Idiom Interpretation: The Effect of Idiom Source Language

A project for LINGUIST 245B

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Motivation

What are idioms?

- Non-compositional
- Conventionally used
- “Frozen” or “dead” metaphors

Example : “piece of cake”, “the black sheep”, “kick the bucket”

Conceptual metaphor

Conceptual metaphor is a means of understanding one idea (usually abstract) in terms of another idea (more concrete)

Conceptual metaphor drives many figurative expressions

Example: ANGER is FIRE is a conceptual metaphor that leads to expressions like

“Hot under the collar”, “add fuel to the fire”, “burning rage”

Interpreting idioms

- The non-compositional view says that idioms are learned contextually through culture and contextual use
- The compositional view says that **to some extent** there is an underlying conceptual metaphor in idioms which contributes to their interpretation aside from just contextual or conventional use.

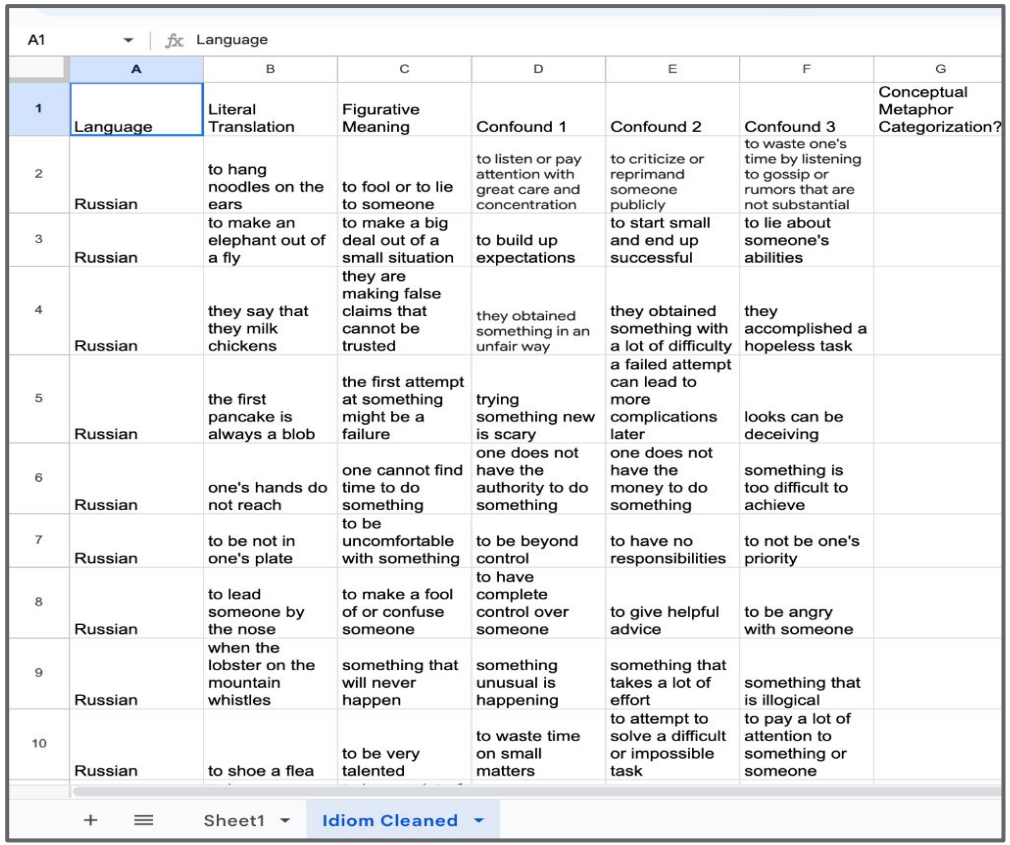
Thus, the question: even if an idiom is unfamiliar, can you still interpret what it means based on some shared conceptual metaphor?

What if these idioms were translations of idioms from another language?

Would this conceptual metaphor theory still hold?

And...does the source language itself affect the likelihood of interpreting the corresponding idiom meaning?

Data



A1 | Language

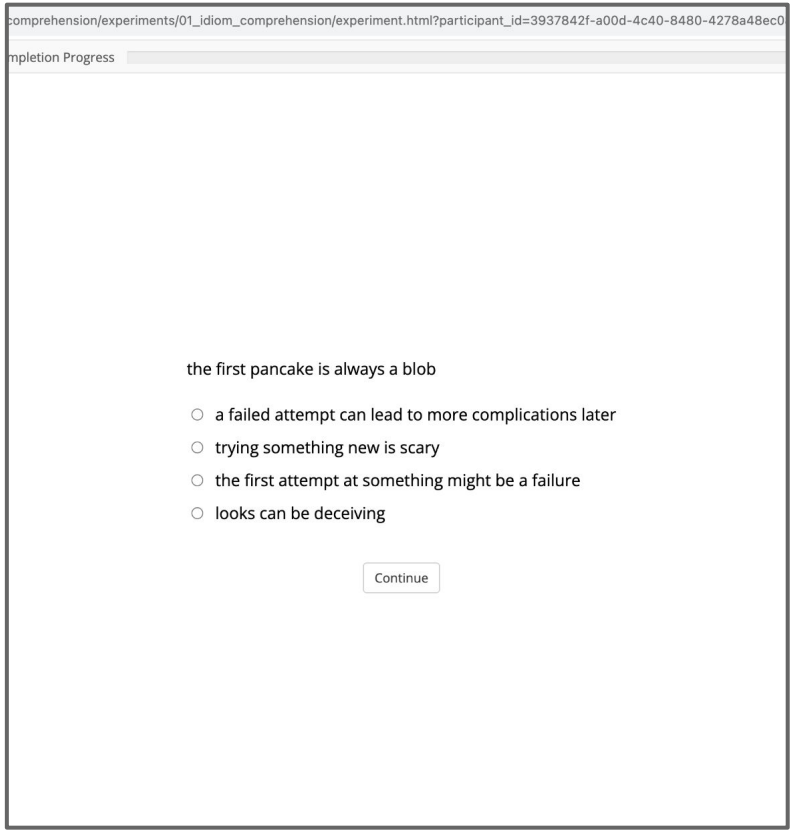
	A	B	C	D	E	F	G
1	Language	Literal Translation	Figurative Meaning	Confound 1	Confound 2	Confound 3	Conceptual Metaphor Categorization?
2	Russian	to hang noodles on the ears	to fool or to lie to someone	to listen or pay attention with great care and concentration	to criticize or reprimand someone publicly	to waste one's time by listening to gossip or rumors that are not substantial	
3	Russian	to make an elephant out of a fly	to make a big deal out of a small situation	to build up expectations	to start small and end up successful	to lie about someone's abilities	
4	Russian	they say that they milk chickens	they are making false claims that cannot be trusted	they obtained something in an unfair way	they obtained something with a lot of difficulty	they accomplished a hopeless task	
5	Russian	the first pancake is always a blob	the first attempt at something might be a failure	trying something new is scary	a failed attempt can lead to more complications later	looks can be deceiving	
6	Russian	one's hands do not reach	one cannot find time to do something	one does not have the authority to do something	one does not have the money to do something	something is too difficult to achieve	
7	Russian	to be not in one's plate	to be uncomfortable with something	to be beyond control	to have no responsibilities	to not be one's priority	
8	Russian	to lead someone by the nose	to make a fool of or confuse someone	to have complete control over someone	to give helpful advice	to be angry with someone	
9	Russian	when the lobster on the mountain whistles	something that will never happen	something unusual is happening	something that takes a lot of effort	something that is illogical	
10	Russian	to shoe a flea	to be very talented	to waste time on small matters	to attempt to solve a difficult or impossible task	to pay a lot of attention to something or someone	

Sheet1 | Idiom Cleaned

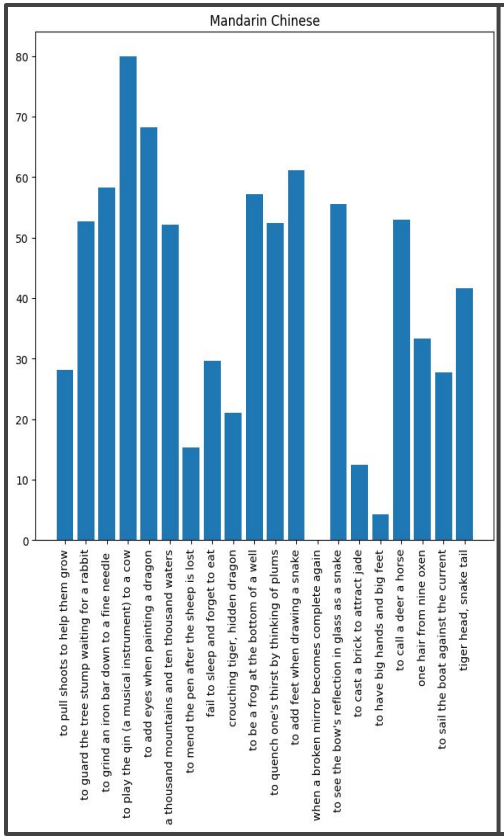
- 80 Idioms split equally across 4 languages - **Russian, Hindi, Mandarin Chinese, Spanish**
- Translated into English
- **One corresponding figurative meaning + 3 confound meanings**
- Idioms collected from Internet mostly, and online books / textbooks
- Confounds generated using **LLMs** (Llama 13B and 70B, PaLM 2) OR **manually** creating plausible options with underlying conceptual metaphors that could potentially fit the idiom

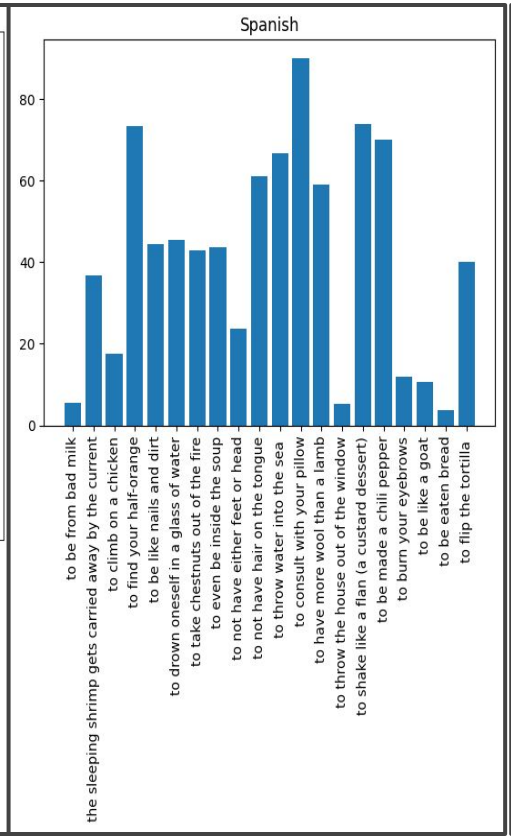
Experiment design

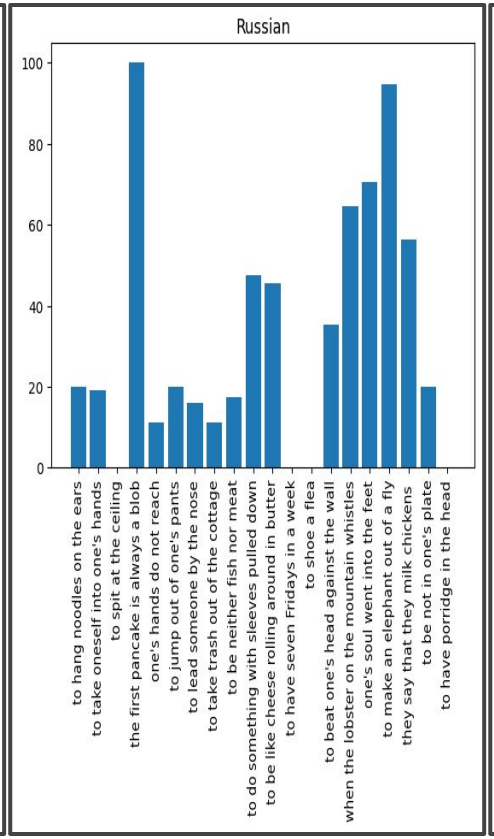
Number of participants: Pilot (10), Main (100)
Demographics: Crowdsourced on Prolific, restricted to US, UK, EU, Mexico, Singapore, Switzerland, and India.
Number of items per participant: 16 (randomly sampled from dataset and shuffled, 4 per language) + 4 standard English idioms as attention checks
Method of presentation: Sequentially show participants idiom along with the 4 options (shuffled) - radio buttons (single choice response)

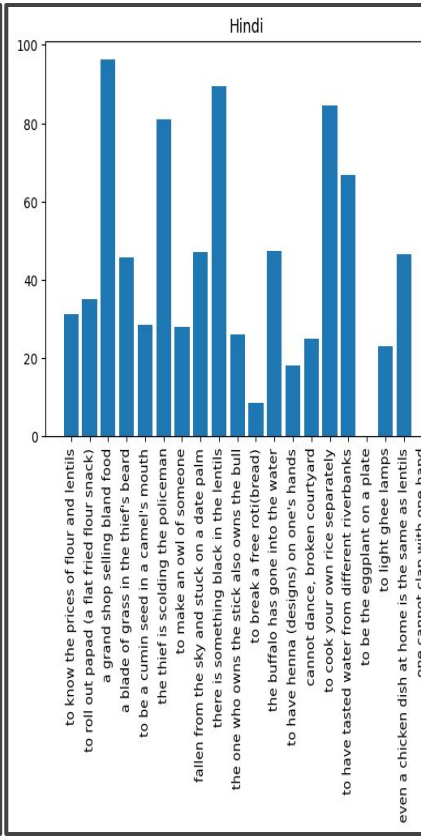


Some visualizations

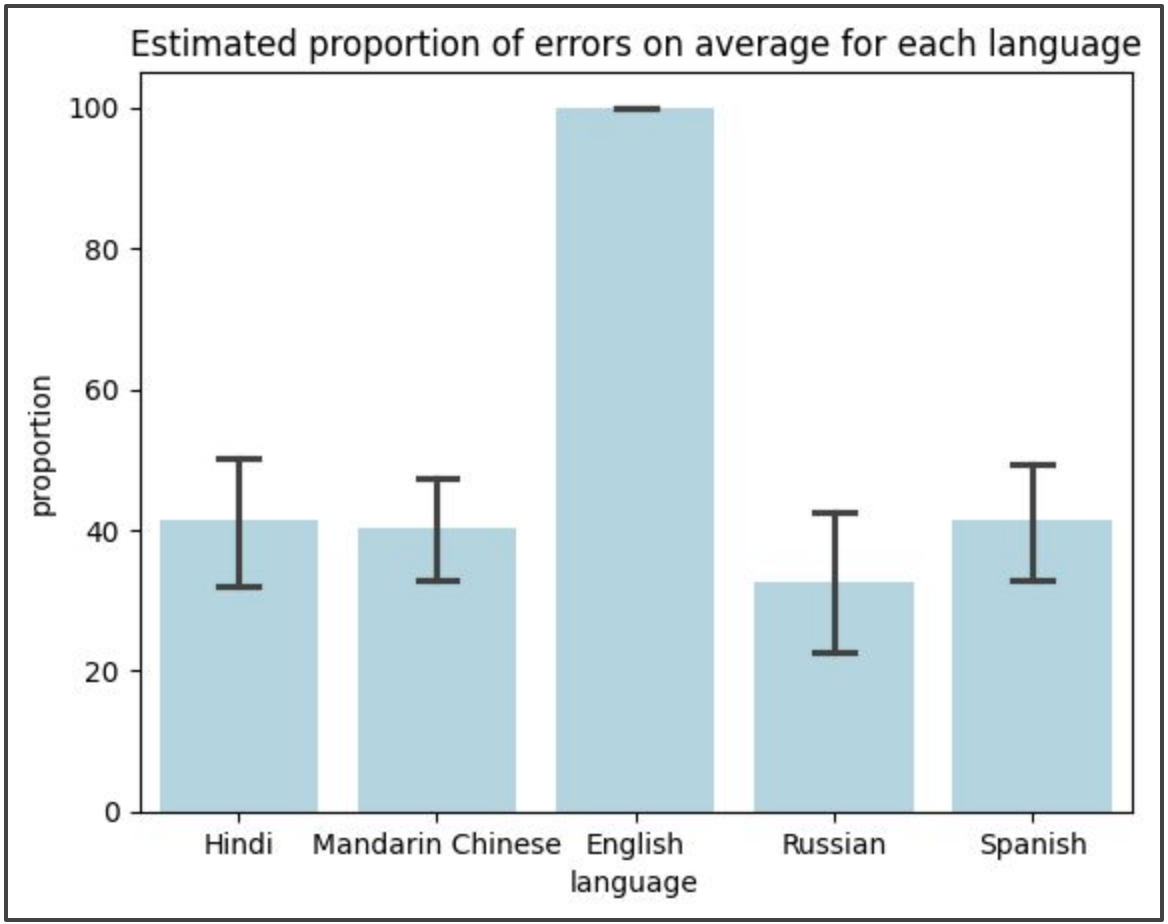








Overall, the proportion of judgments that were predicted were the least favorable for Russian and almost equally distributed across the remainder of the languages, with Spanish having the most consistency (at least one expected judgment per idiom) and Chinese having a good amount of judgments over 50%.



Here, the average proportion of expected idiom meanings predicted is the lowest in Russian with a higher error margin than either Hindi or Spanish (equivalent) or Mandarin (lowest error after English which is our attention check language)

Models:

Mixed Effects Logistic Regression

```
glm(formula = result ~ language, family = "binomial", data = idiomsnew)

Coefficients:
                         Estimate Std. Error z value Pr(>|z|)
(Intercept)               0.34333    0.10148   3.383 0.000716 ***
languageMandarin Chinese  0.06213    0.14392   0.432 0.665962
languageRussian           0.38755    0.14729   2.631 0.008506 **
languageSpanish           0.04134    0.14378   0.288 0.773704
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 2134.5  on 1599  degrees of freedom
```

Model without random effects -> simple correlation between result and language
This shows that with Hindi as the reference language, the comparative likelihood of predicting the expected meaning is lower for Russian and pretty equal and non-significant for the other two languages

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']
 Family: binomial  ( logit )
Formula: result ~ 1 + (1 | idiom)
   Data: idiomsnew

     AIC      BIC   logLik deviance df.resid
  1825.4   1836.2   -910.7   1821.4     1598

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.6096 -0.7458  0.3217  0.6322  3.1431

Random effects:
 Groups Name        Variance Std.Dev.
 idiom  (Intercept) 2.099    1.449
Number of obs: 1600, groups:  idiom, 80

Fixed effects:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)   0.6266     0.1754   3.572 0.000354 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> 
```

Simple random effect for per-item basis

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']
 Family: binomial  ( logit )
Formula: result ~ 1 + (1 | workerid)
   Data: idiomsnew

     AIC      BIC   logLik deviance df.resid
  2136.3   2147.0  -1066.1   2132.3     1598

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.4414 -1.2077  0.7487  0.7874  0.8925

Random effects:
 Groups   Name        Variance Std.Dev.
 workerid (Intercept) 0.06218  0.2494
Number of obs: 1600, groups:  workerid, 100

Fixed effects:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  0.47020    0.05766   8.154 3.51e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>
```

Model with just participant as a random effect

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']
 Family: binomial  ( logit )
Formula: result ~ language + (1 | workerid)
   Data: idiomsnew

     AIC      BIC   logLik deviance df.resid
  2133.4   2160.2  -1061.7   2123.4     1595

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.5733 -1.1713  0.7053  0.8106  0.9519

Random effects:
 Groups   Name        Variance Std.Dev.
 workerid (Intercept) 0.06447  0.2539
Number of obs: 1600, groups:  workerid, 100

Fixed effects:
                        Estimate Std. Error z value Pr(>|z|)
(Intercept)              0.34882    0.10545   3.308 0.000939 ***
languageMandarin Chinese  0.06311    0.14503   0.435 0.663484
languageRussian           0.39338    0.14842   2.650 0.008039 **
languageSpanish           0.04199    0.14489   0.290 0.771939
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) lnggMC lnggRs
lnggMndrnCh -0.684
languagRssn -0.667  0.486
langugSpnsh -0.684  0.498  0.486
>
```

m.itemlang (glmerMod , 71088 bytes)

Language as a fixed effect and participants as random effects shows Russian still having significant odds of being incorrect.

```
> summary(m.c)
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']
 Family: binomial  ( logit )
Formula: result ~ language + (1 + language || workerid)
   Data: idiomsnew

     AIC      BIC   logLik deviance df.resid
  2145.6   2226.3  -1057.8   2115.6     1585

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.5985 -1.1232  0.6707  0.7721  1.1129

Random effects:
 Groups     Name                        Variance  Std.Dev.  Corr
 workerid   (Intercept)                 1.920e-07 0.0004381
 workerid.1 languageHindi               1.421e-01 0.3769594
            languageMandarin Chinese    3.231e-01 0.5684554  0.29
            languageRussian             4.722e-02 0.2173069 -0.91  0.14
            languageSpanish             2.850e-01 0.5338971 -0.47  0.71  0.80
Number of obs: 1600, groups:  workerid, 100

Fixed effects:
                         Estimate Std. Error z value Pr(>|z|)
(Intercept)               0.35551    0.11058   3.215   0.0013 **
languageMandarin Chinese  0.08177    0.16042   0.510   0.6102
languageRussian           0.38364    0.16141   2.377   0.0175 *
languageSpanish           0.05611    0.16816   0.334   0.7387
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) lnggMC lnggRs
lnggMndrnCh -0.654
languagRssn -0.729  0.485
langugSpnsh -0.708  0.544  0.548
```

Model with language decorrelated from participant

The main conclusion:
Does idiom source language affect prediction of expected meaning?

Null hypothesis: Source Language does not have an effect on prediction

Results

- Russian seems to be slightly trickier to predict than the other languages although one idiom “the first pancake…” is universally predicted with the expected meaning.
- Across all participants and items, language is partly a predictor in this case (only if Russian is involved)
- Per participant too, Russian is more likely to be consistently predicted in an unexpected way, although we see that variance in predictions is higher for Spanish among participants (slightly).
- **NOTE: Participants were not told that these were translations of idioms. Since >95% of the participants were monolingual English speakers, this was thus relatively unbiased in terms of immediate knowledge of idioms.**

Future work and analyses:

1. Other variables like idiom affect or presence of certain kinds of noun (natural kind vs artifact) on expected idiom prediction (long-term)
2. LLM performance on this task compared to humans (long-term)