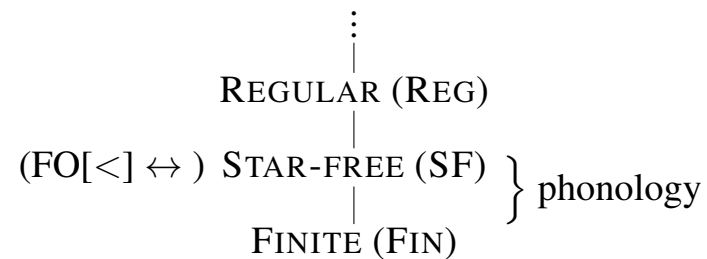


### Computation and representation

- In terms of string patterns, phonology is (at most) STAR-FREE (SF) (e.g., Rogers et al., 2013)



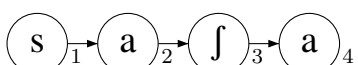
- Hypothesis:** non-string structures should be *first-order (FO-)definable* from strings (with  $<$ )
- Intuitive interpretation: phonological structure does not represent *abstract* information

### Surface correspondence

- Long-distance consonant agreement* analyzed with *surface correspondence* ( $\mathcal{R}$ ) (Hansson, 2001, 2010; Rose and Walker, 2004)
- (1) Navajo (Sapir and Hoijer, 1967; Hansson, 2010)
  - a.  $\text{ʃi-te:ʒ}$  b.  $*\text{si-te:ʒ}$  c.  $*[+\text{ant}] [-\text{ant}]$  ('they (dual) are lying')
  - (1c) is a *banned substructure constraint (BSC)* (Jardine and Heinz, in press)
  - What are  $\mathcal{R}$ 's formal properties? (Bennett, 2013: it is an equivalence relation)

### Logical definitions (I)

- Method:** FO-transductions (Courcelle, 1994)
- Signature* of a string:  $\langle D; <, P_s, P_f, P_t, P_a \rangle$

Ex.: [safa] 

- FO of signature:  $P_a(x) \mid x < y \mid x = y \mid \varphi \vee \psi \mid \neg\psi \mid (\forall x)[\varphi(x)]$

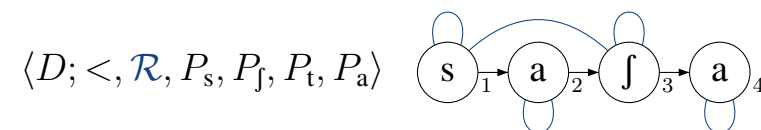
### Logical definitions (II)

- We define *new* relations using FO

$$[+\text{stri}](x) \stackrel{\text{def}}{=} P_s(x) \vee P_f(x)$$

- Navajo correspondence:

$$x\mathcal{R}y \stackrel{\text{def}}{=} x = y \vee [+\text{stri}](x, y)$$



- FO-defined correspondence + BSCs do not exceed SF

### Other cases

- Koyra (Hayward, 1982; McMullin and Hansson 2016)

- a.  $\text{go:tf-uf}$  d.  $*\text{go:tf-us}$  'cause to pull'
- b.  $\text{dʒaf-uf-es:e}$  e.  $*\text{dʒaf-us-es:e}$  'let him/them frighten s.o.'
- c.  $\text{fod-us}$  f.  $*\text{fod-uf}$  'cause to uproot'

$$\begin{aligned} \text{inter}(x, y, z) &\stackrel{\text{def}}{=} (x < z \wedge z < y) \vee (y < z \wedge z < x) \\ \text{int}[\text{str}](x, y) &\stackrel{\text{def}}{=} (\forall z) [( \text{inter}(x, y, z) \wedge C(z) ) \rightarrow [+\text{stri}](z)] \\ x\mathcal{R}y &\stackrel{\text{def}}{=} x = y \vee ([+\text{stri}](x, y) \wedge \text{int}[\text{str}](x, y)) \end{aligned}$$

- Slovenian (Jurgec, 2011; McMullin and Hansson, 2016)

- a.  $\text{pozabi-f}$  c.  $*\text{pozabi-f}$  '(you) forget'
- b.  $\text{zida-f}$  d.  $*\text{zida-f}$  '(you) build'

$$x\mathcal{R}y \stackrel{\text{def}}{=} x = y \vee ([+\text{stri}](x, y) \wedge \text{int}[\text{noncor}](x, y))$$

- Kikongo (Rose and Walker, 2004)

- a.  $\text{ku.ki.ni.na}$  c.  $*\text{ku.ki.ni.la}$  'to dance for'
- b.  $\text{ban.ti.ki.di}$  d.  $*\text{ban.ti.ki.ni}$  'begun'

$$\text{SRole}(x, y) \stackrel{\text{def}}{=} (\text{onset}(x) \wedge \text{onset}(y)) \vee (\text{coda}(x) \wedge \text{coda}(y))$$

$$x\mathcal{R}y \stackrel{\text{def}}{=} x = y \vee ([+\text{voi}, -\text{cont}](x, y) \vee [+ \text{son}, + \text{cons}](x, y)) \wedge \text{SRole}(x, y)$$

### Discussion and comparison

- Distance insensitive & sensitive  $\mathcal{R}$ ,  $\mathcal{R}$  with blocking, and  $\mathcal{R}$  conditioned on syllable role are all FO-definable
- OT-style interaction of same conditions can produce pathologies (McMullin and Hansson, 2016)

/fasasasa/	PROX	CORR[+stri]	CC-ID[-ant]
a. fasasasa		***!*	
$\times$ b. fafaafa	*!* *		
$\text{f} \text{a} \text{f} \text{a} \text{f} \text{a} \text{f} \text{a}$ c. fafasasa		** **	

d.\* fafaafa \*\*\*

- Above  $\mathcal{R}$  is provably not FO
- FO structure + BSCs like *Tier-based Strictly Local (TSL)* (Heinz et al., 2011, et. seq.), but more expressive—Kikongo not TSL
- Other kinds of structure appear FO-definable:
  - Autosegmental representations (Jardine, 2017)
  - Syllable structure (Strother-Garcia, ms.)
  - Feet (?) (Rogers et al., 2013)

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