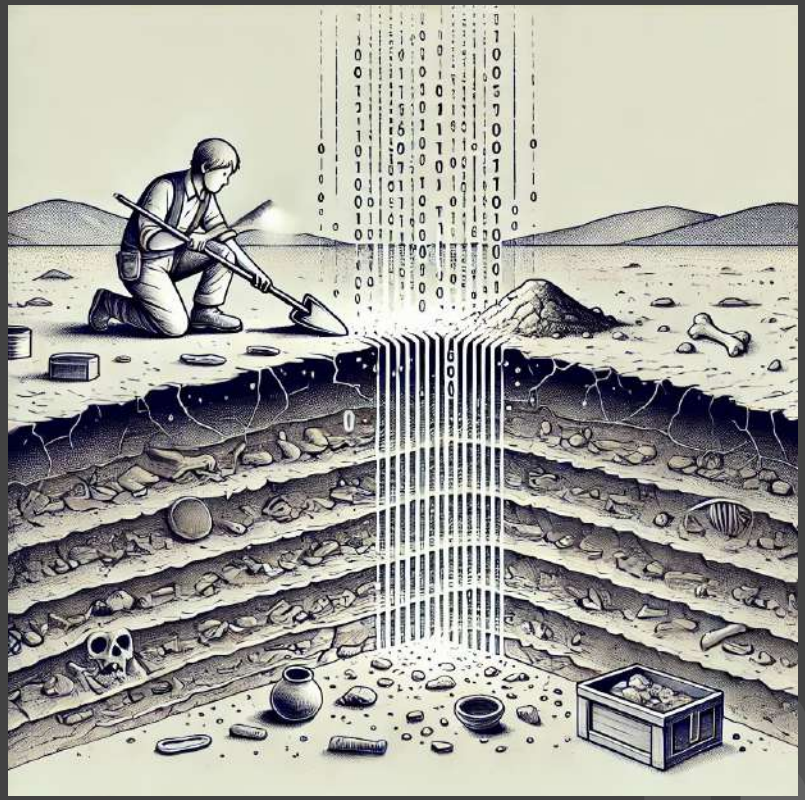
Unearthing the Past with PostgreSQL: How Open Source is Revolutionizing Digital Archaeology

Ophir Lojkine & Thomas Guillemard



Générée par Dall-e

Archeological data needs

What data do archaeologists work with ?

Building a web app in SQL

Quickly building web interfaces on top of a database, with SQLPage

Badmobil

The archaeological multi-tool, to collect and analyze on-site data

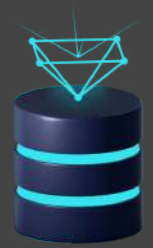
iNTHY

Ophir LOJKINE

Inthy (renewable mobility actor)

Long-time Open-Source Software contributor

sql.js, WBO whiteboard, dezoomify, **SQLPage**



SQLPage

Turns SQL queries into web pages and web applications

Builds UIs on top of databases

Open source tool (github.com/sqlpage)

Thomas Guillemard

Institut national de recherches archéologiques préventives (Inrap)

Archaeological Operations Manager

Geographic Information System (**GIS**) Coordinator & Trainer

RAMEN collective

Recherches Archéologiques en Modélisation de l'Enregistrement Numérique

Research and Development (Database, GIS)

Archaeology produces A LOT of data

Two main type of archaeology in France

Programmed archaeology

- On selected sites
- Specific research questions
- Associations, CNRS, University

excavation/training | studies

Preventive archaeology

- Before construction projects
- Evaluation of archaeological potential
- Diagnostics and excavations

excavation | studies

EXCAVATING = DESTRUCTION

Archaeology on paper

A LOT OF DATA…

- ➔ Everything that archaeologist **finds** is recorded
- ➔ Everything that archaeologist **does** is recorded
- ➔ **Many** specialists with **different methods**

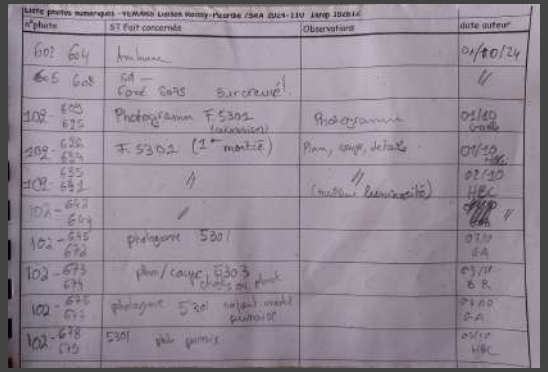
Archaeology and the beginning of digitization

More a clean-up than a recording…

Listing on paper → Listing on computer

Form on paper → Digital form

Drawing on paper → Digital drawing



	A	B	C	D	E
1	n° photo	description	date	auteur	observations
2	602	ambiance	01/10/24		
3	603	ambiance	01/10/24		
4	604	ambiance	01/10/24		
5	605	Sd. ? - F8075 (fossé)	01/10/24		Fossé surcreusé
6	606	Sd. ? - F8075 (fossé)	01/10/24		Fossé surcreusé
7	607	Sd. ? - F8075 (fossé)	01/10/24		Fossé surcreusé
8	608	Sd. ? - F8075 (fossé)	01/10/24		Fossé surcreusé
9	609	F5301 (crémation)	01/10/24	GB	photogrammétrie
10	610	F5301 (crémation)	01/10/24	GB	photogrammétrie
11	611	F5301 (crémation)	01/10/24	GB	photogrammétrie
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22	622	F5301 (crémation)	01/10/24	GB	photogrammétrie
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24	624	F5301 (crémation)	01/10/24	GB	photogrammétrie
25	625	F5301 (crémation)	01/10/24	GB	photogrammétrie
26	626	Plan, coupe et détail de la première moitié de la crémation F5301	01/10/24	HBC	plan, coupe, détail
27	627	Plan, coupe et détail de la première moitié de la crémation F5302	01/10/24	HBC	plan, coupe, détail
28	628	Plan, coupe et détail de la première moitié de la crémation F5303	01/10/24	HBC	plan, coupe, détail
29	629	Plan, coupe et détail de la première moitié de la crémation F5304	01/10/24	HBC	plan, coupe, détail
30	630	Plan, coupe et détail de la première moitié de la crémation F5305	01/10/24	HBC	plan, coupe, détail
31	631	Plan, coupe et détail de la première moitié de la crémation F5306	01/10/24	HBC	plan, coupe, détail
32	632	Plan, coupe et détail de la première moitié de la crémation F5307	01/10/24	HBC	plan, coupe, détail
33	633	Plan, coupe et détail de la première moitié de la crémation F5308	01/10/24	HBC	plan, coupe, détail

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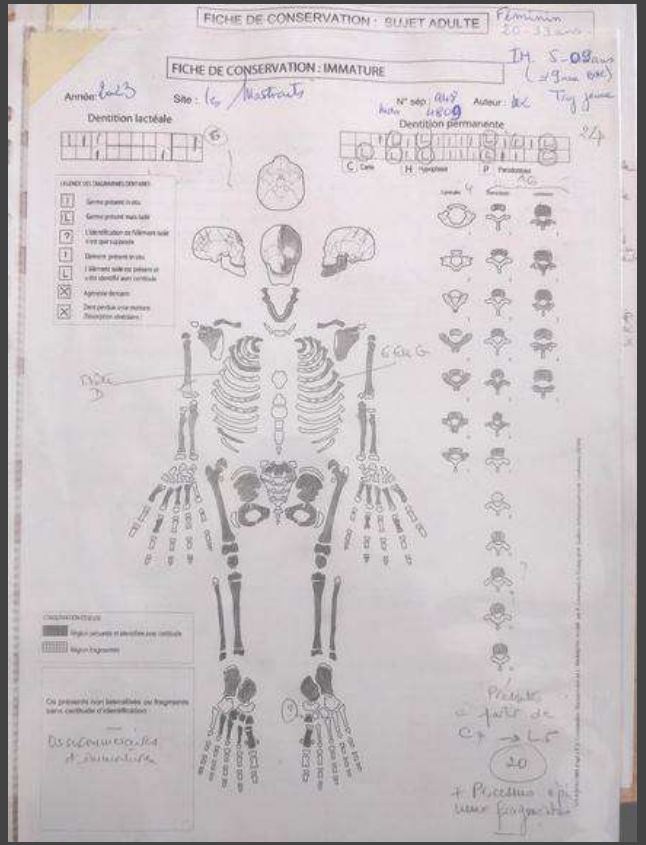
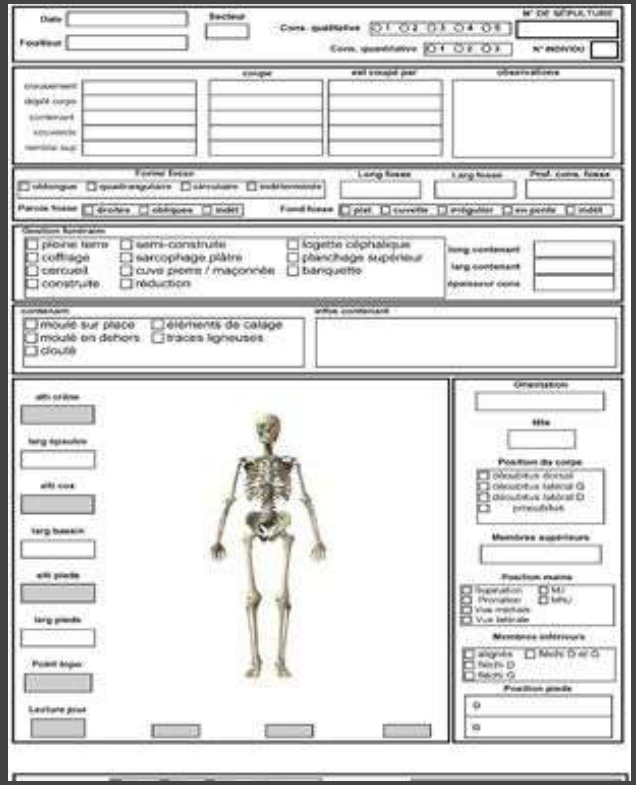
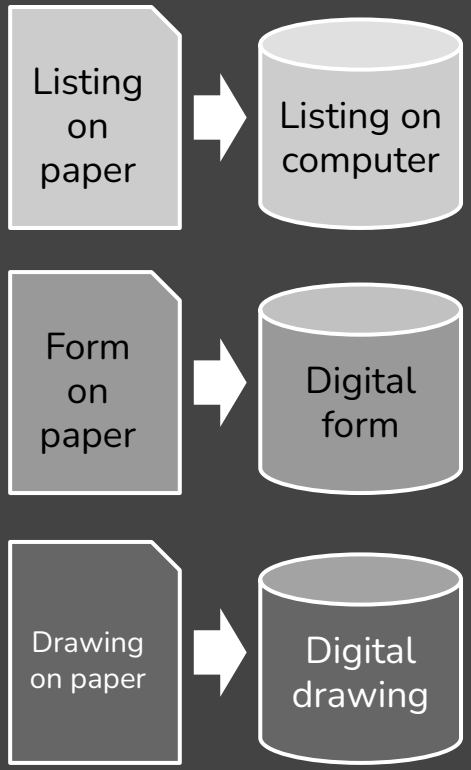
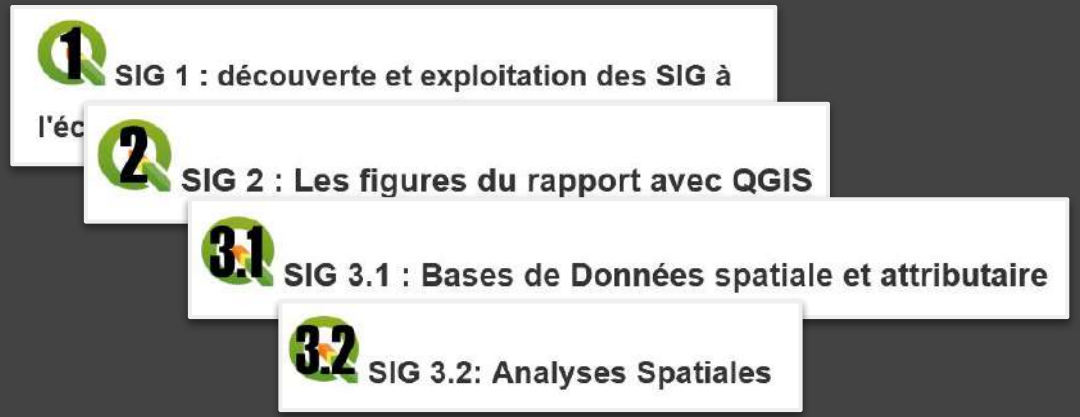




Archaeology and the beginning of digitization

More a clean-up than a recording…

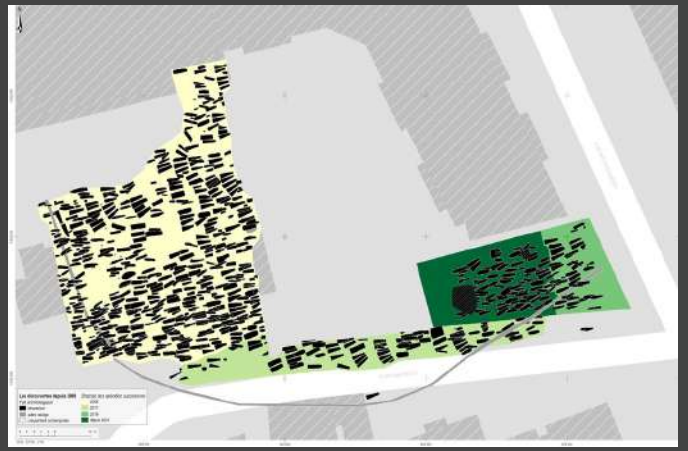




…Until

La Nécropole Numérique / The Digital Necropolis

The Mastraits necropolis at Noisy-le-Grand

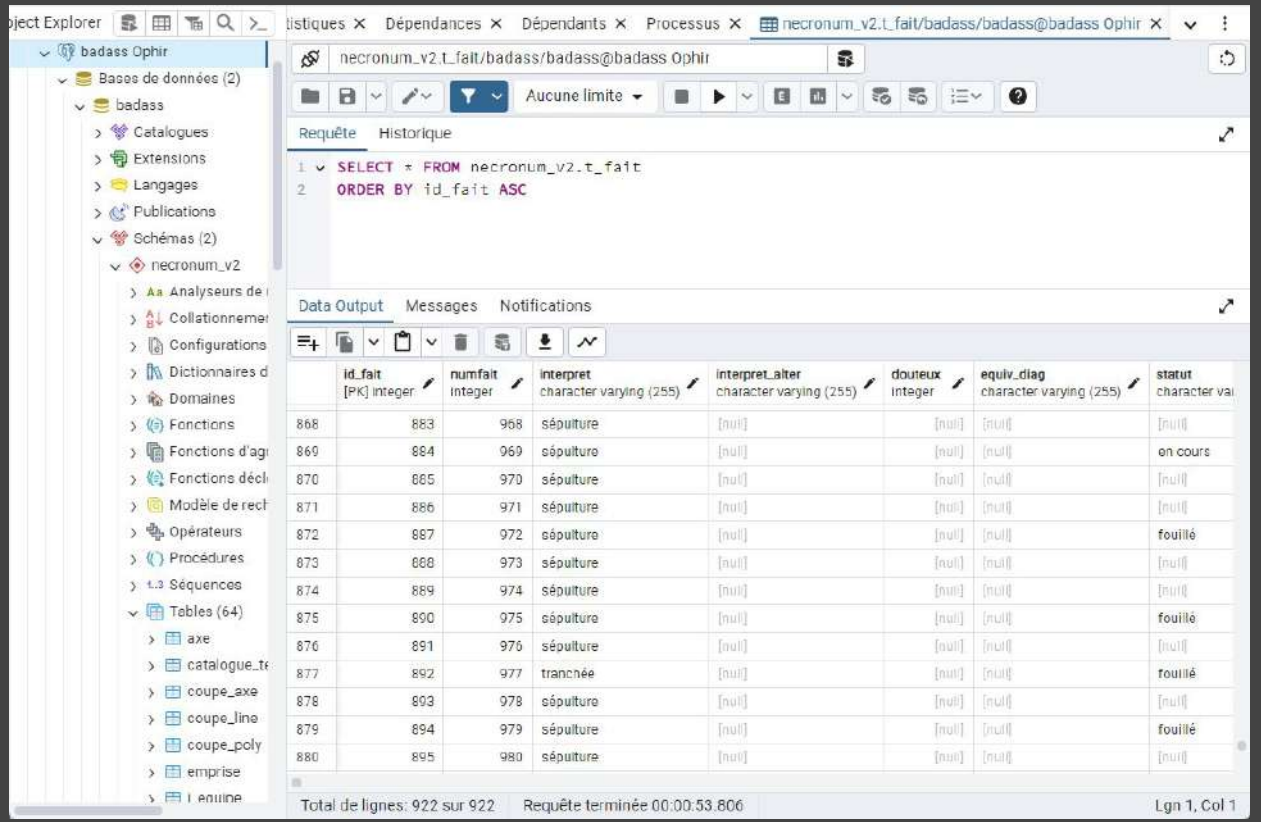


a medieval necropolis
programmed archaeology
near to Paris

No paper / all digital

The Badass project

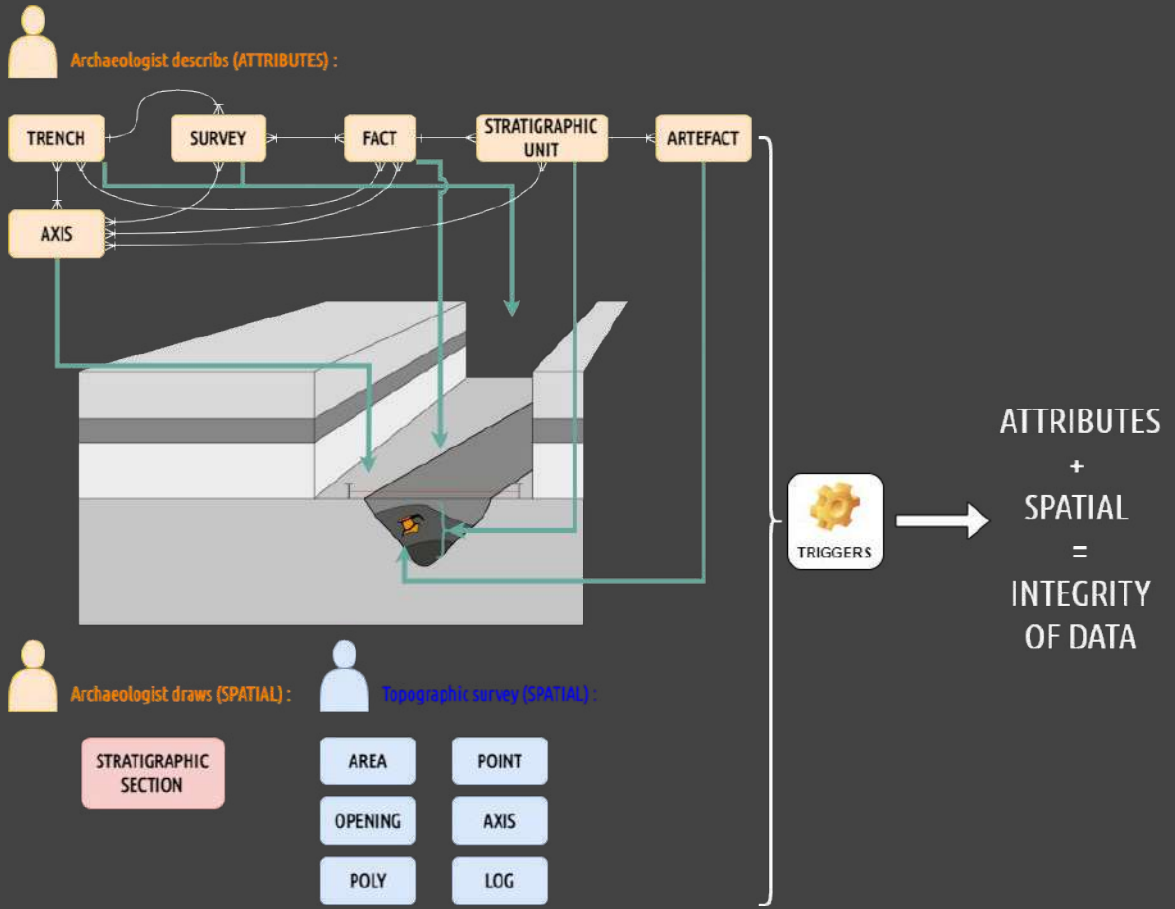
- the data - a Postgresql / Postgis database
- Structuring principle



The Badass project

the data - a Postgresql / Postgis database

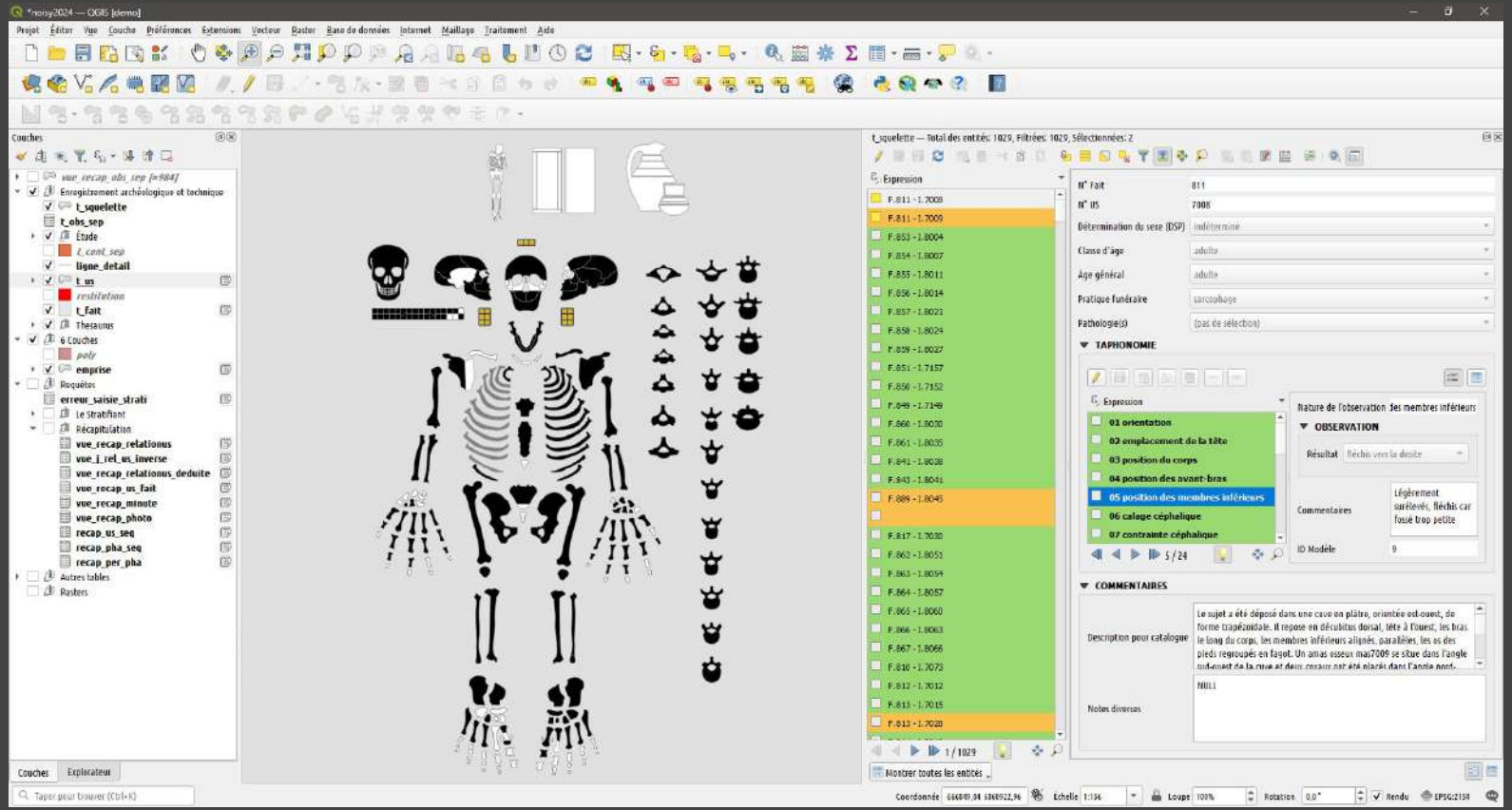
Structuring principle



The Badass project

the user interface - QGIS
a free and open source software

an add-on - Anthropology “Badass of the dead”



SQLPage: SQL to web pages

Turning SQL queries into web apps, fast.

Building a web app, without web dev

What ?

A single server executable that runs on your desktop or your server.

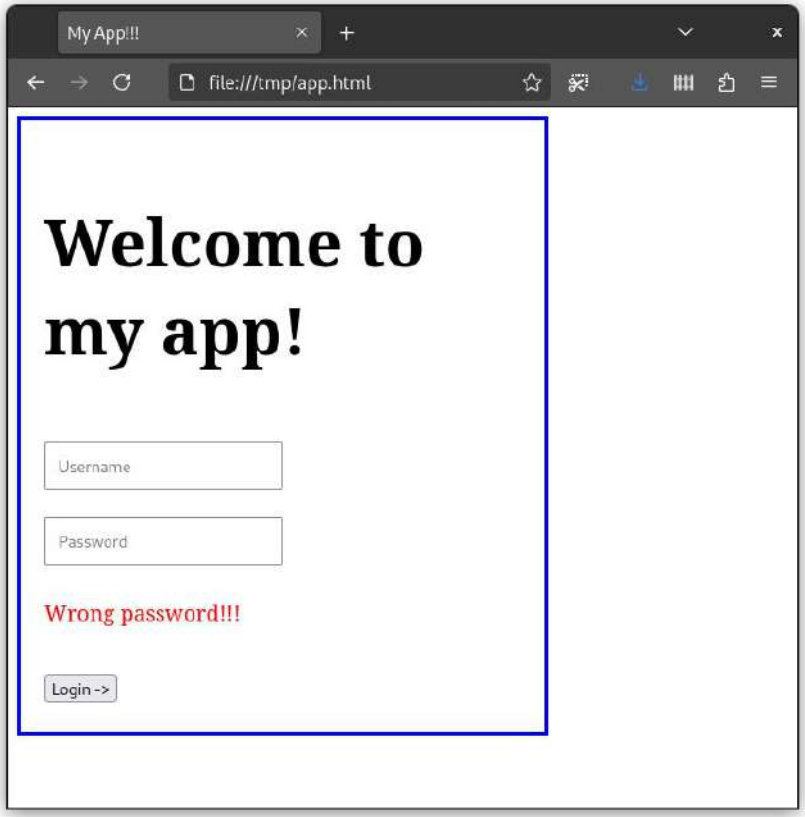
For whom ?

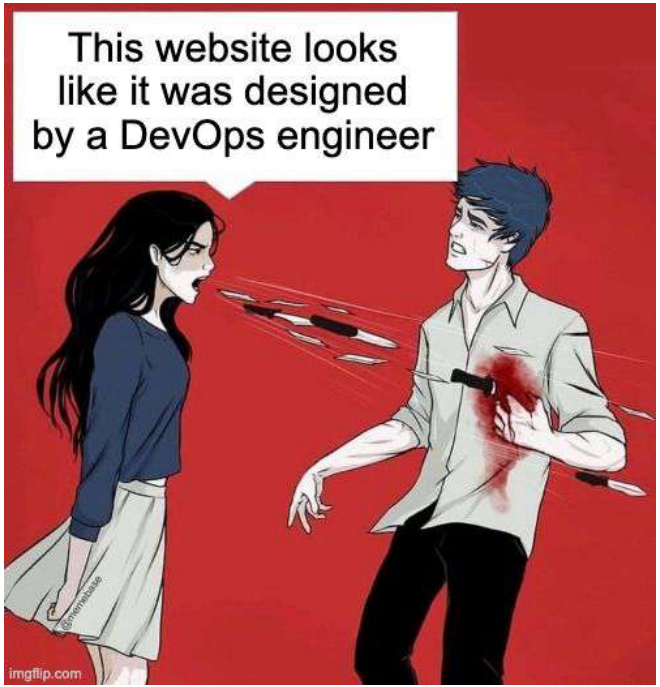
Those who need an app today, and are not JavaScript framework wizards.

How ?

Write a .sql file, connect your database, and you have a website.

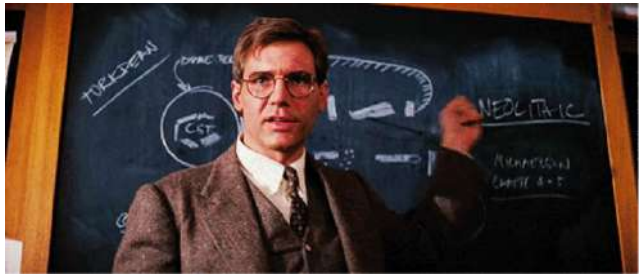
Internal pages do not have to be ugly in 2024





Let’s build together

Prof. Jones : *Archaeology is the search for fact... not truth...*

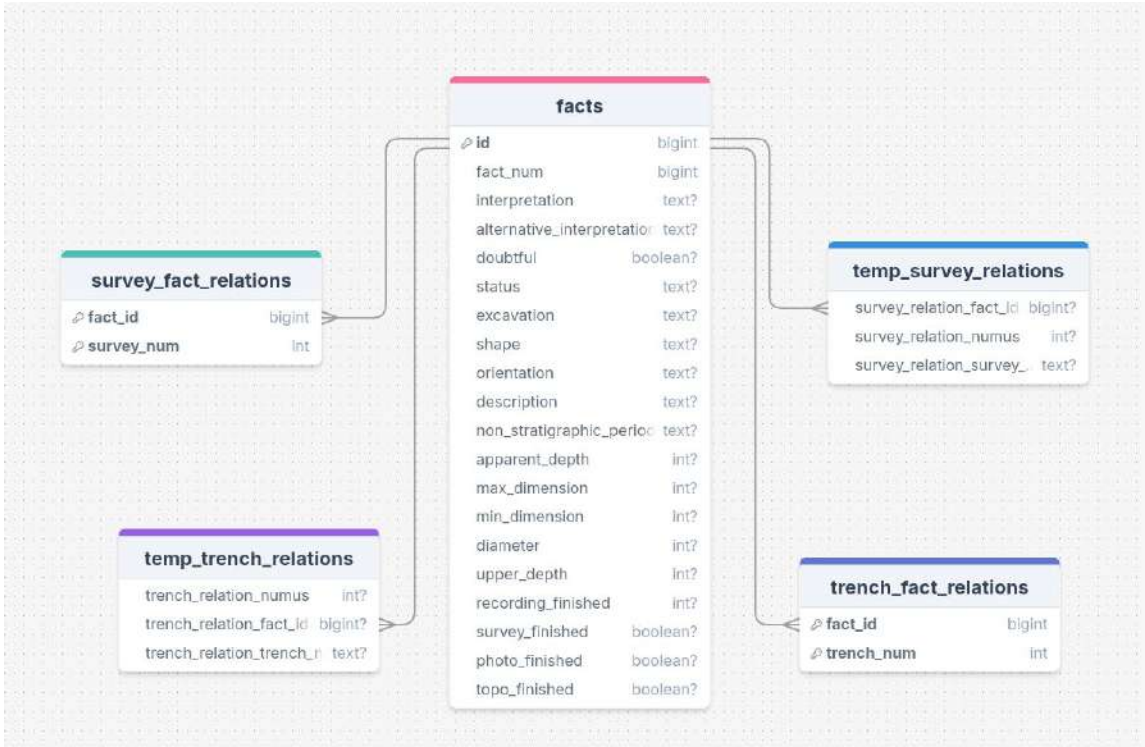


Database schema

Very Simplified Version

Just the *facts*.

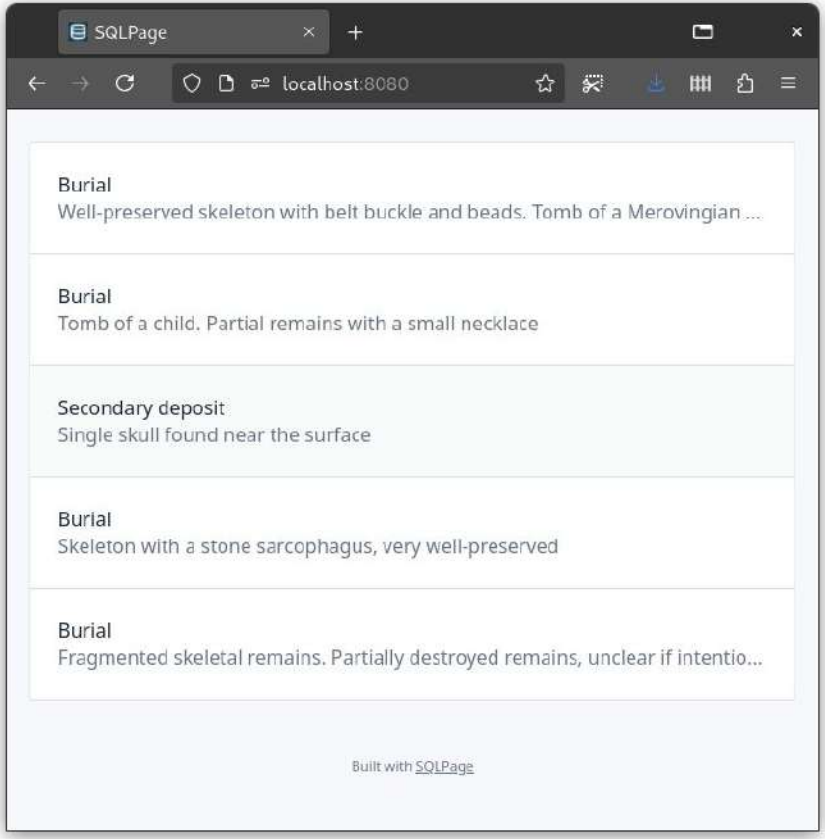
What is a fact ?



Listing

Select a component, then select data to populate it.

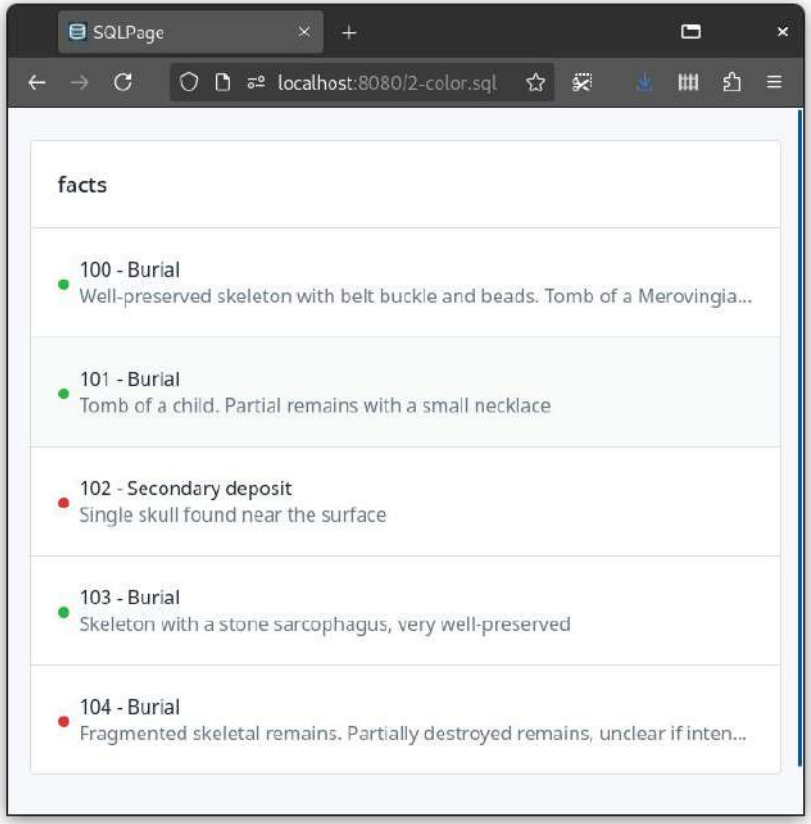
```
SELECT 'list' as component;

SELECT
    interpretation as title,
    description
FROM facts;
```



Top-level and row-level parameters

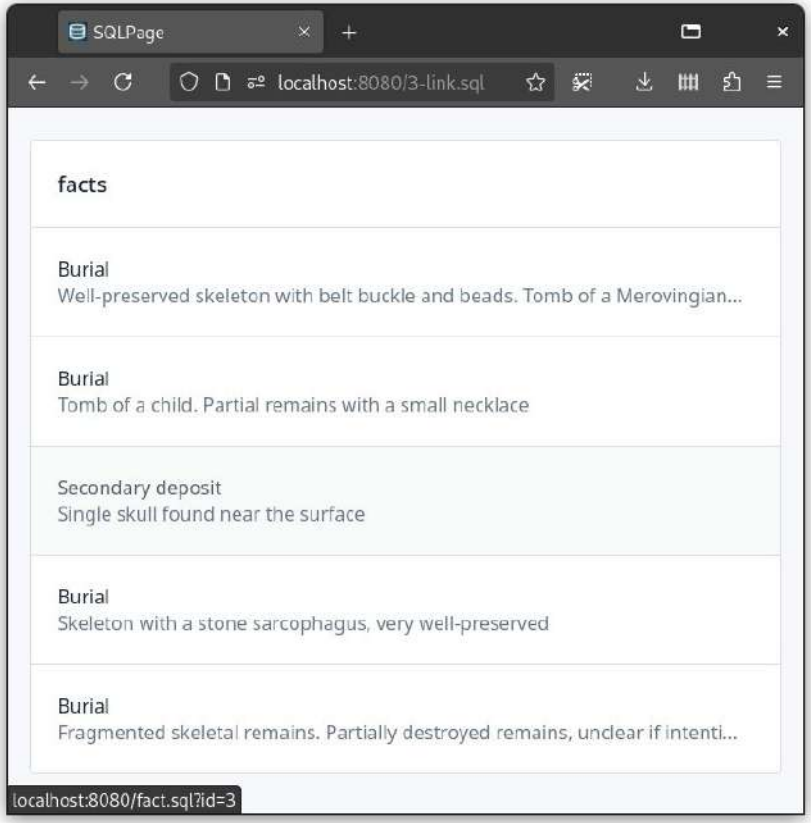
Composite attributes

```sql
SELECT 'list' as component,
    'facts' as title;

SELECT
  fact_num || ' - ' || interpretation as title,
  description,
  case
    when doubtful then
    'red'
    else
      'green'
  end as color
FROM facts;
```



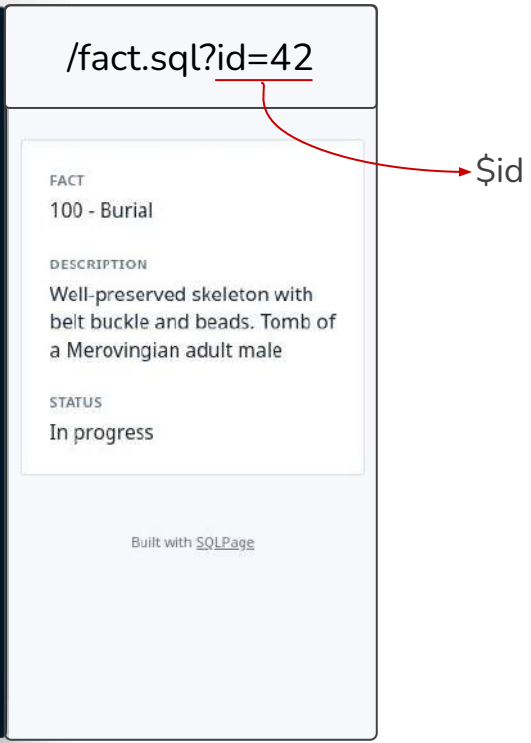
SQLPage pseudo-functions

```
SELECT 'list' as component,
    'facts' as title;

SELECT
    interpretation as title,
    description,
    sqlpage.link(
      'fact.sql',
      json_build_object('id', id)
    ) as link
FROM facts;
```

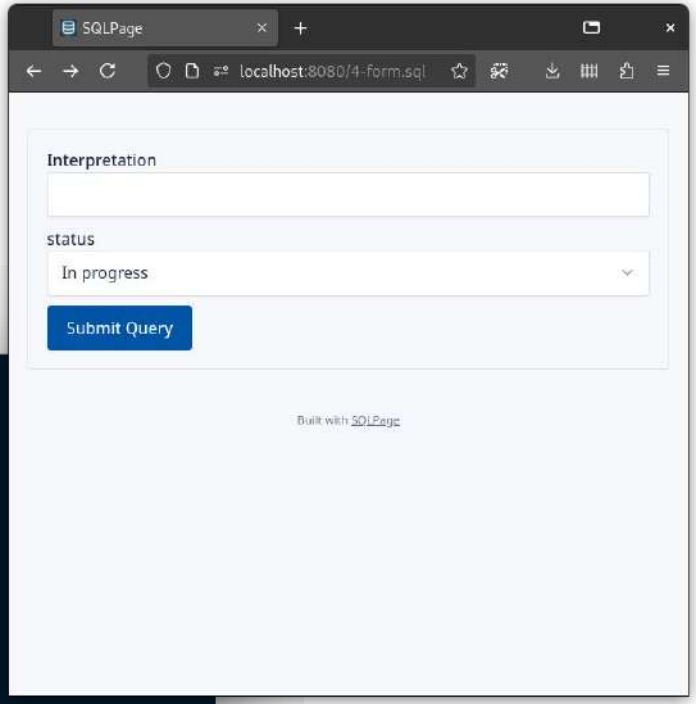


Building the fact page

```sql
select 'datagrid' as component;

with fact as (
    select * from facts where id = $id::int
)
select 'Fact' as title,
       format('%s - %s', fact_num, interpretation) as description
from fact

union all

select 'Description', description from fact

union all

select 'Status', status from fact;
```



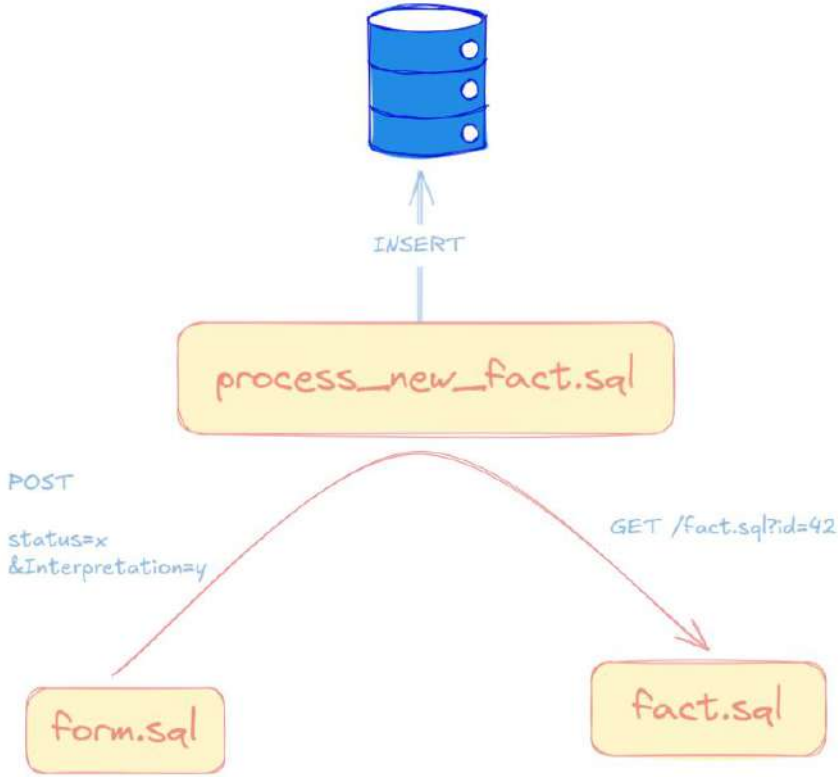
Building a form




```
SELECT 'form' as component,
       'process_new_fact.sql' as action;

SELECT 'text' as type, 'Interpretation' as name;

SELECT 'select' as type, 'status' as name, json_build_array(
    json_build_object('label', 'In progress', 'value', 'inprogress'),
    json_build_object('label', 'Complete', 'value', 'complete')
) as options;
```

Building a form

```
Insert into
  facts(interpretation, status)
values
  (:Interpretation, :status)
returning
  'redirect' as component,
  'fact.sql?id=' || id as link;
```



35 components

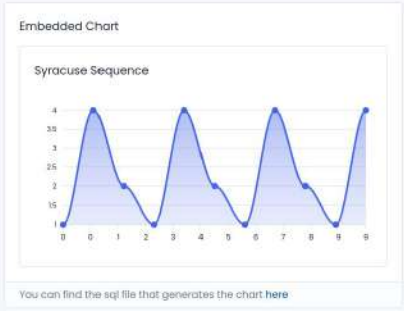
... and growing are built into SQLPage

+

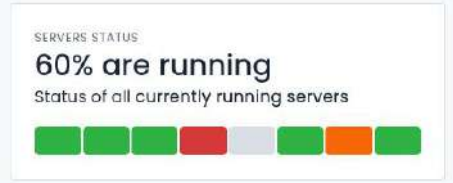
Build your own components with just an HTML template

Card

Button



Tracking



Chart

Map

Timeline

And many more...

alert, authentication, big_number, breadcrumb, carousel, columns, cookie, csv, debug, dynamic, foldable, html, http_header, json, redirect, shell, tab, table...

24 functions

Going from simple formatting, to API calling and script execution

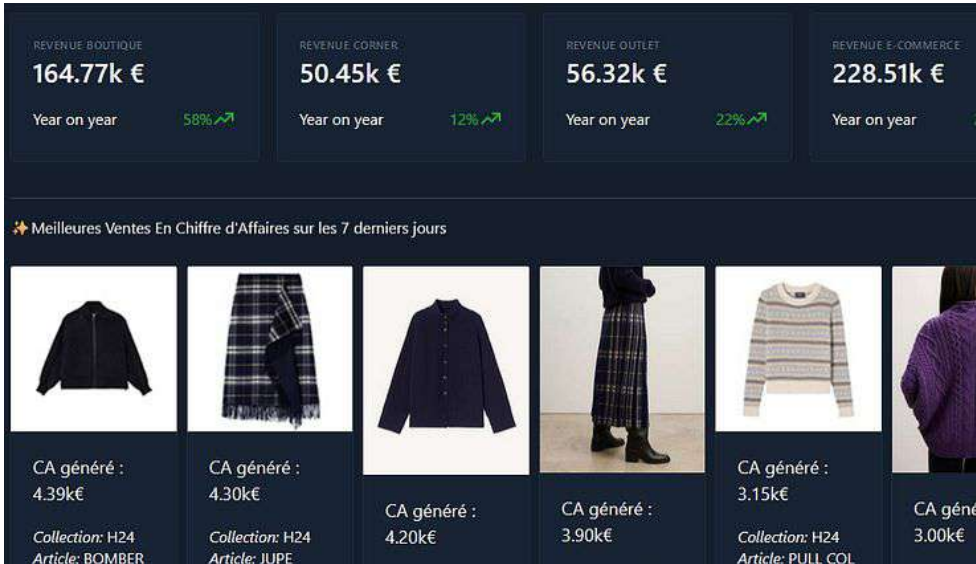
SQLPage functions

basic_auth_password	basic_auth_username	cookie
current_working_directory	environment_variable	exec
fetch	hash_password	header
link	path	persist_uploaded_file
protocol	random_string	read_file_as_data_url
read_file_as_text	request_method	run_sql
uploaded_file_mime_type	uploaded_file_name	uploaded_file_path
url_encode	variables	version

How does it work ?

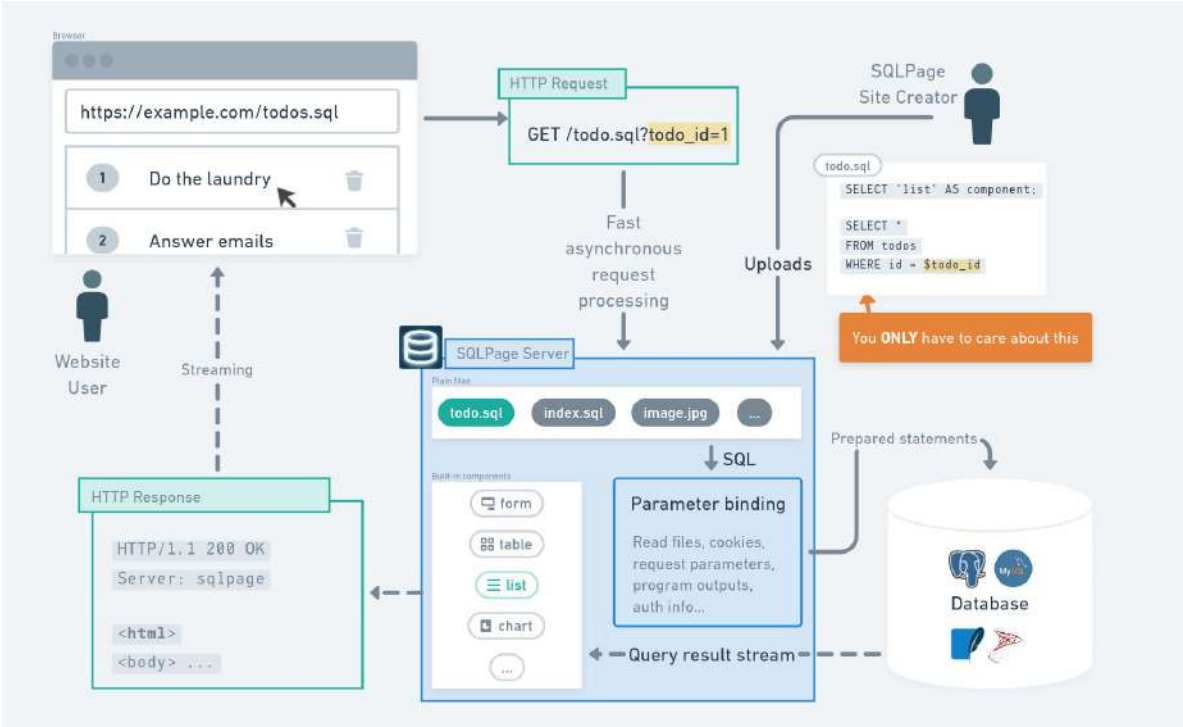
What’s inside ?

- A web server (http, ssl, http2)
- Database drivers (pg, mysql, sqlite, mssql)
- A sql parser (to dynamically bind http query parameters and sqlpage function results)
- A large set of components (pre-built handlebars templates)
- A CSS library (tabler.io)



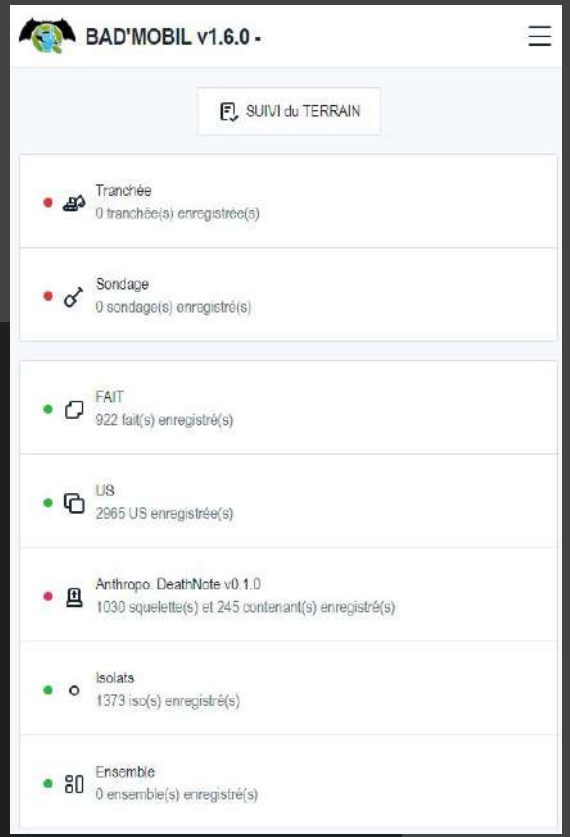
How it works

- Get a request
- Find the SQL file
- Parse it
- Bind request parameters where needed
- Pass it to the db.
- Identify the component in the db response.
- Load the HTML template
- Fill the template with rows
- Stream the HTML back



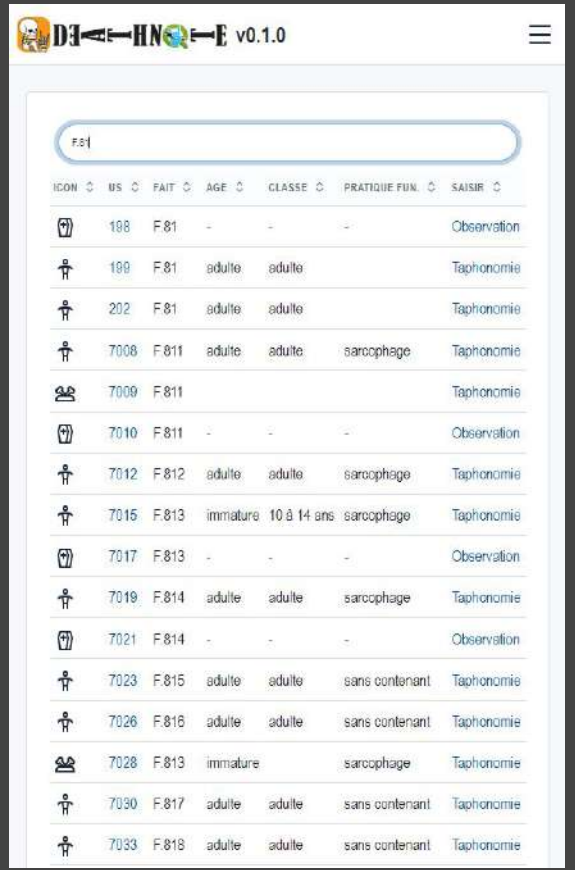
Badmobil

```
SELECT
    'list' as component;
SELECT
    'FAIT' AS title,
    'fait/fait.sql' AS link,
    'green' as color,
    '**'||(SELECT count(numfait) from t_fait)||'** fait(s) enregistré(s)'
    as description_md,
    'layers-union' as icon;
SELECT
    'US' AS title,
    'us/us.sql' AS link,
    'green' as color,
    '**'||(SELECT count(numus) from t_us)||'** US enregistrée(s)'
    as description_md,
    'squares' as icon;

-- Requete qui détermine si la partie anthropo s'affiche dans
l'accueil en fonction de la présence de l'extension DeathNote
SELECT
    'Anthropo.     DeathNote v0.1.0' as title,
    'of_the_dead/anthropo_liste.sql' as link,
    'pink' as color,
    'grave-2' as icon,
    '**'||(SELECT count(numus) from t_us where interpret IN('dépôt primaire inhumation', 'dépôt non primaire inhumation'))
    || '** squelette(s) et ' ||'**'||(SELECT count(numus) from t_us where interpret like 'contenant inhumation')
    || '** contenant(s) enregistré(s)' as description_md
FROM sqlite_master
WHERE
    type='table' AND name='t_squelette';
```



Badmobil

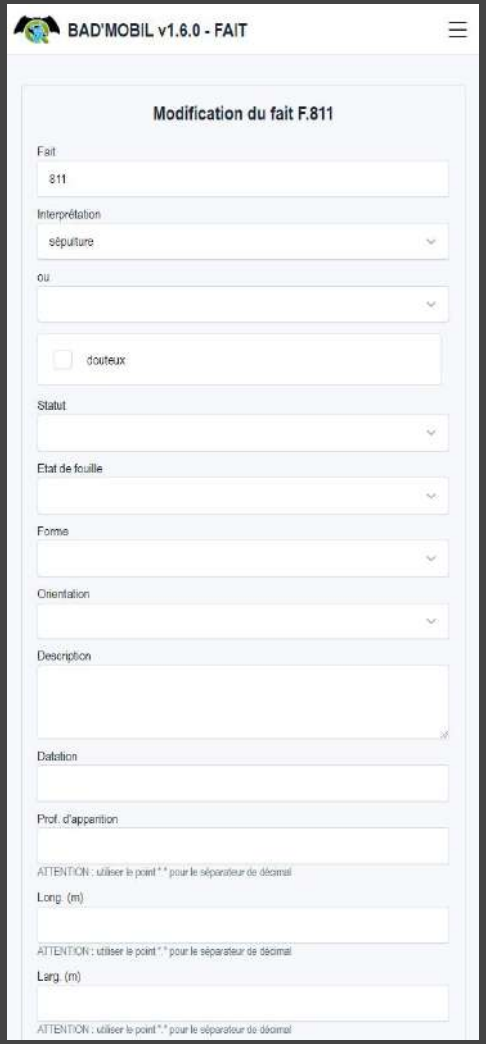
```
SELECT
    'table' AS component,
    'Liste des Squelettes et Contenants' as title,
    'icon' as icon,
    'US' as markdown,
    'Saisir' as markdown,
    1 as small,
    1 as sort,
    1 as search;

SELECT
    icon, US, Fait, Age, Classe, "Pratique fun.", Saisir
    FROM (
SELECT
    (CASE
    WHEN u.interpret like 'dépôt primaire inhumation' THEN 'man'
    WHEN u.interpret like 'dépôt non primaire inhumation' THEN 'dog-bowl'
    END) as icon,
    '['||s.sq_numus||'](squelette/modif_squelette.sql?sq_numus='||s.sq_numus||')' AS US,
    'F.'||f.numfait as Fait,
    s.age_terrain as Age,
    s.age_class as Classe,
    s.res_pratiq_fun as 'Pratique fun.',
    '[Taphonomie](squelette/observ_sep_list.sql?sq_numus='||s.sq_numus||')' AS Saisir
    FROM t_squelette as s
    JOIN t_us as u on u.numus = s.sq_numus
    LEFT JOIN t_fait as f on u.numfait = f.numfait
    GROUP BY s.sq_numus
UNION
SELECT
    'coffin' as icon,
    '['||u.numus||'](../us/modif_us.sql?numus='||u.numus||')' AS US,
    'F.'||u.numfait as Fait,
    '-' as Age,
    '-' as Classe,
    '-' as 'Pratique fun.',
    '[Observation](squelette/observ_cont_list.sql?cont_numus='||u.numus||')' AS Saisir
    FROM t_us as u
    WHERE u.interpret LIKE 'contenant inhumation'
    )
    ORDER BY US
```



Badmobil

One form per archaeological fact

- *description*
- *dimensions*
- *treatment progress*
- *the stratigraphic units of which it is composed*
- *photographs and photogrammetric models*
- *the geometry of the fact*

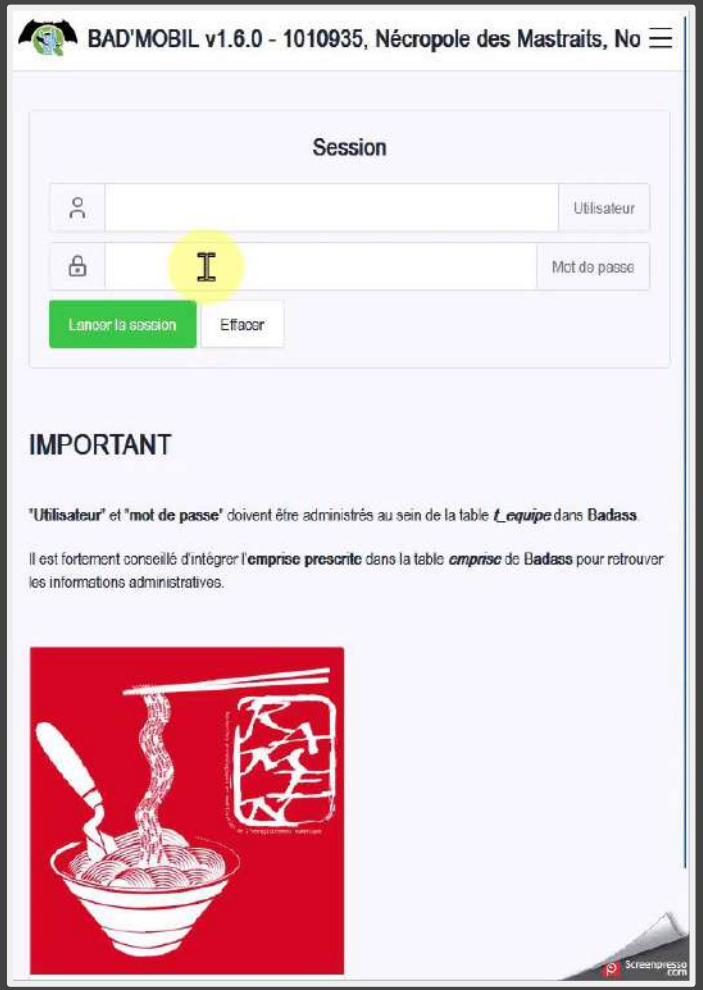


With a map component, you can display all the other facts.
Clicking on a geometry takes you to the form for another fact

Bad'mobil

Changes for archaeologists using Badass and Badmobil

- *descriptive data and spatial data in the same place, immediate spatialization of data*
- *standardisation of data recording*
- *multi-user*
- *on various terminals*
- *immediate recording of the data*
- *fewer writing errors*
- *filtering and searching data easily*
- *user friendly*
- *use in the field and during the study*
- *the archaeologist becomes increasingly badass…*

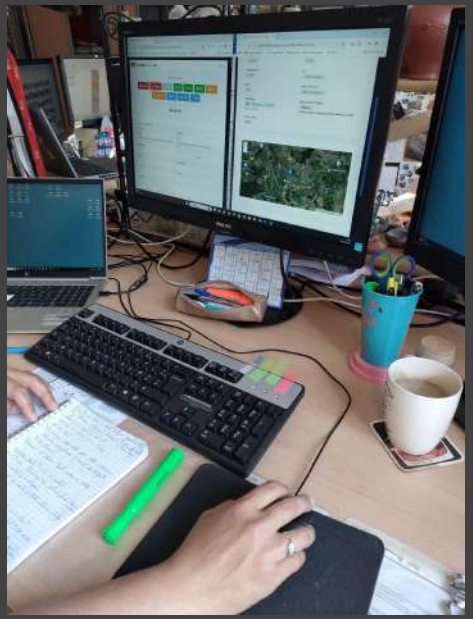


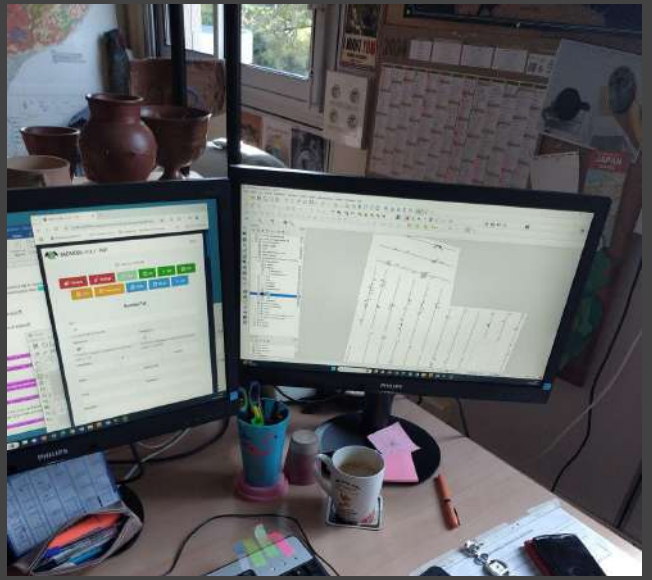
Ever since Badass, SQLpage and Badmobil...

…new ways of working

Ever since Badass, SQLpage and Badmobil...

…new ways of working





Thank You !

Inrap website
https://www.inrap.fr/

“Archéologie Des Nécropoles” association
https://archeonec.hypotheses.org/

En français
https://linuxfr.org/news/comment-l-archeologie-entre-progressivement-dans-l-ere-du-logiciel-libre

SQLPage
https://sql.datapage.app/

BADASS Wiki
https://gitlab.com/projet-r-d-bddsarcheo/tutos/-/wikis/home

Talk Feedback

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