Day 2: Planning Your Database

Understanding the Relational Model, Organizing Data for It

Database Theory and Design
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Goals for Today:

A Review

- The 'Flat' database, and the DBMS
- The Database Management System (DBMS)

The Relational Database Model

- Understanding the Relational Database
- A flat table converted into realtions
- In class exercise: A mini-relational database for Gitksan

The Next Step: Designing a Relational Database

- Preliminary steps, and the "Systems Development Life Cycle"
- Planning
- Analysis & Design

Exercise and Follow-up

- In class exercise: An Mini-relational database
- The Next Step: Implementing a Relational Database
- Take-home Assignment

A common starting point: the 'Flat' database

Word	Gloss	Gram.	Morph.
hon	'fish'	N	ROOT
smax	'bear, meat'	N	ROOT
algyax̲	'language'	N	ROOT
sm̓-algyax̲	Gitksan	N	STEM
sm̓-	'true'	A	PREFIX
siipxw	'sick, ill'	A	ROOT
wii-n̓akw	'tall'	A	STEM
wii-	'long'	A	PREFIX
n̓akw	DISTAL		ROOT
n̓akw	EVIDENTIAL		ROOT
x̲-	'consume'	V	PREFIX
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=hl	common noun	Det.	ENCLITIC
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Table: A 'Flat' Database of a Gitksan (Tsimshianic) word list

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- A Relational Database: Consists of several tables called *relations*, that are linked to each other.

★: **Before we can start working on our database we need to understand how a relational database is modeled.**

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  1. **Relations**
  2. **Entities**
  3. **Attributes**
  4. **Records**

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- Each entity has a set of **Attributes**:
  - The set of characteristics associated with the entity.
  - Words: gloss, grammatical and morphological categories.
- A **Record**: Each (unique) row in a table is a single record within the entity set (simply listing of all the related entities in a set).

A simple example

Word	Gloss	Gram.	Morph.
hon	'fish'	N	ROOT
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wii-	'long'	A	PREFIX
n̓akw	DISTAL		ROOT
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Table: The Entity set: Words

- Consider the familiar, standard word list. What is it in relational terms?

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  - Each Gitksan word is an entity: it occupies a unique row.

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- **An entity set of Gitksan words.**
  - Each Gitksan word is an entity: it occupies a unique row.
  - Each row is associated with a set of attributes: **Gloss, Gram.** and **Morph.**

A simple example cont.

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‘bear, meat’	*smax*	N	**ROOT**
‘language’	*algyax̱*	N	**ROOT**
Gitksan	*sm̓-algyax̱*	N	STEM
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DISTAL	*n̓akw*		**ROOT**
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‘arrive’	*witxw*	V	**ROOT**
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- So far, we been using the attributes (the columns in our flat database) to define new relations (entity sets).
- However, it is the values of these attributes that defines entity sets as a natural class of objects.

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- For example, the morphological category ‘ROOTS’ become the entity set containing everything that is ROOT, while excluding everything that isn’t.

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Table: The Entity set: ROOTS

A mini-relational database for Gitksan

- Form groups of 3 and work out how many relations (tables) there are in the Gitksan dataset on the handout.

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- Form groups of 3 and work out how many relations (tables) there are in the Gitksan dataset on the handout.
- (Hint: Be as exhaustive as possible, including trying out ALL the attributes and features...)

Discussion

- In addition to Word, Gloss, and Roots, the Gitksan flat DB can be organized into at least X more unique entity sets:

Word	Gloss	Morph.
hon	‘fish’	ROOT
smax	‘bear, meat’	ROOT
algyax̲	‘language’	ROOT
sm̓-algyax̲	Gitksan	STEM

Table: The Entity set: NOUNS

Word	Gloss	Morph.
x̲-	‘consume’	PREFIX
iixwt	‘fish’	ROOT
witxw	‘arrive’	ROOT
bakw	‘arrive’	ROOT
litsx̲xw	‘read’	ROOT

Table: The Entity set: VERBS

Word	Gloss	Morph.
sm̓-	‘true’	PREFIX
siipxw	‘sick, ill’	ROOT
wii-n̓akw	‘tall’	STEM
wii-	‘long’	PREFIX

Table: The Entity set: ADJ.

Word	Gloss	Morph.
=hl	common noun	ENCLITIC
=t	proper noun	ENCLITIC
=tip	plural noun	ENCLITIC

Table: The Entity set: DET.

Discussion cont.

Word	Gloss	Morph.
-y̓	1sg	SUFFIX
-n	2sg	SUFFIX
-t	3	SUFFIX

Table: The Entity set: AGR

Word	Gloss	Gram.
sm̓-algyax̲	Gitksan	N
wii-n̓akw	‘tall’	A

Table: The Entity set: STEM

Word	Gloss	Gram.
sm̓-	‘true’	A
wii-	‘long’	A
x̲-	‘consume’	V

Table: The Entity set: PREFIX

Word	Gloss	Gram.
=hl	common noun	Det.
=t	proper noun	Det.
=tip	plural noun	Det.

Table: The Entity set: ENCLITIC

Discussion cont.

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Table: The Entity set: V ROOTS

Word	Gloss
hon	'fish'
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algyax̱	'language'

Table: The Entity set: N ROOTS

Word	Gloss
siipxw	'sick, ill'

Table: The Entity set: A ROOTS

- And more...

Designing a Relational Database

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- In the next section we will take the first steps on designing a relational database.
  - Examining your data and determining your goals: turning a flat database into a relational one.
  - The "Systems Development Life Cycle": the planning, design and implementation of your database in FileMaker PRO and MS Access.

Pulling the Conceptual Pieces together

- A flat database can be re-organized into a collection of unique tables (also called **relations**).

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- A flat database can be re-organized into a collection of unique tables (also called **relations**).
- Thus, relational databases consist of one or more tables which are related to each other based on sharing common entities.

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- A flat database can be re-organized into a collection of unique tables (also called **relations**).
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  - has a set of attributes: these are typically your column headings which encode that attributes of the individual entities within the set.

Some Entity sets

Word	Gloss	Morph.
hon	‘fish’	**ROOT**
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Table: The Entity set: Nouns

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Table: The Entity set: Verbs

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siipxw	‘sick, ill’	A
n̓akw	DISTAL	
n̓akw	EVIDENTIAL	
iixwt	‘fish’	V
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Table: The Entity set: ROOTS

The “Systems Development Life Cycle”

- A concept from database design theory: the *Systems Development Life Cycle* (SDLS).
- The SDLS is a useful set of (re)iterative conceptual phases:

	Phase	**Action**
1.	*Planning*	What is the the purpose of the database?
2.	*Analysis*	Assessing and organizing the data.
3.	*Design*	Logical design of the database.
4.	*Implementation*	MS Access, FMP, OO Base etc.
5.	*Maintenance*	Evaluation, maintenance, further development

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    - Etc.
- **There is no single, out-of-the-box solution:** think of all the things you could possible document about a language, and all the different ways to look at it and organize it – that's how many potentially different kinds of databases you could make.

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- Work through the construction of an appropriate diagram for your database: This diagram is the basis for the tables and fields.

Dos and Don’ts

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- It may not be immediately obvious what the entities might be in your dataset.

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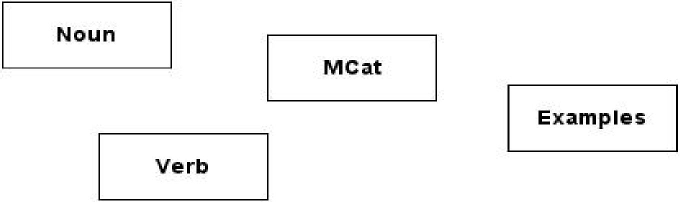

Noun

MCat

Examples

Verb

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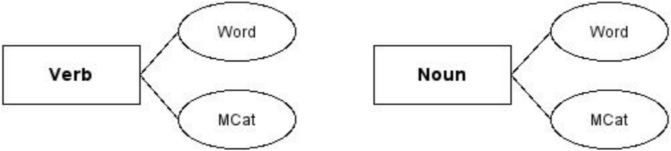

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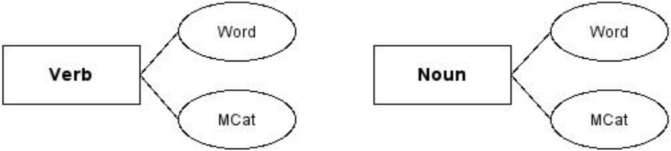

- An alternative notation: VERB(Word, MCat)

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- The other grammatical categories will also have their own unique attributes (Adjective: physical, colour, etc.).

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- Make sure that your definitions apply equally accurately to every possible instance – not just the normal case.

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- We will see how determining attribute domains helps in determining relationships and adds power to queries.

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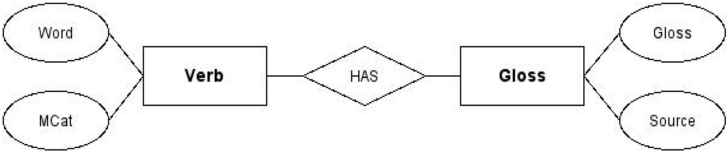

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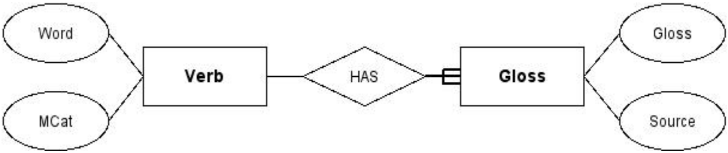
- In an ER diagram, this represented by a little ‘pitchfork’ at the ‘many side’ of the relationship:



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- Don't go crazy with relationships: they can be difficult to implement and can actually end up making your database overly-restrictive and difficult to query.

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  - Identify the relationships that connect them. (tip: don't overcomplicate these! Find an attribute they share in common.)