CS213
Principles of Database Systems(H)

Chapter 12

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Most contents are from Stéphane Faroult's slides

12.1 Change data through views

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What about **CHANGING DATA** through views?

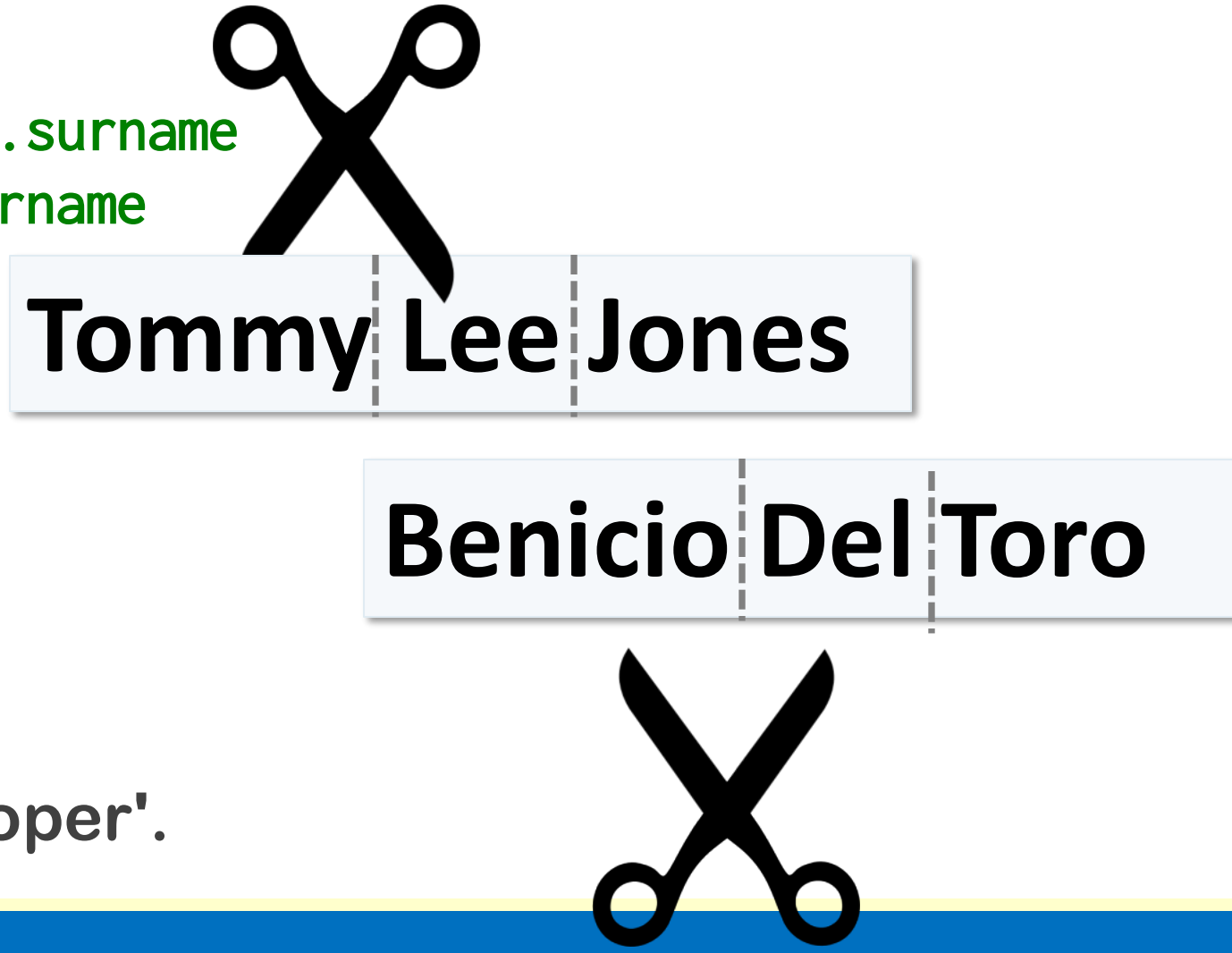
If views are in theory like tables, why not using them for controlling not only what you SEE, but what you CHANGE?

Lots of things can go wrong

It all depends on the view ... The problem is that most view are designed to provide a more user-friendly view of data: joins transforming codes into more legible values, functions making data prettier (date formatting, for instance). And by doing so you often lose information.

For instance if your view concatenates first_name and surname, splitting a single string in two parts is tough if you want to insert through the view.

```
case
  when p.first_name is null then p.surname
  else p.first_name || ' ' || p.surname
end name
```



Everybody isn't called 'Gary Cooper'.

```
create view vmovies
as select m.movieid,
          m.title,
          m.year_released,
          c.country_name
   from movies m
        inner join countries c
           on c.country_code = m.country
```

And for updates ... Let's have a view that displays the country name rather than code.

from movies

from countries

movieid	title	year_released	country_name
2	Blade Runner	1982	United States
6	Das Boot	1985	Germany
9	Goodfellas	1990	United States
15	Le cinquième élément	1997	France
22	The Lord of the Rings	2001	New Zealand
27	We Feed the World	2005	Australia
25	Ying hung boon sik	1986	Hong Kong

Wrong!

AUSTRIA, not Australia!

CORRECTION

```
create view vmovies
as select m.movieid,
          m.title,
          m.year_released,
          c.country_name
   from movies m
        inner join countries c
           on c.country_code = m.country
```

SQL Server would let you update … and try to change the name in table COUNTRIES.

Most products will express concern and prevent you from doing it.

Tx: Auto

filmdb.p

```
1  update vmovies
2  set country_name='Australia'
3  where movieid=27;
4
```

[55000] ERROR: cannot update view "vmovies"
详细：Views that do not select from a single table or view are not automatically updatable.
建议：To enable updating the view, provide an INSTEAD OF UPDATE trigger or an unconditional ON UPDATE DO INSTEAD rule.

Abandon all hope, ye who enter here

In many cases, view update is simply impossible.

Most joins

Aggregates

Expressions

Omitted

mandatory columns

(insert)

Sometimes
it works very well

In some cases, view update is quite possible.

This will work fine with Oracle, which would have complained with a join

One table

```
create or replace view vmy_movies
as select m.movieid,
          m.title,
          m.year_released,
          m.country
   from movies m
   where m.country in
      (select c.country_code
       from countries c
            inner join user_scope u
               on u.continent = c.continent
       where u.username = user)
```

USER_SCOPE

Username	Continent
HUIZHONG	ASIA
PAVEL	EUROPE
IBRAHIM	AFRICA
AMINATA	AFRICA
MICHAEL	EUROPE
JUAN_CARLOS	AMERICA
SANDEEP	ASIA
PATRICIA	AMERICA
PATRICIA	EUROPE

```
create or replace view vmy_movies
as select m.movieid,
          m.title,
          m.year_released,
          m.country
   from movies m
   where m.country in
     (select c.country_code
      from countries c
           inner join user_scope u
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```

USER_SCOPE

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SANDEEP	ASIA
PATRICIA	AMERICA
PATRICIA	EUROPE

Everything else in a subquery

Which proves that in some cases join and subquery aren't exactly equivalent ...

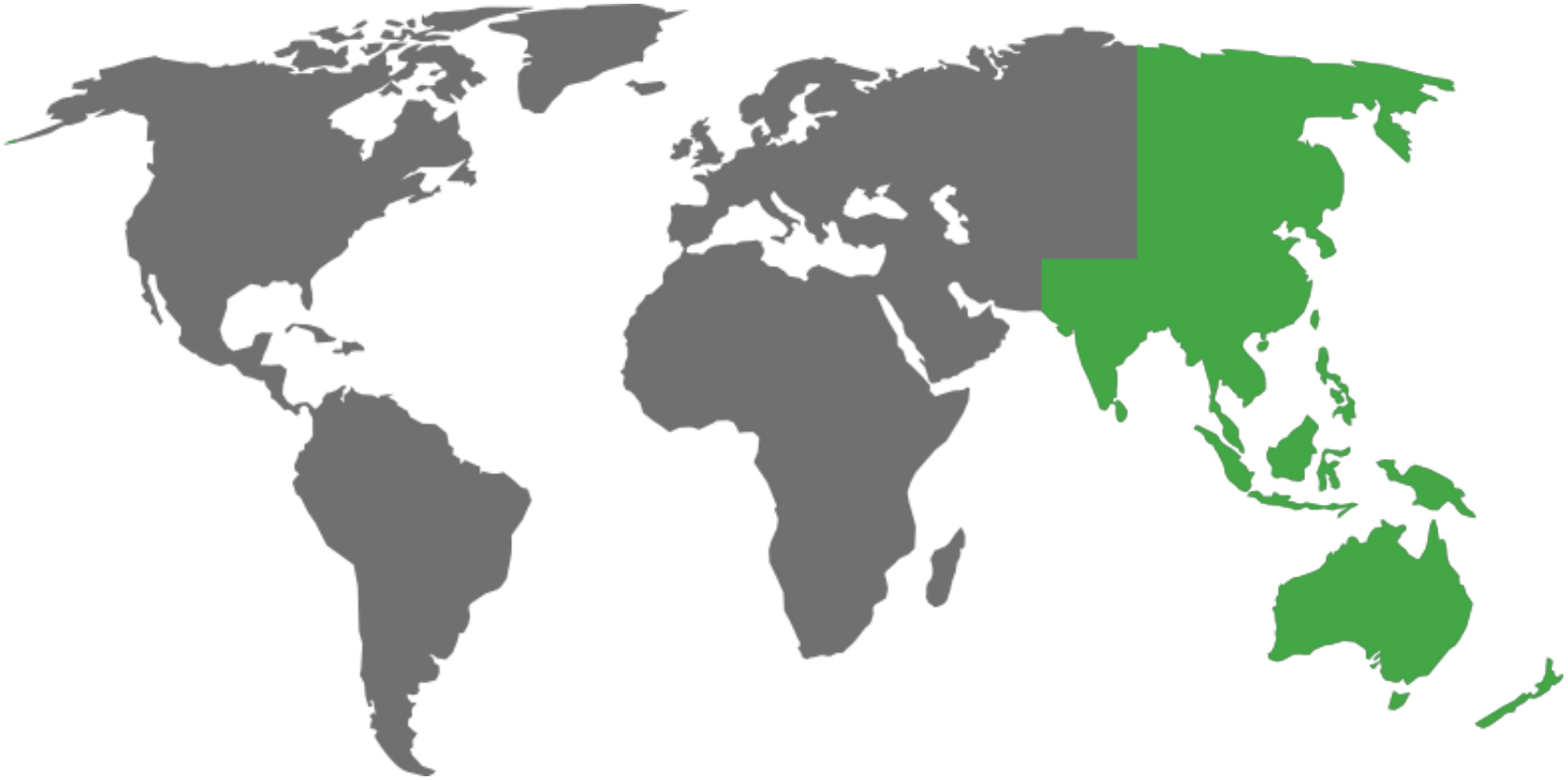
There is no problem because the view update maps to a simple table update.

Plain

insert/update/delete

of *movies*

Now, there may STILL be a problem.



Suppose that you are in charge of Asia/Pacific, and only see films from this region.

Consistency Issue

```
select * from vmy_movies;
```

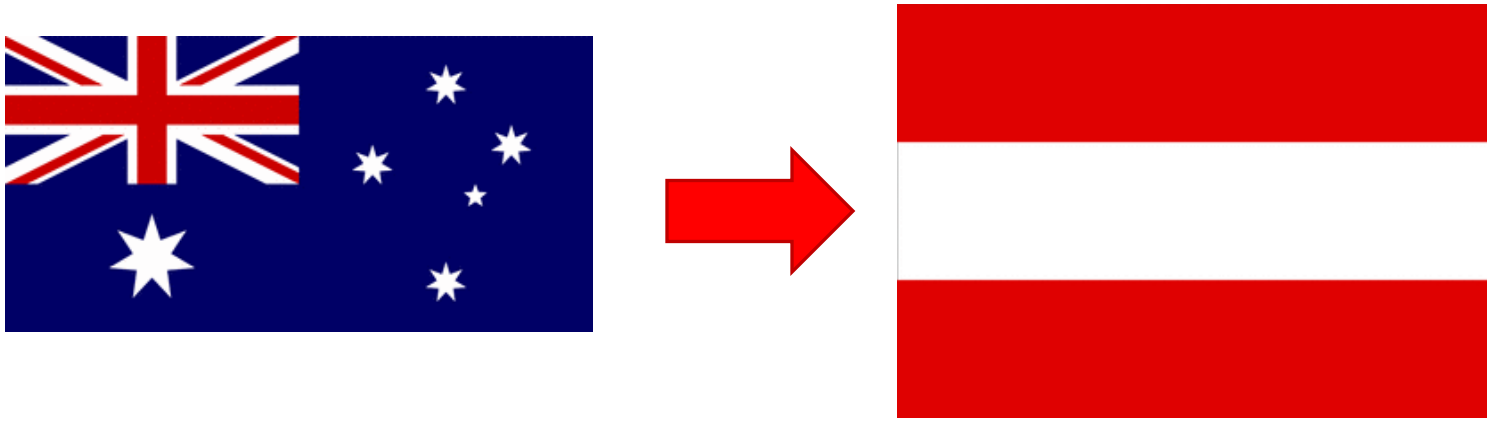
movieid	title	year_released	country
19	Pather Panchali	1955	in
20	Shichinin no Samurai	1954	jp
21	Sholay	1975	in
22	The Lord of the Rings	2001	nz
25	Da Nao Tian Gong	1965	cn
26	We Feed the World	2005	au

Ooops

Only from Asia/Oceania

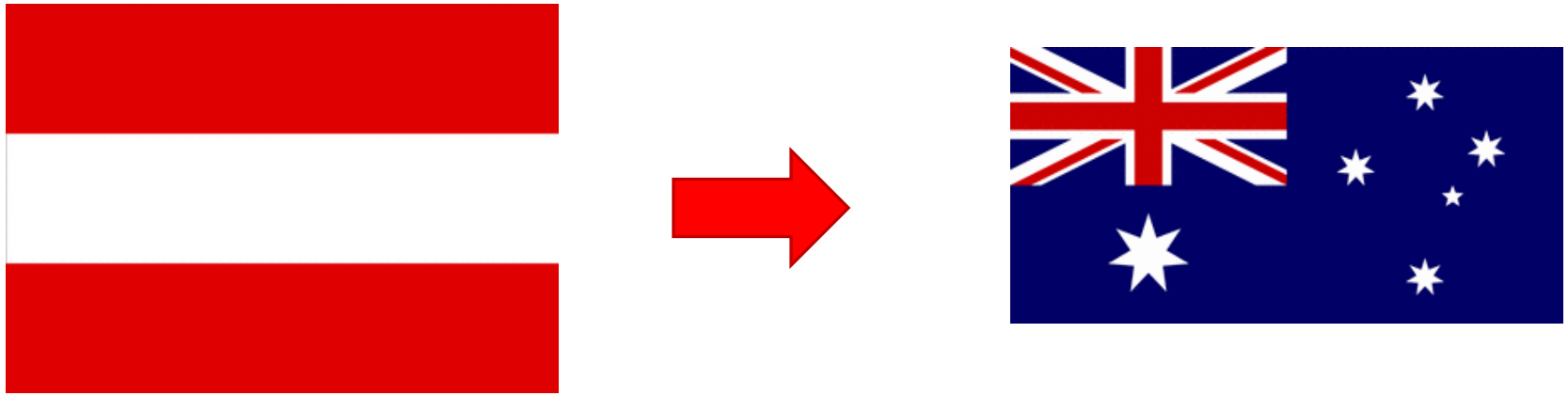
If you change the country from Australia to Austria (in Europe), poof! you no longer see it.

```
update vmy_movies
set country = 'at'
where movieid = 26
```



The following command cannot bring it back.

```
update vmy_movies
set country = 'au'
where movieid = 26
```



Nothing prevents from

```
insert into vmy_movies(movieid, title, year_released, country)
values (9205, 'NEW MOVIE', 2020, 'us');
```

UNLESS

There is one special constraint, though, that exists for views: **WITH CHECK OPTION**.

```
create or replace view vmy_movies
as select m.movieid,
          m.title,
          m.year_released,
          m.country
   from movies m
   where m.country in
     (select c.country_code
      from countries c
           inner join user_scope u
              on u.continent = c.continent
      where u.username = user)
with check option
```

Tx: Auto

```
1  insert into vmy_movies(movieid,title, year_released, country)
2  values (9205, 'NEW MOVIE', 2020, 'us');
3
```

[44000] ERROR: new row violates check option for view "vmy_movies"
详细：Failing row contains (9205, NEW MOVIE, us, 2020, null).

CHECK OPTION would let you update from Australia to any Asian country.

But not to a country from another region

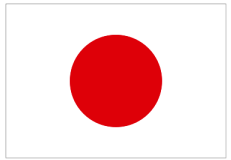
au

cn

in

id

jp



at

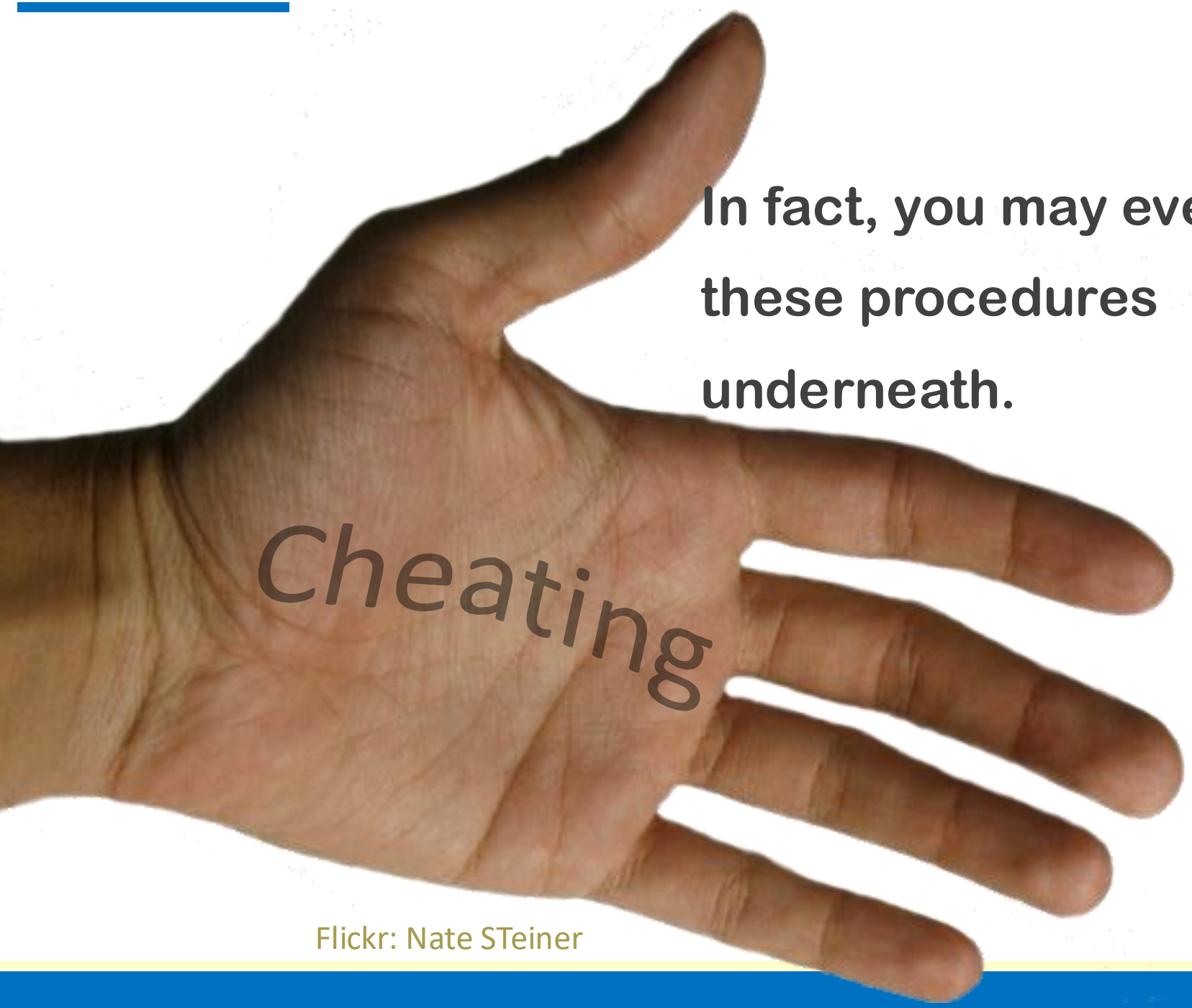
Solution in some cases:

insert procedure

update procedure

delete procedure

If updating the view directly is impossible, in many cases (remember when we were displaying the country name) what should be applied to base tables is fairly obvious and can be performed by dedicated stored procedures.



Flickr: Nate STeiner

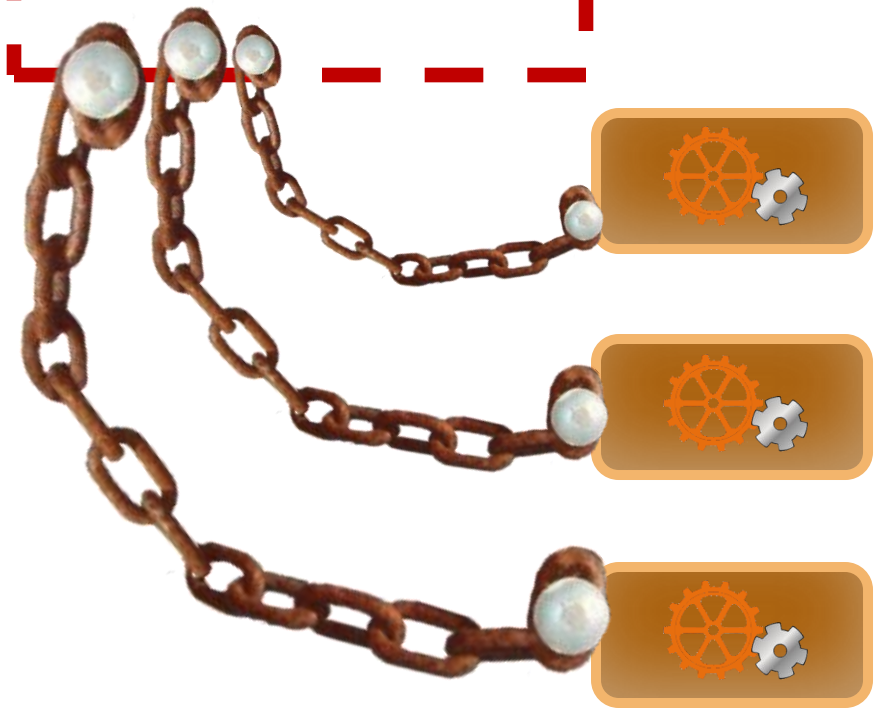
In fact, you may even call these procedures underneath.

View

There is a special type of trigger called an

instead of trigger

It can be created on a view and lets you call a procedure "instead of" performing the triggering event



insert procedure

update procedure

delete procedure

CREATE TRIGGER -- define a new trigger

Synopsis

```
CREATE [ CONSTRAINT ] TRIGGER name { BEFORE | AFTER | INSTEAD OF } { event [ OR ... ] }
    ON table_name
    [ FROM referenced_table_name ]
    [ NOT DEFERRABLE | [ DEFERRABLE ] { INITIALLY IMMEDIATE | INITIALLY DEFERRED } ]
    [ FOR [ EACH ] { ROW | STATEMENT } ]
    [ WHEN ( condition ) ]
    EXECUTE PROCEDURE function_name ( arguments )

where event can be one of:

    INSERT
    UPDATE [ OF column_name [, ... ] ]
    DELETE
    TRUNCATE
```

12.2 Data Dictionary

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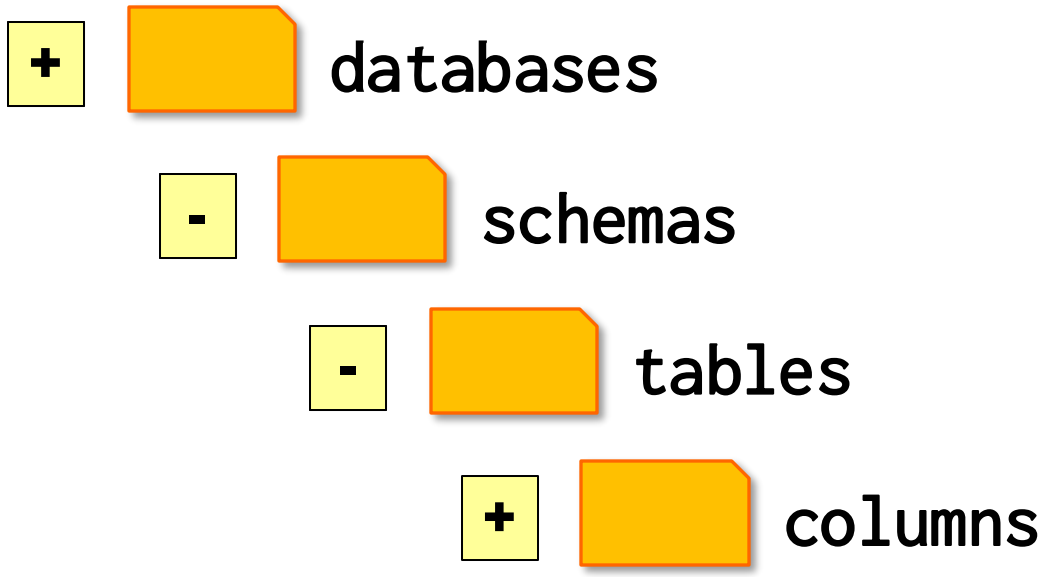
One very good example of view application is the set of tables that contain information about the objects in the database, collectively known as the

Data Dictionary

or sometime called the

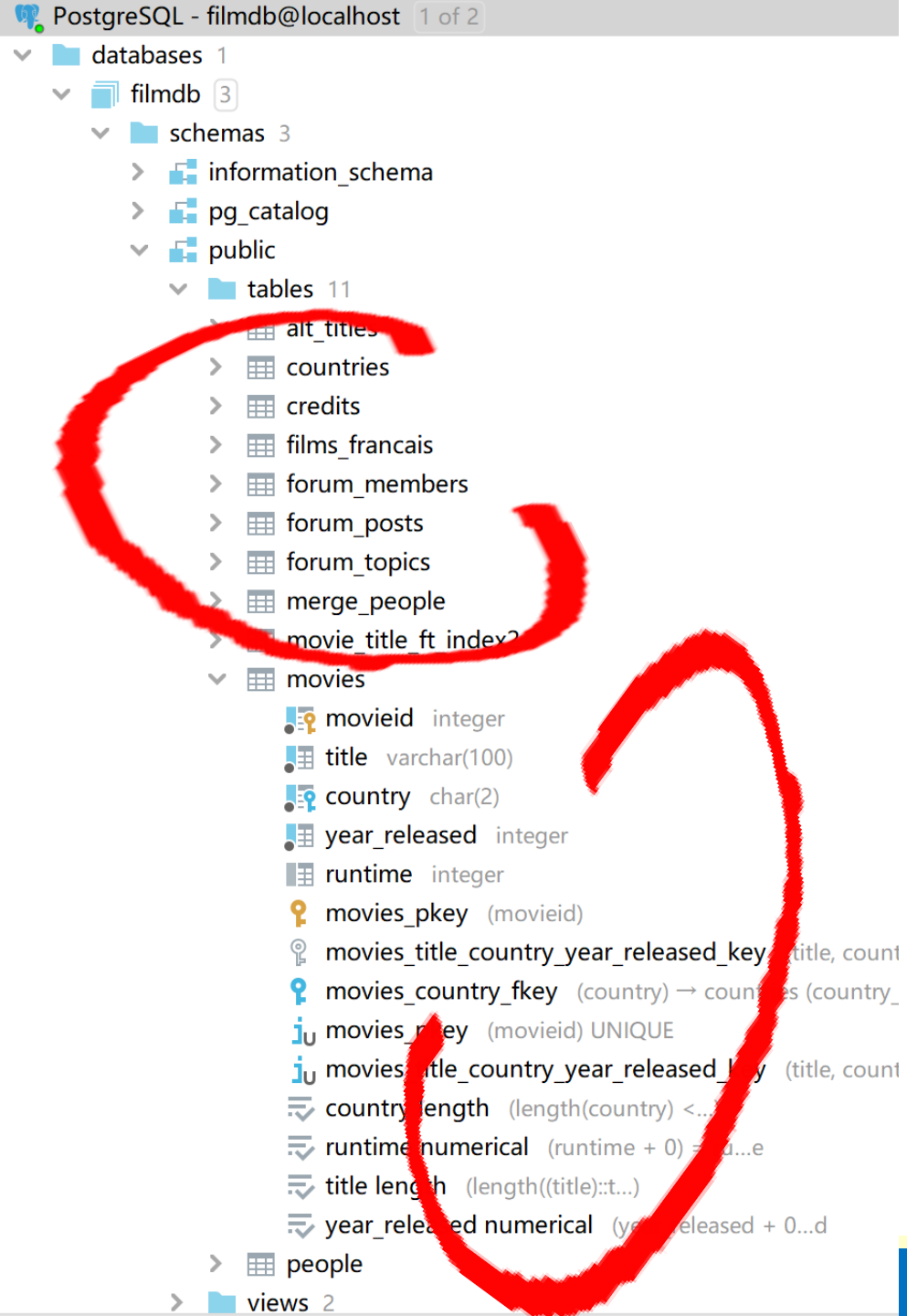
Catalog

They are using all the features we have seen (you only have privileges to read views and only see what is relevant to your account)


+
databases
-
schemas
-
tables
+
columns

One catalog per database

You always have ONE catalog per database. A database is an independent unit and you can have foreign keys only within (inside) one database; however, you can have several schemas in a database, and you can reference tables in another schema. There may also be metadata such as user accounts that is shared among databases. Most DBMS products can manage several databases at once; other than SQLite, the exception is MySQL that only has ONE catalog. What MySQL calls a *database* is actually a schema.



Any database stores "metadata" that describes the tables in your database (and not only them)

All client tools use this information to let you browse the structure of your tables

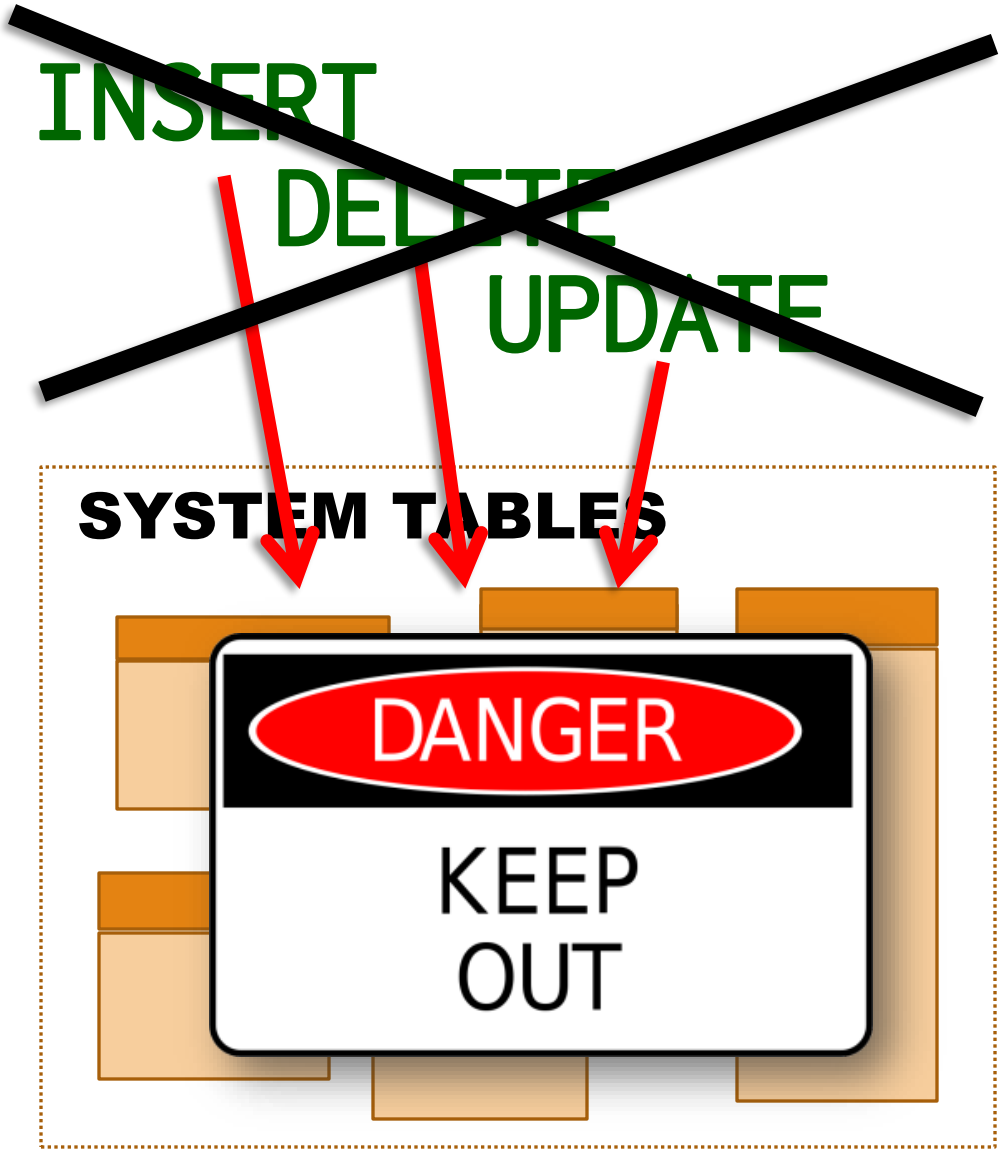
CREATE

DROP

ALTER

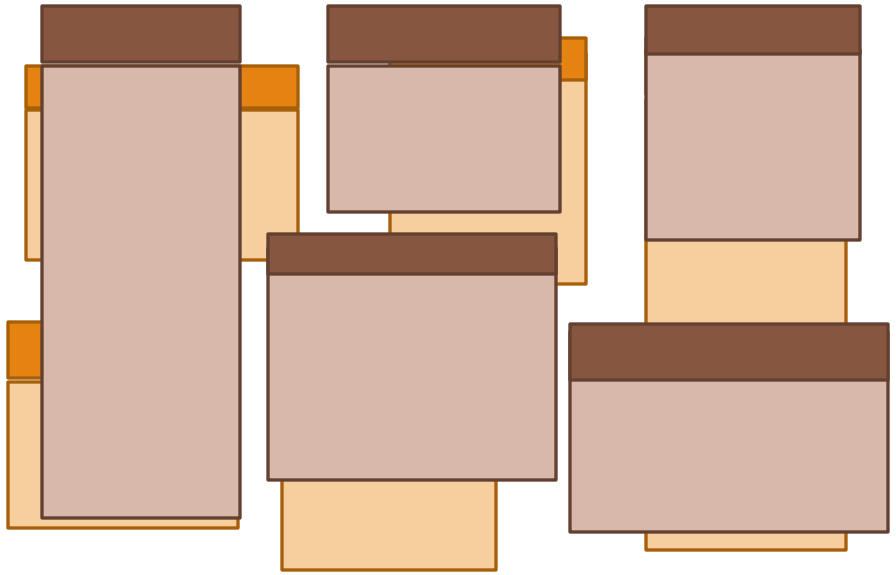
GRANT

REVOKE



Whenever you are issuing DDL commands, you are actually modifiying system tables. They must NEVER be directly changed.

SYSTEM VIEWS



SQLite sqlite_master

Read access to these tables is provided through system views.

Microsoft SQL Server

MySQL

PostgreSQL

information_schema

sysibm IBM DB2

+ views in schema sys

+ views in schema syscat

+ pg_... views

Microsoft SQL Server

IBM DB2

PostgreSQL

INFORMATION_SCHEMA.TABLES

In these views you only see what YOU are allowed to see. Only administrators see everything.

SYSCAT.TABLES

USER_TABLES / ALL_TABLES

- PostgreSQL - filmdb@localhost 1 of 2
  - databases 1
    - filmdb 3
      - schemas 3
        - information_schema
          - tables 7
          - views 60
            - _pg_foreign_data_wrappers
            - _pg_foreign_servers
            - _pg_foreign_table_columns
            - _pg_foreign_tables
            - _pg_user_mappings
            - administrable_role_authorizations
            - applicable_roles
            - attributes
            - character_sets
            - check_constraint_routine_usage
            - check_constraints
            - collation_character_set_applicability
            - collations
            - column_domain_usage
            - column_options
            - column_privileges
            - column_udt_usage
            - columns
            - constraint_column_usage

```sql
SELECT table_catalog, table_schema, table_name, table_type
FROM information_schema.tables
where table_schema='public'
```

	table_catalog	table_schema	table_name	table_type
1	filmdb	public	merge_people	BASE TABLE
2	filmdb	public	countries	BASE TABLE
3	filmdb	public	people	BASE TABLE
4	filmdb	public	credits	BASE TABLE
5	filmdb	public	forum_members	BASE TABLE
6	filmdb	public	forum_topics	BASE TABLE
7	filmdb	public	forum_posts	BASE TABLE
8	filmdb	public	films_francais	BASE TABLE
9	filmdb	public	movies	BASE TABLE
10	filmdb	public	alt_titles	BASE TABLE
11	filmdb	public	movie_title_ft_index2	BASE TABLE
12	filmdb	public	vmovies	VIEW
13	filmdb	public	vmy_movies	VIEW

There are usually simpler commands to display the structure of a table, but these commands execute nothing more than this type of query. Everything is pulled out of the data dictionary.

Tx: Auto

```
1  SELECT table_name, column_name, ordinal_position, data_type
2  FROM information_schema.columns
3  where table_name='movies'
4
```

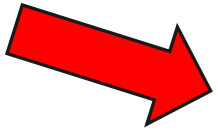
	table_name	column_name	ordinal_position	data_type
1	movies	movieid	1	integer
2	movies	title	2	character varying
3	movies	country	3	character
4	movies	year_released	4	integer
5	movies	runtime	5	integer

INFORMATION

As a developer, you can get from the data dictionary some information that is hard to get elsewhere (constraints, for instance). Database administrators use them a lot for scripting, because the data dictionary always reflects the current state of a database.

SCRIPTING (DBA)

```
select 'drop table ' ||
       table_name || ';'
from information_schema.tables
where table_name like 'TMP%'
  and ...
```



```
drop table TMP_People;
drop table TMP_Posts;
drop table TMP_XYZ;
drop table TMP_dump;
```

DBAs often use queries on the catalog to generate other SQL queries; it can be done in a script, or in a procedure with a cursor (a case when cursors are mandatory). They sometimes generate other commands, such as shell script, for instance for backing up database files (the name of which can be found in some remote corners of the catalog).