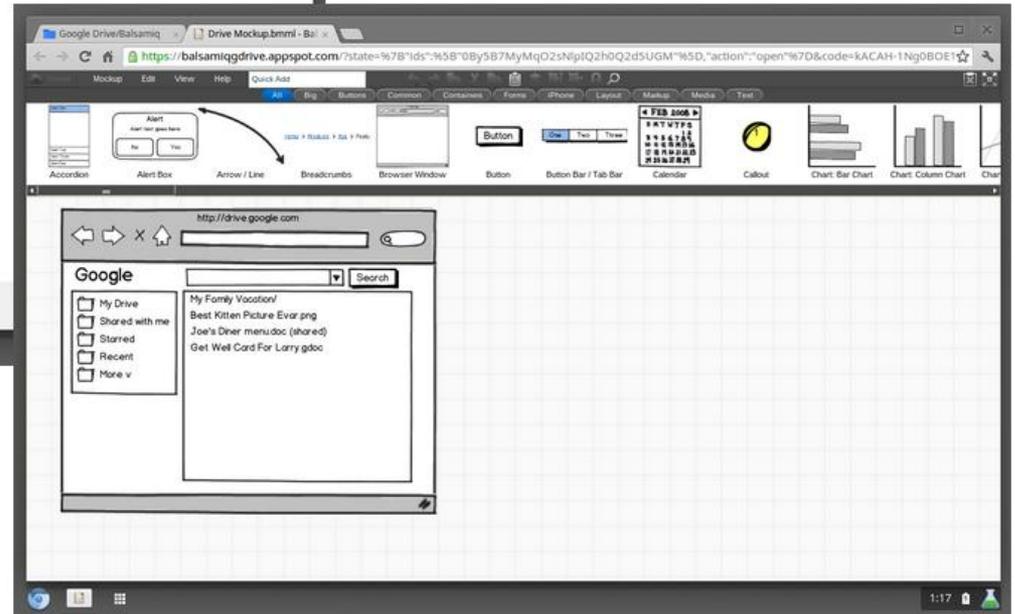
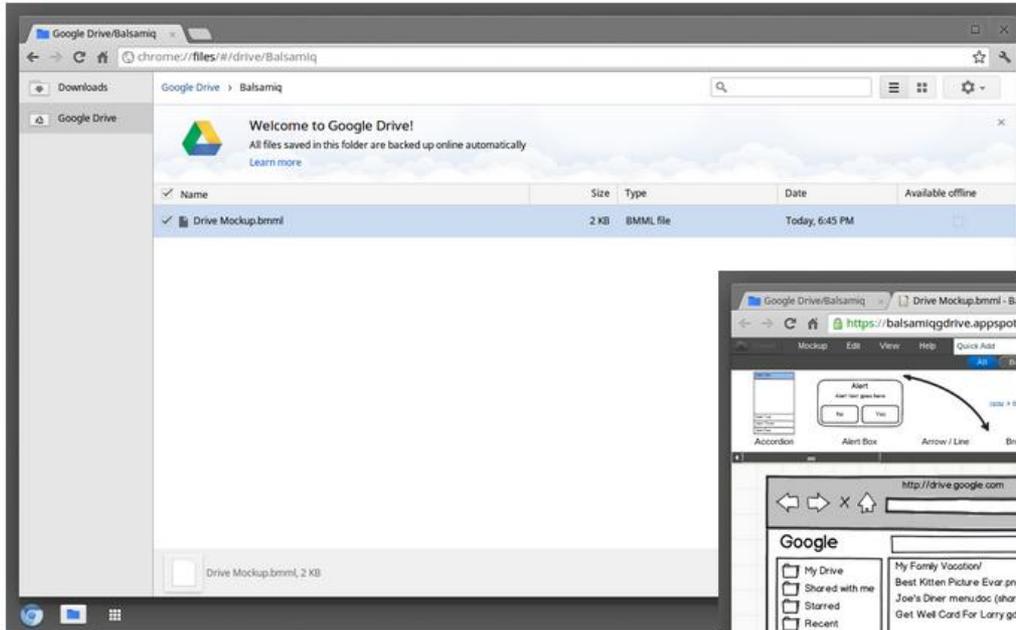


Companion Mobile Apps: Use your app anywhere

Native App experience



Full Drive App integration with **Chrome OS**





Open anywhere

Select a file



Google Docs

Upload



Select

Cancel

Picker

```
<script src="http://www.google.com/jsapi"></script>
```

HTML

```
google.setOnLoadCallback(initPicker);  
google.load('picker', '1');
```

JS

```
function initPicker() {  
    ... // Library ready  
}  
  
function showPicker() {  
    var picker = new google.picker.PickerBuilder()  
        .addView(new google.picker.DocsView())  
        .setCallback(pickerCallback)  
        .setAppId(YOUR_APP_ID)  
        .build();  
    picker.setVisible(true);  
}  
function pickerCallback(data) {  
    if (data[google.picker.Response.ACTION] == google.picker.Action.PICKED) {  
        // Do something!  
    }  
}
```





Be secure

Scopes with the Google Drive SDK

Full, file-specific, apps, read-only

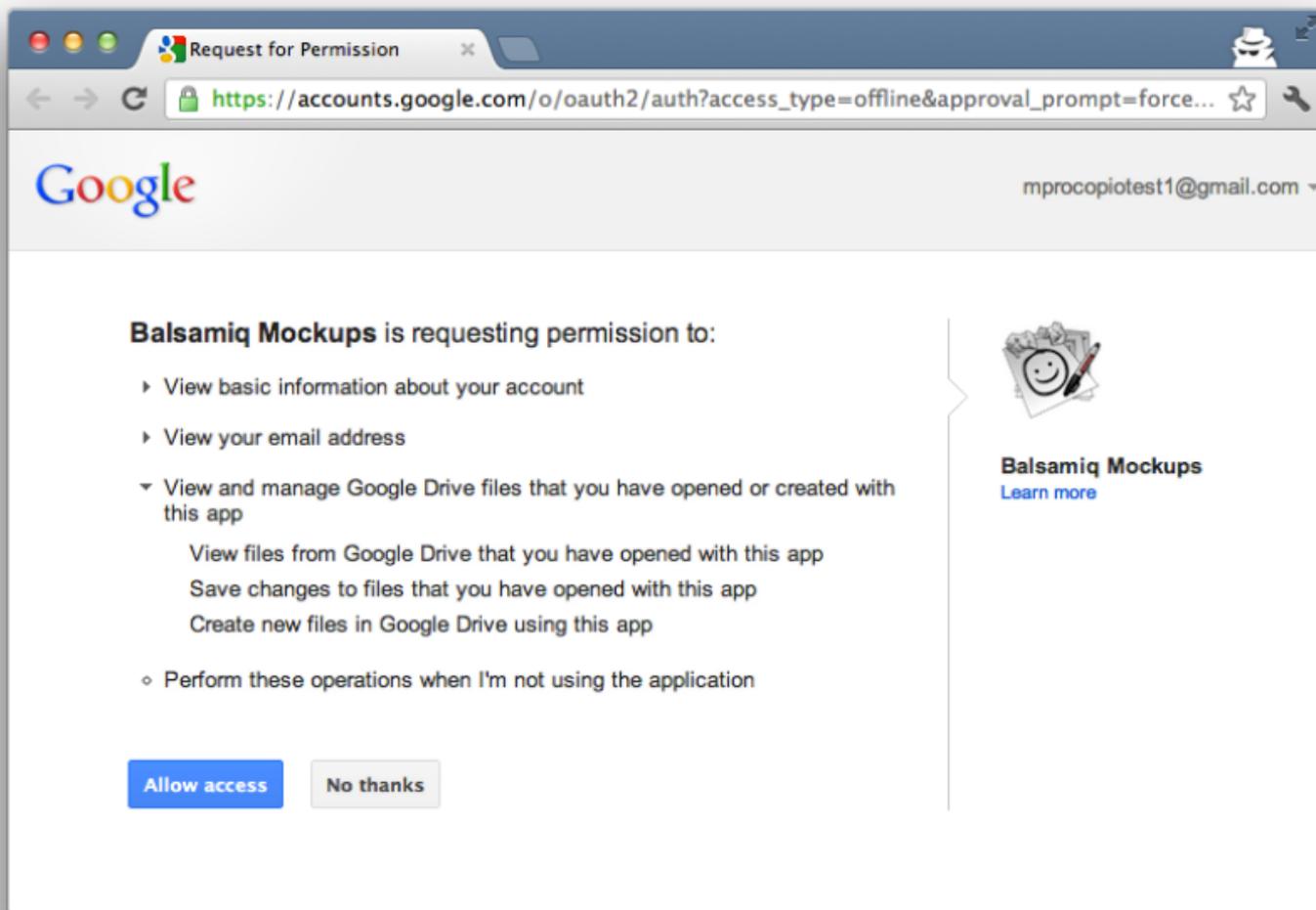
Scope	Meaning
https://www.googleapis.com/auth/drive.file	Per-file access to files created or opened by the app
https://www.googleapis.com/auth/drive	Full, permissive scope to access all of a user's files. Request this scope only when it is strictly necessary.
https://www.googleapis.com/auth/drive.apps	Allows apps access to the list of Drive apps a user has installed.
https://www.googleapis.com/auth/drive.readonly	Allows read-only access to file metadata and file content
https://www.googleapis.com/auth/drive.readonly.metadata	Allows read-only access to file metadata, but does not allow any access to read or download file content

Scopes with the Google Drive SDK

Narrow File-Specific Scope is best for you and your users

Scope	Meaning
https://www.googleapis.com/auth/drive.file	Per-file access to files created or opened by the app
https://www.googleapis.com/auth/drive	Full, permissive scope to access all of a user's files. Request this scope only when it is strictly necessary.
https://www.googleapis.com/auth/drive.apps	Allows apps access to the list of Drive apps a user has installed.
https://www.googleapis.com/auth/drive.readonly	Allows read-only access to file metadata and file content
https://www.googleapis.com/auth/drive.readonly.metadata	Allows read-only access to file metadata, but does not allow any access to read or download file content

Example Authorization Flow



The screenshot shows a web browser window with the title "Request for Permission". The address bar contains the URL: https://accounts.google.com/o/oauth2/auth?access_type=offline&approval_prompt=force.... The page header features the Google logo on the left and the email address "mprocopiotest1@gmail.com" on the right.

The main content area displays the following information:

Balsamiq Mockups is requesting permission to:

- ▶ View basic information about your account
- ▶ View your email address
- ▼ View and manage Google Drive files that you have opened or created with this app
 - View files from Google Drive that you have opened with this app
 - Save changes to files that you have opened with this app
 - Create new files in Google Drive using this app
- Perform these operations when I'm not using the application

At the bottom of the list, there are two buttons: "Allow access" (highlighted in blue) and "No thanks".

On the right side, there is a profile card for "Balsamiq Mockups" featuring a logo of a smiley face on a notepad and a pencil. Below the logo, the text "Balsamiq Mockups" is displayed, followed by a blue link "Learn more".



New File-Specific Scope

Authorization text

Google OAuth 2.0 Playground is requesting permission to:

- ▼ View and manage Google Drive files that you have opened or created with this app

View files from Google Drive that you have opened with this app

Save changes to files that you have opened with this app

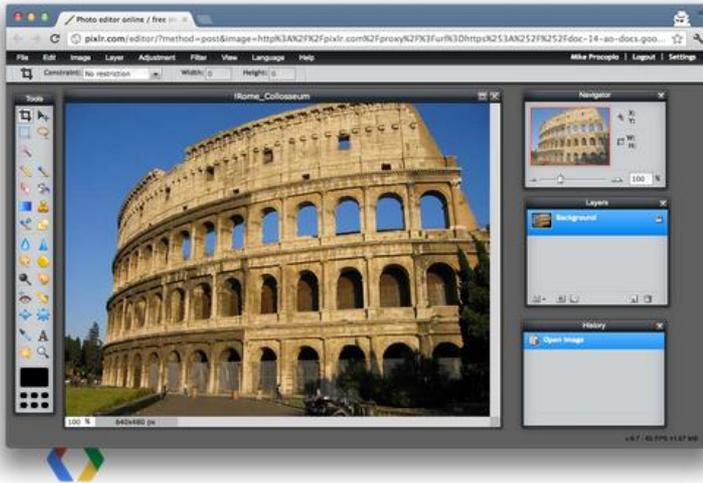
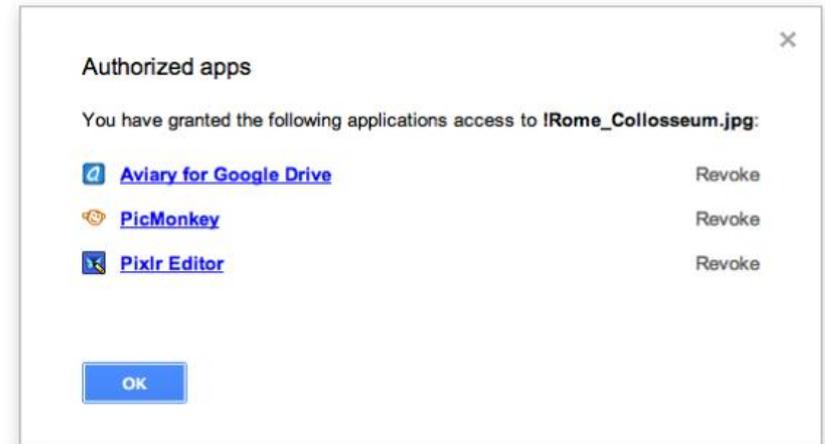
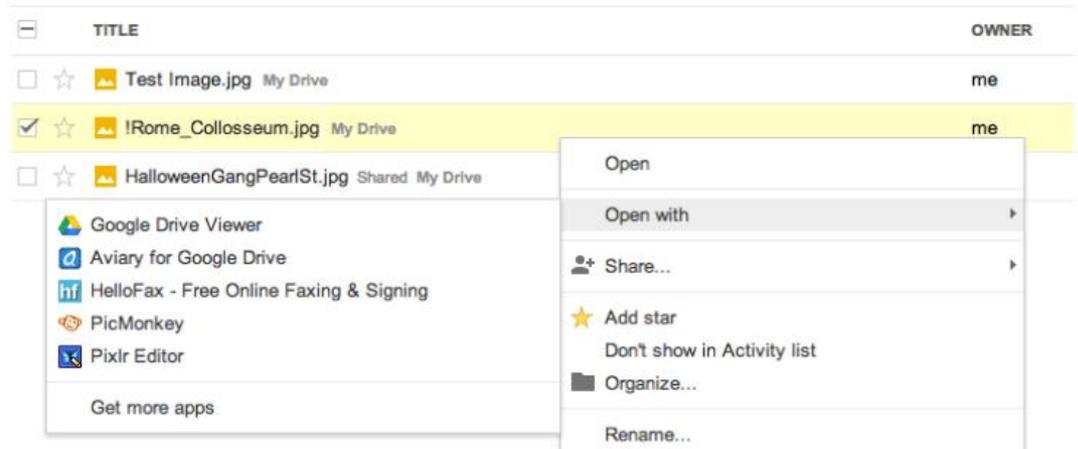
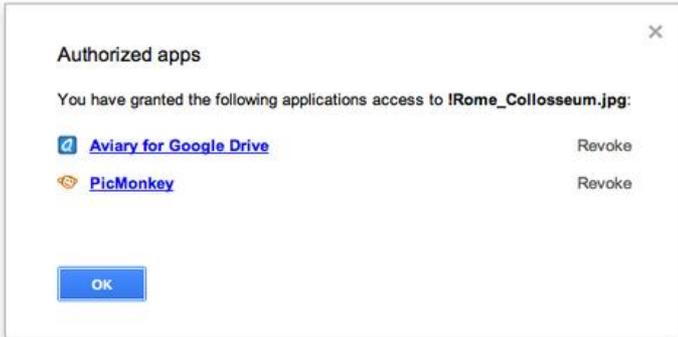
Create new files in Google Drive using this app



New File-Specific Scope - Demo



Demo (Backup)





Make sharing *easy*

Sharing settings

Link to share (only accessible by collaborators)

<https://docs.google.com/presentation/d/1RDZSP3ullipCqkCxEx3yNp5iCBGzb5HSrD6TlxDHaxA/edit>

Who has access

	Private - Only the people listed below can access	Change...
	Steven Bazyl (you) sbazyl@google.com	Is owner

Add people:

Editors will be allowed to add people and change the permissions. [\[Change\]](#)

[Done](#)

Sharing

```
<script src="https://apis.google.com/js/client.js"></script>
```

HTML

```
gapi.load('drive-share', initSharing);
```

```
function initSharing() {  
  .. // Library loaded  
}
```

```
function share(docId) {  
  var client = new gapi.drive.share.ShareClient(YOUR_APP_ID);  
  client.setItemIds([docId]);  
  client.showSettingsDialog();  
}
```

JS



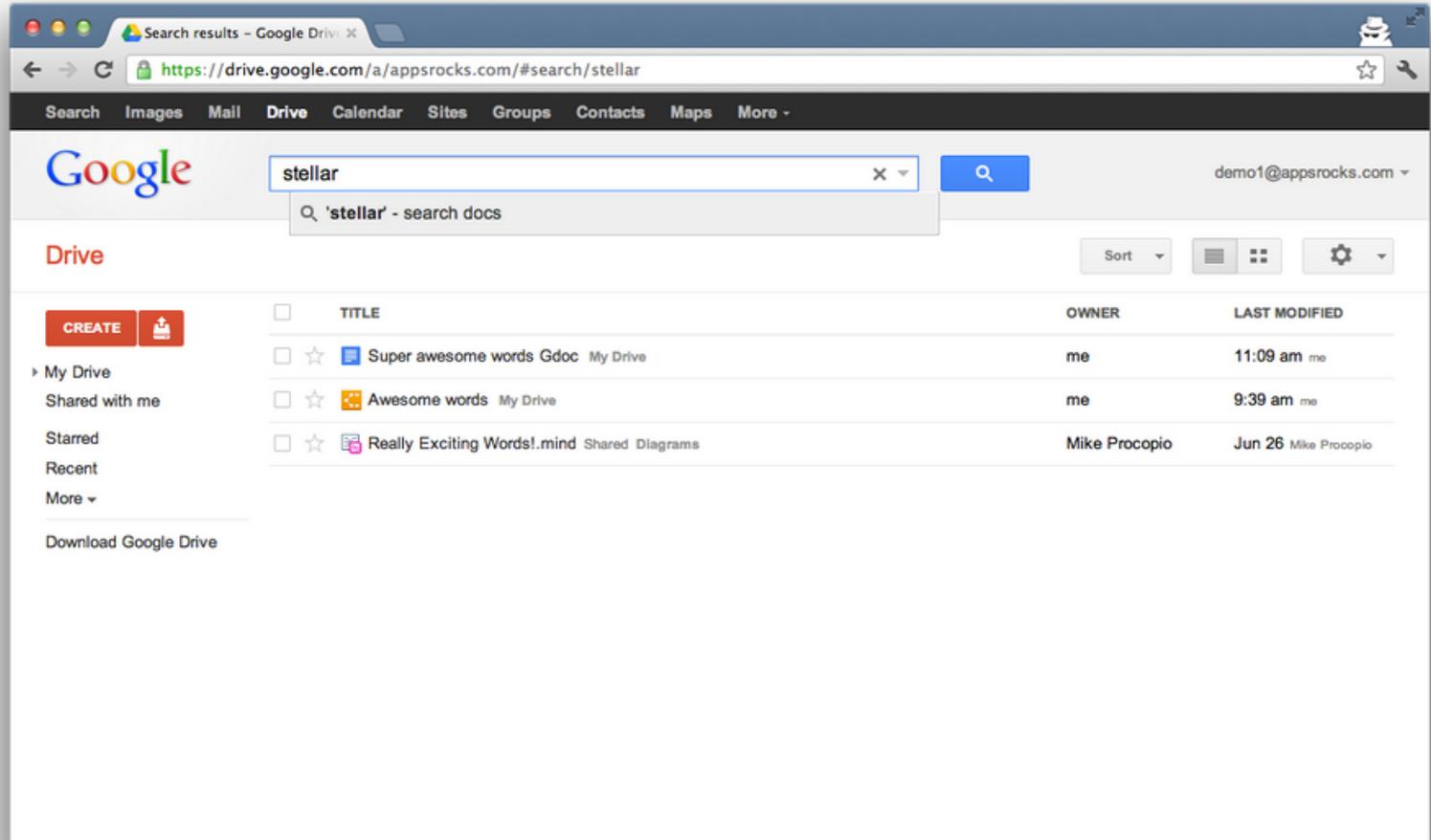
Be searchable

Setting IndexableText - Demo

Make the files created with your app discoverable with search!



Setting IndexableText - Demo (Backup)



The screenshot shows a web browser window displaying Google Drive search results. The address bar shows the URL `https://drive.google.com/a/appsrocks.com/#search/stellar`. The search bar contains the text "stellar" and a dropdown menu shows the suggestion "Q 'stellar' - search docs". The search results are displayed in a table with columns for "TITLE", "OWNER", and "LAST MODIFIED".

	TITLE	OWNER	LAST MODIFIED
<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> Super awesome words Gdoc My Drive	me	11:09 am me
<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> Awesome words My Drive	me	9:39 am me
<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> Really Exciting Words!.mind Shared Diagrams	Mike Procopio	Jun 26 Mike Procopio



Setting IndexableText - Demo (Backup)

The screenshot displays the MindMeister web interface. The central mind map has a root node 'Spectacular' (blue rounded rectangle) with several branches:

- 'Stunning' (white rounded rectangle with a smiley icon)
- 'Fabulous' (white rounded rectangle with a flag icon)
- 'Fab' (white rounded rectangle)
- 'Stellar' (white rounded rectangle with a brown briefcase icon)
- 'Phenomenal' (white rounded rectangle)
- 'Astounding' (white rounded rectangle)
- 'Marvelous' (white rounded rectangle with pink text)
- 'Extraordinary' (white rounded rectangle with a green and orange bar chart icon)

The right sidebar contains the following sections:

- Properties**
 - Format**: Includes text size (a), bold (B), italic (I), and color (purple) options.
 - Icons & Images**: Includes a 'Recent Icons' section with a flag icon and an 'Images' section with a star icon.
 - Notes**: A large yellow sticky note area.
 - Links**, **Files**, **Tasks**: Tabbed sections.
 - Advanced...**: A link to advanced settings.

The bottom status bar shows 'Currently editing: No one else is editing this mind map' and a search bar.





Save early, save often

4/5

users
assumed
their work
was auto-
saved



Source: Google Internal UX study on Drive Apps

Autosave complexities

Mutations vs. Blobs
Quota vs. Timeliness
Frequency vs. History



Autosave psuedocode

```
var autosaver = setInterval(function() {  
  if (dirty()) {  
    var newRev = timeSinceLastSave() > HOUR; // Been a while...  
    save(newRev); // New revision  
  }  
}, 30000); // Autosave every 30 seconds if dirty  
  
$('#saveButton').click(function() {  
  save(true); // Explicit save, create new revision  
});
```

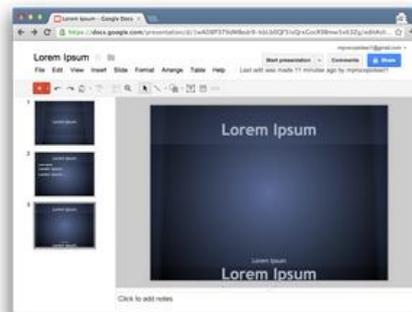
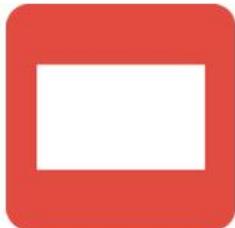
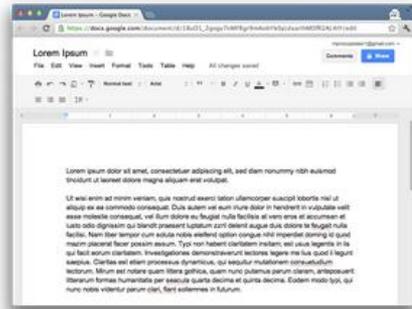
JS





Open Google Docs Types

Directly Open Google Docs with your App



Example Export Formats

Google Doc Format	Conversions Format	Corresponding MIME type
Documents	HTML	text/html
	Plain text, Rich text	text/plain, application/rtf
	Open Office doc	application/vnd.oasis.opendocument.text
	PDF	application/pdf
Spreadsheets	MS Excel	application/vnd.ms-excel
	Open Office sheet	application/x-vnd.oasis.opendocument.spreadsheet
Drawings	JPEG, PNG, SVG	image/jpeg, image/png, image/svg+xml
	PDF	application/pdf
Presentations	MS PowerPoint	application/vnd.openxmlformats-officedocument.presentationml.presentation
	Open Office, PDF	application/pdf



Setting up your app for this is simple

In APIs Console, Specify your MIME types, check the "Import" checkbox

Default MIME Types

List MIME types that your application can open. Users can make your application open files with these MIME types by default.

1. ×
2.

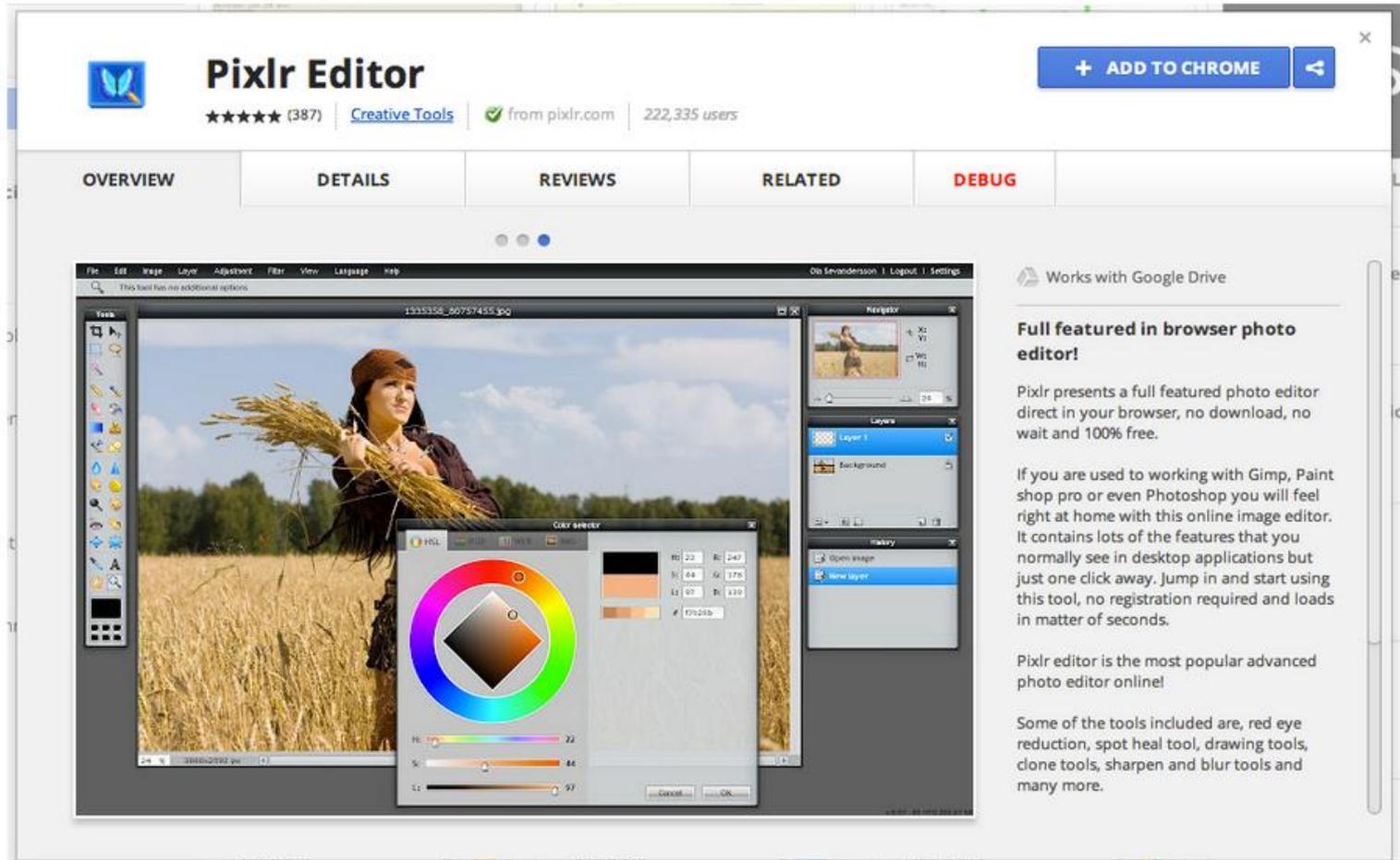
Import

Allow users to open files that can be converted to a format that this app can open



Be discoverable

The CWS page is your chance to sell your app!



Pixlr Editor

★★★★★ (387) | [Creative Tools](#) |  from pixlr.com | 222,335 users

[+ ADD TO CHROME](#)

OVERVIEW | DETAILS | REVIEWS | RELATED | **DEBUG**

Works with Google Drive

Full featured in browser photo editor!

Pixlr presents a full featured photo editor direct in your browser, no download, no wait and 100% free.

If you are used to working with Gimp, Paint shop pro or even Photoshop you will feel right at home with this online image editor. It contains lots of the features that you normally see in desktop applications but just one click away. Jump in and start using this tool, no registration required and loads in matter of seconds.

Pixlr editor is the most popular advanced photo editor online!

Some of the tools included are, red eye reduction, spot heal tool, drawing tools, clone tools, sharpen and blur tools and many more.



Viral adoption



No preview available

This item was created with **Balsamiq Mockups**, a Google Drive app.

By installing the app, you will get access to all of its features, including preview.

Install app

Download

[Get more apps](#)

Enter a description



Declaring file types

Chrome Web Store Manifest Example

```
"intents": {  
  "http://drive.google.com/intents/opendrivedoc": [  
    {  
      "type": ["text/plain",  
              "application/vnd.google.drive.ext-type.txt"],  
      "href": "https://www.yourapp.com/",  
      "title": "Open",  
      "disposition" : "window"  
    }  
  ]  
},  
...
```

HTML





Quick Recap

Recap

Nine things you can do to make your app **rock**:

1. Be consistent (UX matters)
2. Go mobile
3. Make sharing easy
4. Be secure
5. Open anywhere
6. Be searchable
7. Save early, save often (autosave)
8. Open Google Docs types
9. Be discoverable





Opportunity

What are you going to build?

Zillions of files stored in Drive...

Files of all types

Images

Videos

PDFs

Documents, Spreadsheets, and Presentations

Text and RTF files

HTML, XML and CSS

ZIP and RAR archives

Source code: JS, Java, PHP, Python, C#

How can we bring life to these files?

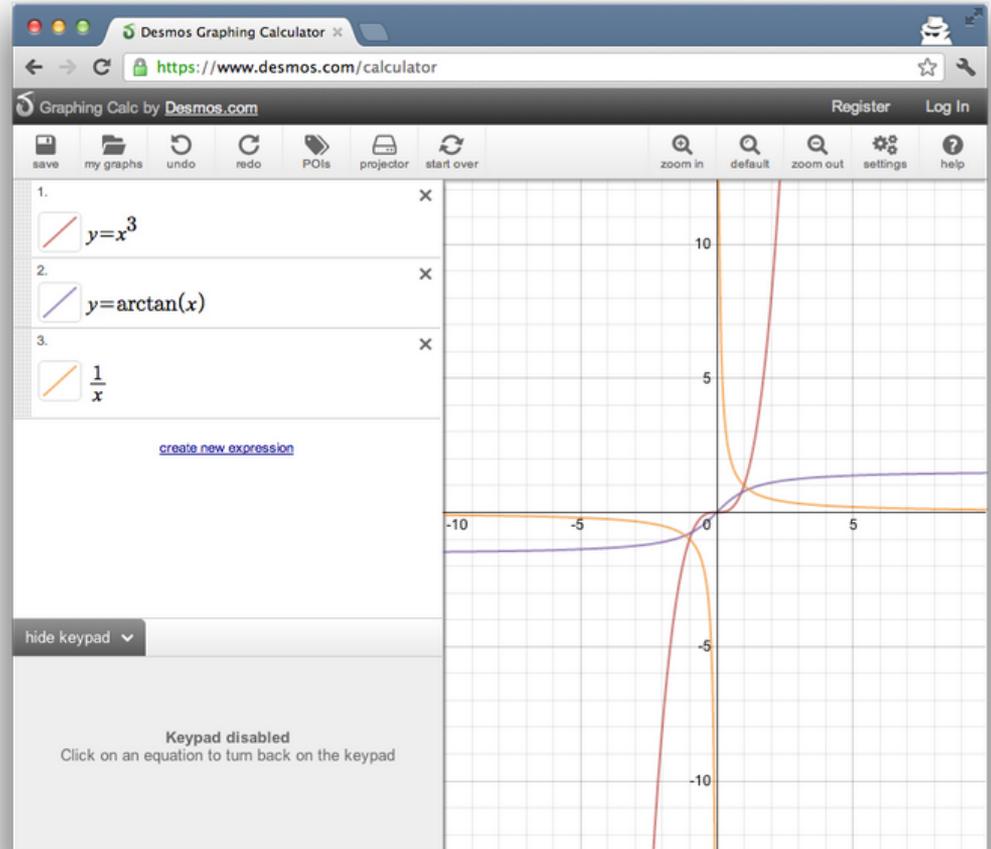
If we needed an app in the desktop days... we need it now in the cloud!



Add your own file type

Build new types of apps

- These apps are more about the capability, the experience...
- And less about the actual file (although state is stored in Drive).



We're here for you

Developer advocates & engineers standing by to accept your donation feature request



developers.google.com/drive

A screenshot of the Google Developers website for the Google Drive SDK. The page features a navigation bar with 'Home', 'Products', 'Events', 'Showcase', 'Live', and 'Groups'. The main content area is titled 'Integrate your app with Google Drive' and includes a list of benefits: 'Instantly reach millions of users', 'Let users store, create, and open files anywhere', and 'Leverage Google sharing, storage, and identity'. Below this, there are four sections: 'How Apps Work', 'Get Started', 'See Examples', and 'API Reference', each with a brief description and a small icon.

[google-drive-sdk on Stack Overflow](https://stackoverflow.com/questions/tagged/google-drive-sdk)

A screenshot of the Stack Overflow website showing a list of questions tagged with 'google-drive-sdk'. The page includes a navigation bar with 'Questions', 'Tags', 'Users', 'Badges', and 'Unanswered'. The main content area displays several questions, including 'How to POST a large file (+ 5 mb) from Blobstore to Google Drive?' and 'Append mode on Google Drive'. Each question shows the number of votes, answers, and views, along with the user's profile picture and name.



<Thank You! />

Get started with the SDK:
developers.google.com/drive

Get help on the Stack Overflow forum:
<http://stackoverflow.com/questions/tagged/google-drive-sdk>

Discover and install apps:
https://chrome.google.com/webstore/category/collection/drive_apps

And... Come and talk to us now!

Mike Procopio
googplus.org/mike
mikeprocopio.com

Steven Bazyl
profiles.google.com/sqrrrl

