

CS213

Principles of Database Systems(H)

Chapter 8 Update, Delete, Function, Procedure

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Most contents are from Stéphane Faroult's slides

8.1 Update

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Things change ...



We have talked about inserting data, lets' now see how we can update what is in the database.

Update is the command than changes column values. You can even set a non-mandatory column to NULL. The change is applied to all rows selected by the WHERE.

```
update table_name  
    set column_name = new_value,  
        other_col = other_val,  
        ...  
    where ...
```

```
update us_movie_info  
    set title = replace(title, '''', '')
```

Without a WHERE all rows are affected.

A nobiliary particle is used in a surname or family name in many Western cultures to signal the nobility of a family.

John von Neumann



We may want to modify some names in such a way as they sort as they should.

```
update people
set surname = substr(surname, 4)
      || ' (von)'
where surname like 'von %'
```

This could be used to postfix all surnames starting by 'von' with '(von)' and turn for instance 'von Stroheim' into 'Stroheim (von)'

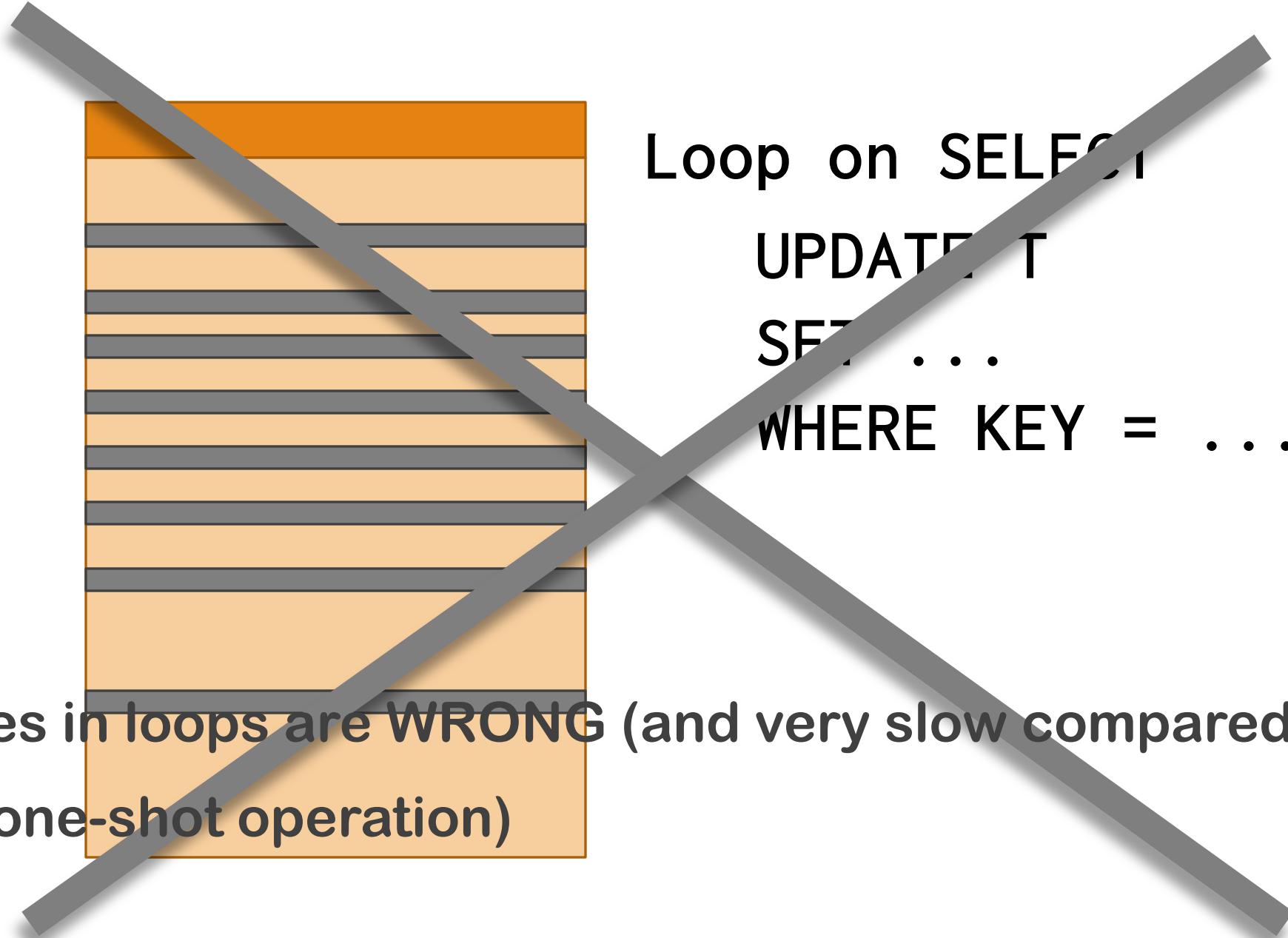


A very important point to remember is that UPDATE is a SET operation. The set may contain 1, or 1,000,000 or 0 rows.

~~row~~

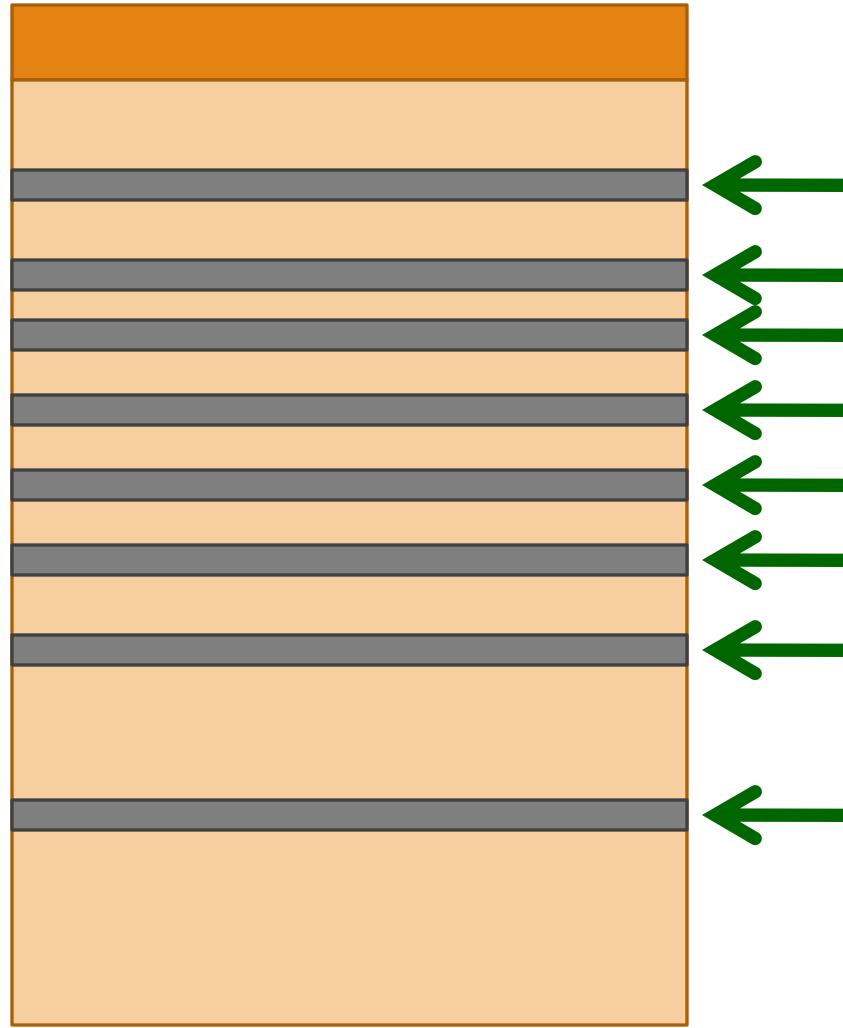
update

set



Loop on SELECT
UPDATE T
SET ...
WHERE KEY = ...

Updates in loops are **WRONG** (and very slow compared
to the one-shot operation)



UPDATE T
SET ...
WHERE ...

Think massive operations.

movies_2

movieid	title	country	year_released	duration	color

us_movies_info

title	year_released	duration	color

Updates can be subtle when you want to update a table with data coming from another table.

Like a join in a select ...
... same issues
with nulls
and duplicates !

movieid	title	duration	color
country	year_released		
1234	Wo Shi Li Huanying	2021	Y
us_movies_info			
	title	year_released	duration

Not found ?



```
update movies_2
set duration = (select duration
                  from us_movie_info i
                  where i.title = movies_2.title
                        and i.year_released = movies_2.year_released) ,
color = (select case color
                  when 'C' then 'Y'
                  when 'B' then 'N'
                  end color
                  from us_movie_info i
                  where i.title = movies_2.title
                        and i.year_released = movies_2.year_released)
where country = 'us'
      and exists (select null
                  from us_movie_info i2
                  where i2.title = movies_2.title
                        and i2.year_released = movies_2.year_released)
```

NULL

As subqueries can return NULL, you must be certain to only affect rows in your scope.

```
update movies_2
set duration = (select duration
                  from us_movie_info i
                  where i.title = movies_2.title
                    and i.year_released = movies_2.year_released),
color = (select case color
                  when 'C' then 'Y'
                  when 'B' then 'N'
                end color
                  from us_movie_info i
                  where i.title = movies_2.title
                    and i.year_released = movies_2.year_released)
where country = 'us'
      and exists (select null
                  from us_movie_info i2
                  where i2.title = movies_2.title
                    and i2.year_released = movies_2.year_released)
```

Three Queries per row

processed

Not madly efficient; all subqueries are correlated (for the third query SQLite now supports the same as Oracle - next slide).

```
update movies_2
set (duration, color) =
  (select duration,
         case color
             when 'C' then 'Y'
             when 'B' then 'N'
         end color
      from us_movie_info i
     where i.title = movies_2.title
       and i.year_released = movies_2.year_released)
  where country = 'us'
    and exists (select null
                 from us_movie_info i2
                where i2.title = movies_2.title
                  and i2.year_released = movies_2.year_released)
```

run for each retrieved row

Oracle and DB2 both support
subqueries returning several columns
(SQLite also now).

```
update movies_2
set (duration, color) =
  (select duration,
         case color
             when 'C' then 'Y'
             when 'B' then 'N'
         end color
      from us_movie_info i
     where i.title = movies_2.title
       and i.year_released = movies_2.year_released)
  where country = 'us'
    and (m.title, m.year_released)
      in (select title, year_released
            from us_movie_info)
```

run for each retrieved row

Once

Oracle and DB2 both support
subqueries returning several columns
(SQLite also now).



```
update movies_2
set duration = i.duration,
    color = case i.color
        when 'C' then 'Y'
        when 'B' then 'N'
    end
from us_movie_info i
where i.title = movies_2.title
    and i.year_released = movies_2.year_released
    and movies_2.country = 'us' } Join
```

SQL Server and PostgreSQL both support the same older-join type of syntax allowing to join the updated table to the one from which we are getting data.



```
update movies_2 m
    inner join us_movie_info i
        on i.title = m.title
        and i.year_released = m.year_released
set m.duration = i.duration,
    m.color = case i.color
        when 'C' then 'Y'
        when 'B' then 'N'
    end
where m.country = 'us'
```

MySQL allows a join with the newer syntax.

What can happen when join conditions are

WRONG!

When you have a **SELECT** wrong, it only affects your query. When you have an **UPDATE** wrong, you can corrupt the database and later correct queries on wrong data will return wrong results.

So you really need to be extra careful.

movies_2

us_movie_info

title \longleftrightarrow **title**

year_released \longleftrightarrow **year_released**

country = 'us'

Imagine for instance that we forget the join on the year and that we have remakes. What will happen?

movies_2



us_movie_info



Let's first say that we only have remakes in the table that we update.

Running a SELECT shows what happens.

```
select m.title, m.year_released,  
       i.year_released, i.duration, i.color  
  from movies_2 m  
  inner join us_movie_info i  
    on i.title = m.title  
   where m.title like 'Treasure%'
```

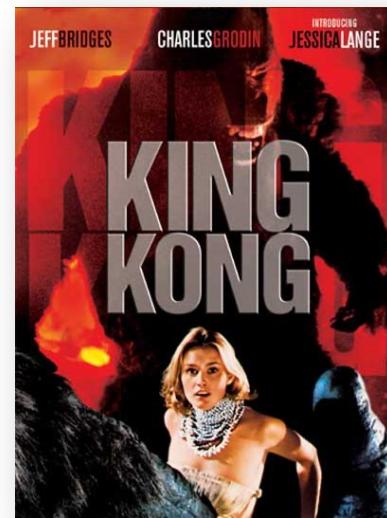
One row from the source table will be associated with both films.

title	year_released	year_released	duration	color
Treasure Island	1934	1934	103	B
Treasure Island	1950	1934	103	B

The diagram illustrates the relationship between the two tables. Two horizontal curly braces, one under each row of the movies_2 table, point to a single row in the us_movie_info table. The first brace covers the 'Treasure Island' row, and the second covers the 'Treasure Island' row from 1950. This visualizes how one row from the source table is associated with multiple rows in the target table.

movies_2 **us_movie_info**

movies_2



us_movie_info



Now let's see what happens if we have remakes in the source table, but not in the one that we update

Once again, a SELECT shows what happens.

```
select m.title, m.year_released,  
       i.year_released, i.duration, i.color  
  from movies_2 m  
inner join us_movie_info i  
    on i.title = m.title  
   where m.title = 'King Kong'
```

The same row will be updated twice. What will remain is the last update. Heads or tails?

title	year_released	year_released	duration	color
King Kong	1976	1933	100	B
King Kong	1976	1976	134	C



movies_2



us_movie_info

Subquery

```
update movies_2  
set duration =  
  (select duration  
   from us_movie_info i  
   where i.title = movies_2.title)
```

...

Join

2 rows



FAILURE

Note that a subquery returning more than one row would generate an error.

title	year_released	year_released	duration	color
King Kong	1976	1953	100	B
King Kong	1976	1976	134	C

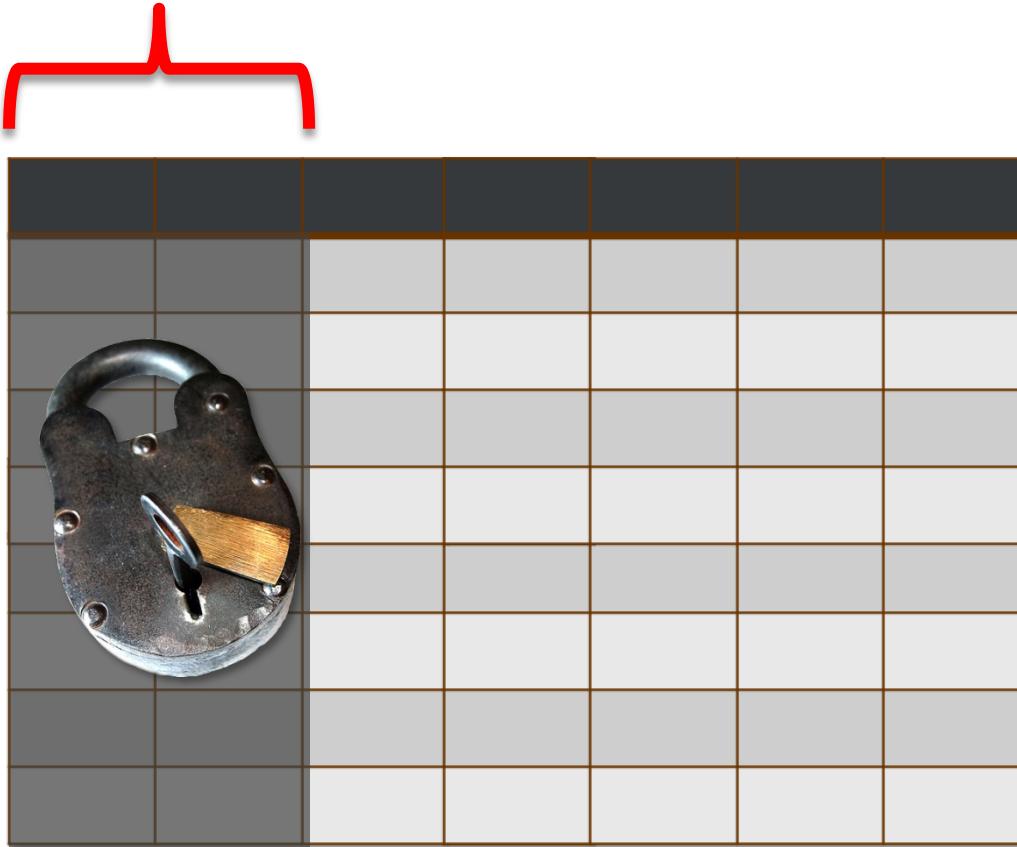
A join won't fail, and just update randomly.

Primary key

Surname	Firstname	Birthdate	Picture
Hepburn	A STOP	4-May-1929	
Katharine			

You are reminded that if a regular attribute can be updated, it's usually forbidden to update a key - it's the identifier. You cannot change an identifier. You can only delete the row and insert another.

Primary key



Update-wise, a primary key is locked.
Off-limits.



```
merge into movies_2 m
using (select 'us' as country,
            title,
            year_released,
            duration,
            case color
                when 'C' then 'Y'
                when 'B' then 'N'
            end as color
        from us_movie_info) i
on (i.country = m.country
and i.title = m.title
and i.year_released = m.year_released)
when matched then
    update
        set m.duration = i.duration,
            m.color = i.color
when not matched then
    insert(title, year_released, country, duration, color)
        values(i.title, i.year_released, i.country, i.duration, i.color)
```

Update or Insert

An interesting operation would be to update a film we know, and insert it if we don't. That's the purpose of MERGE.

Update or Insert

```
insert into movies_2(title, year_released,  
                     country, duration, color)  
select title, year_released, country, duration, color  
from (select title,  
          year_released,  
          'us' as country,  
          duration,  
          case color  
              when 'C' then 'Y'  
              when 'B' then 'N'  
          end color  
       from us_movie_info) i  
on duplicate key update  
movies_2.duration = i.duration,  
movies_2.color = i.color
```

MySQL can catch an insert
that fails because the row is
already here, and turn on
the fly the insert into an
update.



Update or Insert

```
insert or replace into movies_2(title, year_released,  
                                country, duration, color)  
select title, year_released, country, duration, color  
from (select title,  
        year_released,  
        'us' as country,  
        duration,  
        case color  
            when 'C' then 'Y'  
            when 'B' then 'N'  
        end color  
    from us_movie_info) i
```

SQLite allows something similar with a simpler (but less flexible) syntax.
Beware, because it deletes a row and creates a new one, foreign keys may not like it.

then Update ~~or~~ Insert

Update



```
insert into movies_2(title, year_released, country,  
                     duration, color)  
select i.title, i.year_released, 'us', i.duration,  
      case i.color  
        when 'C' then 'Y'  
        when 'B' then 'N'  
      end  
from us_movie_info i  
left outer join movies_2 m  
  on m.title = i.title  
  and m.year_released = i.year_released  
  and m.country = 'us'  
where m.movieid is null
```

When none of the above is available, you should try to update, and if nothing is affected insert.

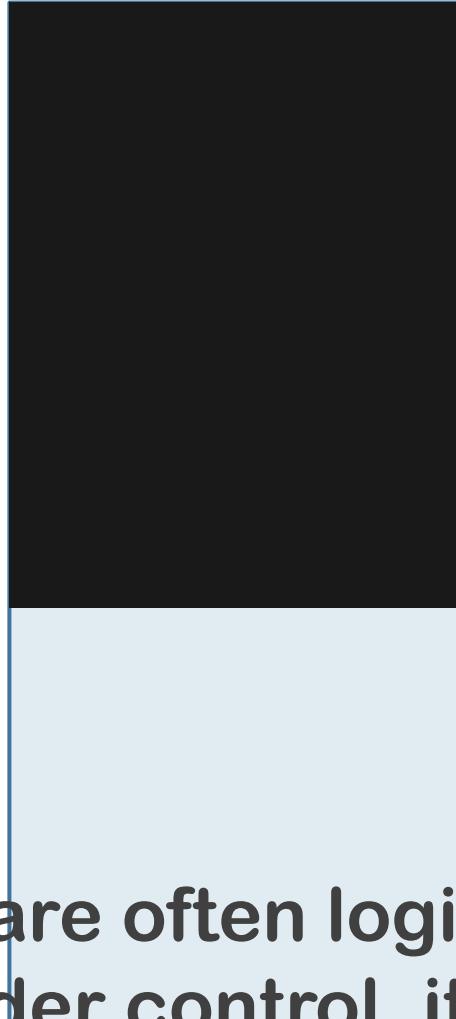
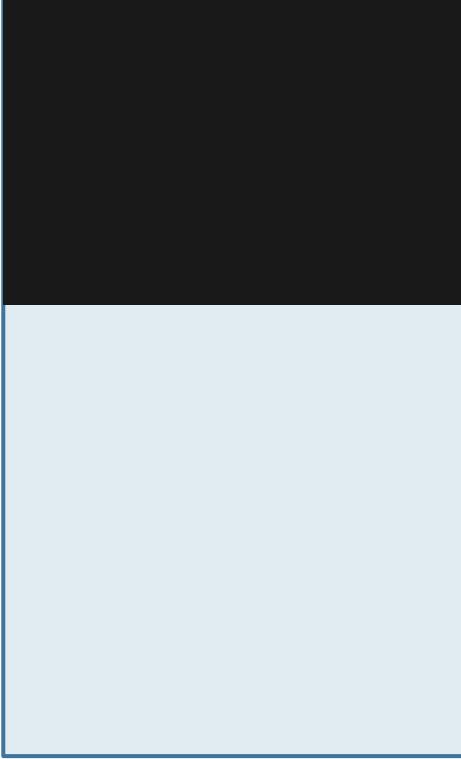
8.2 Delete

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history_table

operational_table



I have told you that deletions are often logical (flagged rows). However, to keep volumes under control, it's frequent to copy old rows to a history table, then delete them from the "active" table.

```
delete from table_name  
where ...
```

If you omit the WHERE clause, then (as with UPDATE)
the statement affects all rows and you

Empty table_name !

But of course you NEVER work in autocommit mode and always
execute a big update or delete in a transaction, don't you?



rollback

That's when you feel
grateful for some
features



As `DELETE` saves data for rollback before removing it, it can be slow. There is a `TRUNCATE` (without a `WHERE` clause) that cannot be rolled back and is far more efficient. It's better not to use it.

Constraints

= **guarantee**

One important point with constraints (foreign keys in particular) is that they guarantee that data remains consistent. They don't only work with INSERT, but with UPDATE and DELETE as well.

Try to delete rows from table **countries**

For instance, you can delete a country for which there are no movies. As soon as you have one movie, you are prevented from deleting the country otherwise the foreign key on table MOVIES would no longer work for films from that country.

To delete the row for China in table countries.

The constraint will prevent you to do that.

1 ! `delete from countries where country_code='cn';`

[23503] ERROR: update or delete on table "countries" violates foreign key constraint "movies_country_fkey" on table "movies"
详细: Key (country_code)=(cn) is still referenced from table "movies".

movies

countries

credits

people

This is why constraints are so important: they ensure that whatever happens, you'll always be able to make sense of ALL pieces of data in your database.

8.3 Functions

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Build-in functions:

lower()

upper()

substring()

trim()

...

Functions

Most DBMS (the exception is SQLite, not a true DBMS) implement a built-in, SQL-based programming language, that can be used when a declarative language is no longer enough. Let's start with the simplest thing, defining functions.

Sort ??

first_name	surname
Erich	von Stroheim

I gave an update example in which I was modifying every name starting with 'von ' so that they sort properly.

```
select first_name || ' ' || surname as full_name  
from people;
```

Erich Stroheim (von)

Sorting is one thing, but if I ever want to display the full name of a person by concatenating first_name and surname, it will look weird for von Stroheim. What I really want to see is

Erich von Stroheim



```
case first name?
  when first_name is null then ''
  else first_name || ''
end
|| case position('(' in surname)
  when 0 then surname
  else trim(')' from substr(surname,
                                position('(' in surname) + 1) )
  || ''
  || trim(substr(surname, 1,
                                position('(' in surname) - 1))
```

```
end full_name
```

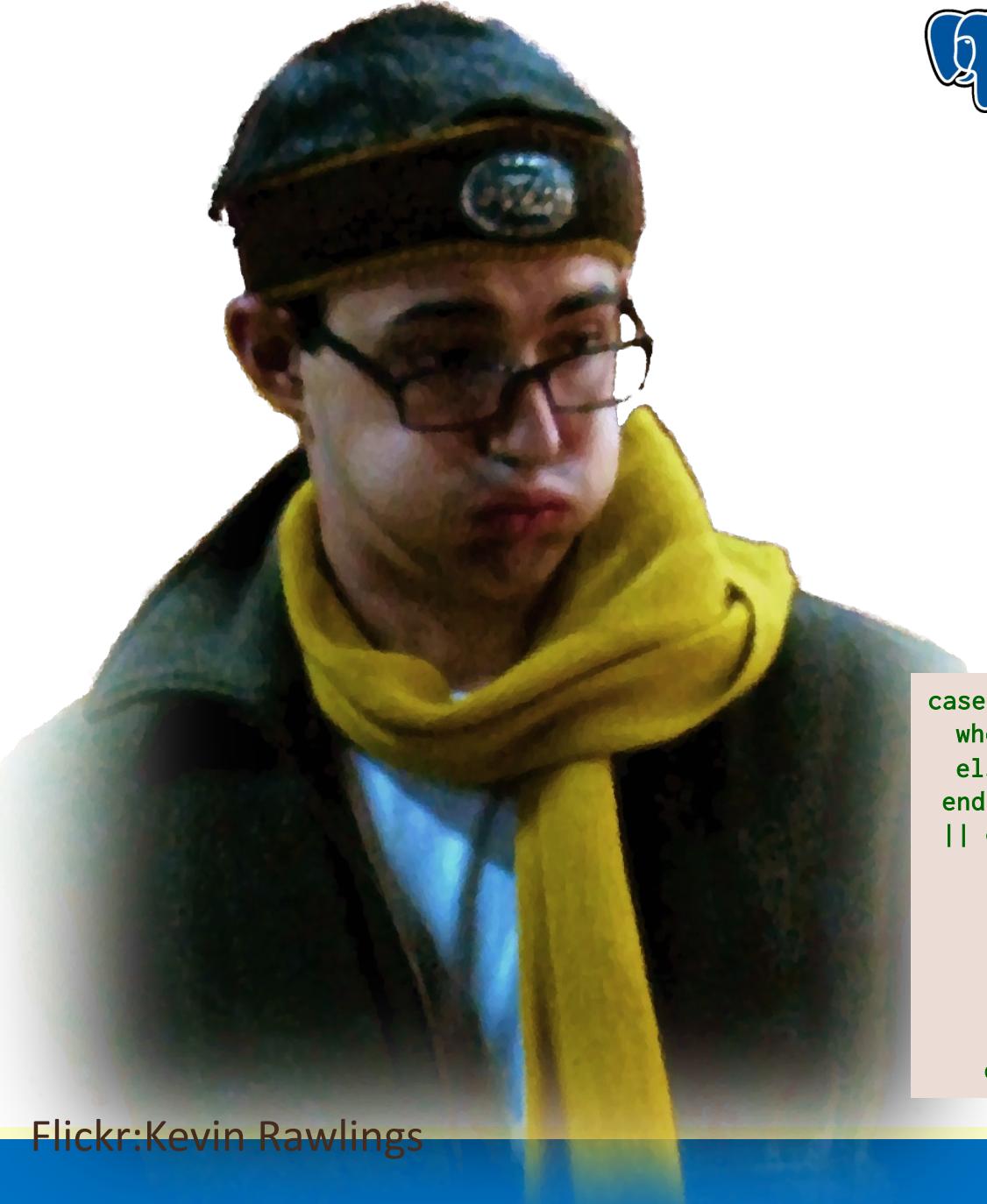
first_name

surname

Erich

Stroheim (von)

Erich von Stroheim



Needless to say, whenever you have painfully written something as complicated, which is pretty generic, you'd rather not copy and paste the code every time you need it.

```
case
  when first_name is null then ''
  else first_name || ' '
end
|| case position('(' in surname)
  when 0 then surname
  else trim(')' from substr(surname,
                                position('(' in surname) + 1))
  || ' '
  || trim(substr(surname, 1,
                                position('(' in surname) - 1))
end full_name
```

STORE FOR REUSE

You'd like to store the expression and reuse it in another context. In fact you can.

Here is a PostgreSQL example

```
create function full_name(p_fname varchar, p_sname varchar)
returns varchar
as $$

begin
    return case
        when p_fname is null then ''
        else p_fname || ' '
    end |

    case position('(' in p_sname)
        when 0 then p_sname
        else trim('0' from substr(p_sname,
                                position('(' in p_sname) + 1))
                    ||
                    ''
                    ||
                    trim(substr(p_sname, 1,
                                position('(' in p_sname) - 1)))
    end;
end;
$$ language plpgsql;
```

```
select full_name(first_name, surname) as name,  
       born, died  
  from people  
order by surname
```

Once your function is created, you can use it as if it were any built-in function.

Note that you usually have to write your functions in the provided language for safety: a badly coded C function could take down a whole server, corrupt data, etc. The provided language provides a kind of sand-boxed environment.

Procedural extensions to SQL



T-SQL



(no name)

ORACLE®

PL/SQL

PostgreSQL



PL/PGSQL

IBM® DB2®

SQL PL



nothing ...

You can use C or any language with SQLite. If you crash your program, it only affects you.

Procedural ?

variables

conditions

loops

arrays

error management

Procedural extensions provide all the bells and whistles of true programming languages (they were often inspired by programming languages such as PL/I or ADA). They are a mixed blessing, because they often incite programmers to do the wrong things with them.

... TRUE PROGRAMMING LANGUAGE

They also support all DML statements (no always DDL, but you can cheat)

```
select col1, col2, ...  
into local_var1, local_var2, ...  
from ...
```

+ CURSORS

To retrieve data from the database into your variables, you can use **SELECT ... INTO ...** if your query returns a single row, or you can use cursors, which are basically "row variables" that are used for iterating over what a query returns.



Cultural mismatch

row-by-row set processing

And here we have a problem,
because there is a big cultural gap
between the relational mindset
and procedural processing.

Bad example

In the category "never, ever do that even if you encounter it often" there is the infamous "look-up" function that returns for instance the label associated with a value.

Because it's a procedure stored inside the database, many developers believe in good faith that's how things should be done. Definitely no.

```
select country_name(country_code), title, ...  
from movies  
where ...
```

```
create function country_name(p_code varchar2)  
return countries.country_name%type  
as  
    v_name    countries.country_name%type;  
begin  
    select country_name  
    into v_name  
    from countries  
    where country_code = p_code;  
    return v_name;  
end;
```

NO

```
select c.country_name, m.title, ...  
from movies m  
    inner join countries c  
        on c.country_code = m.country  
where ...
```

Why is it bad? You can retrieve the same data with a join. I have hardly talked about the query optimizer so far but there are many ways to perform a join, some of which are particularly efficient on big volumes. A look-up function forces a "one row at a time" join which in most cases will be dreadful. A function shouldn't query the database.

SQL FIRST!



Tom Kyte, who is Senior Technology Architect at Oracle, says that his mantra is:

- You should do it in a single SQL statement if at all possible.
- If you cannot do it in a single SQL statement, then do it in PL/SQL (as little PL/SQL as possible!)

What Prof. Yu says:

- You should ask for help from someone more experienced than you, Google, tech forums, etc.