An Introduction to Mildly Context-Sensitive Grammar Formalisms

— *Minimalist Grammars / Example* —

Gerhard Jäger & Jens Michaelis
Universität Potsdam

{jaeger,michael}@ling.uni-potsdam.de

MG-example 2

(α_0) =t.c.*that*

(α_1) =t.+wh.c.$\emptyset$

(α_2) =$\tilde{\text{v}}$.+k.t.$\emptyset$

(α_3) =v.=d.$\tilde{\text{v}}$.$\emptyset$

(α_4) =d.+k.v.*eat*

(α_5) v.*laugh*

(α_6) =n.d.−k.*the*

(α_7) =n.d.−k.−wh.*which*

(α_8) n.*king*

(α_9) n.*pie*

MG-example 2

(α_7) =n.d.-k.-wh.*which*

(α_9) n.*pie*

MG-example 2

(α_7) $=\mathtt{n}.\mathtt{d}.-\mathtt{k}.-\mathtt{wh}.$*which*

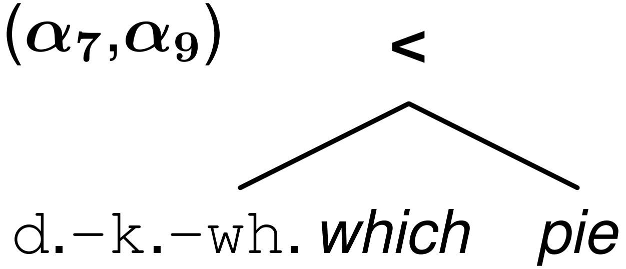
(α_9) $\mathtt{n}.$*pie*

MG-example 2

$(\boldsymbol{\alpha_7})$ $=$n.d.$-$k.$-$wh.*which*

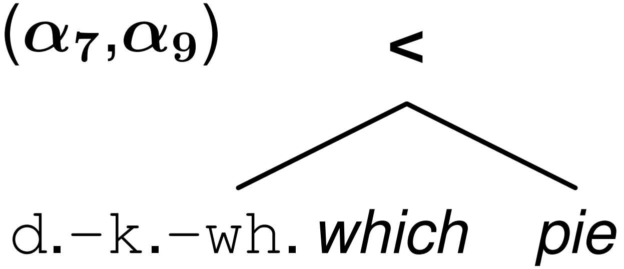
$(\boldsymbol{\alpha_9})$ n.*pie*

(γ_1) merge$(\boldsymbol{\alpha_7},\boldsymbol{\alpha_9})$



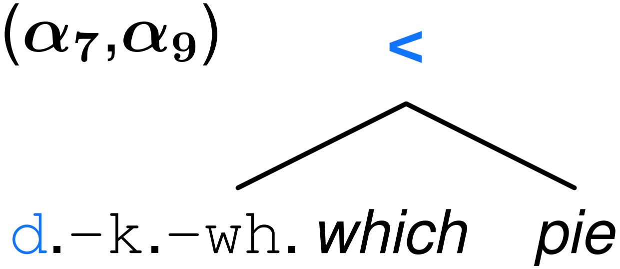
MG-example 2

(γ_1) merge($\boldsymbol{\alpha_7}$,$\boldsymbol{\alpha_9}$)



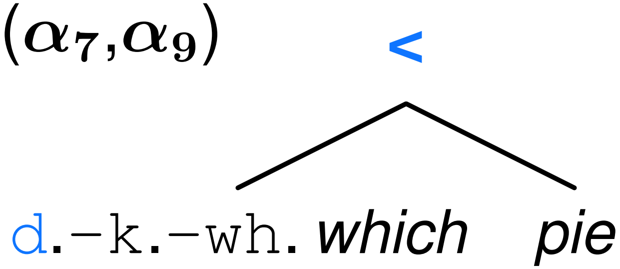
MG-example 2

(γ_1) merge($\boldsymbol{\alpha_7}$,$\boldsymbol{\alpha_9}$)



MG-example 2

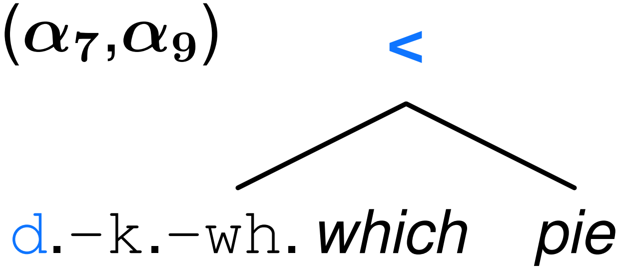
(γ_1) merge($\boldsymbol{\alpha_7}$,$\boldsymbol{\alpha_9}$)



$(\boldsymbol{\alpha_4})$ =d.+k.v.*eat*

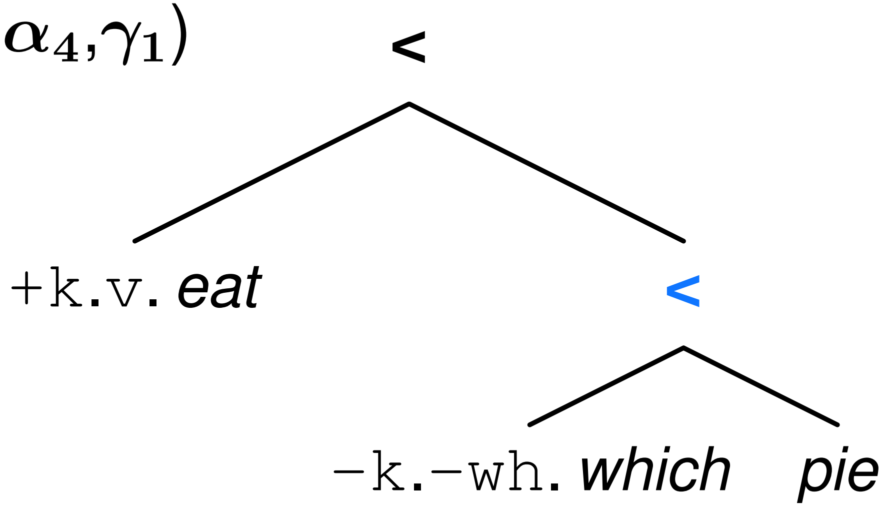
MG-example 2

(γ_1) merge(α_7,α_9)



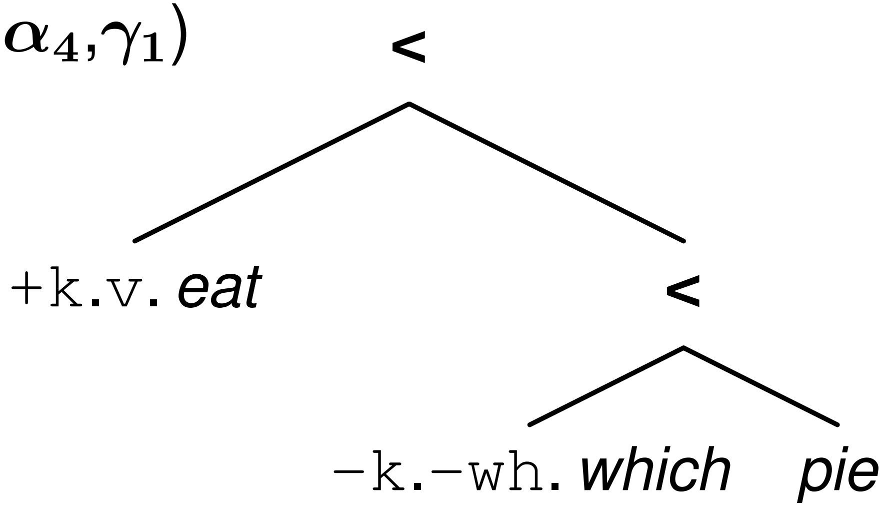
(α_4) =d.+k.v.*eat*

(γ_2) merge(α_4,γ_1)



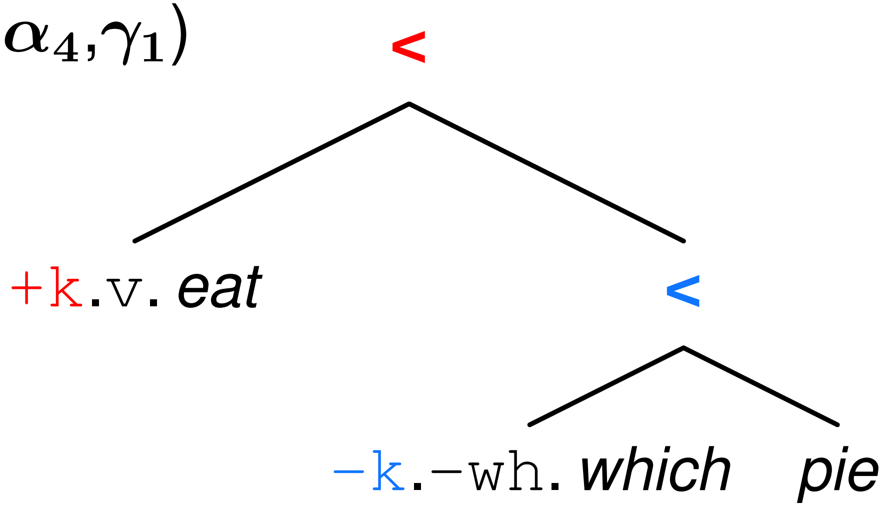
MG-example 2

(γ_2) merge(α_4,γ_1)



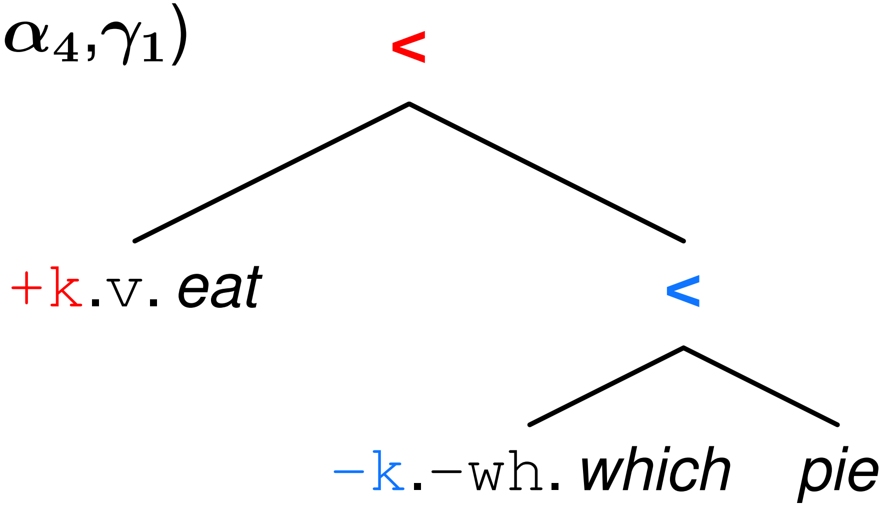
MG-example 2

(γ_2) merge(α_4,γ_1)

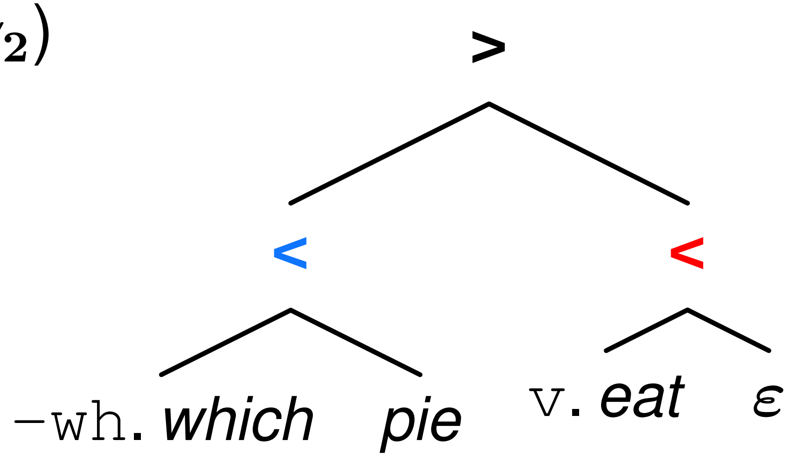


MG-example 2

(γ_2) merge(α_4,γ_1)

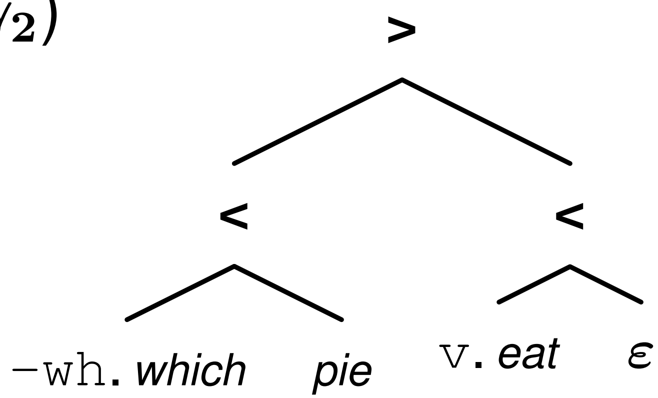


(γ_3) move(γ_2)



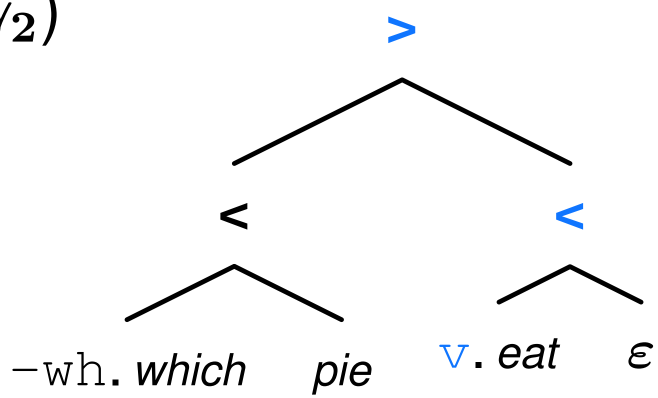
MG-example 2

(γ_3) move(γ_2)



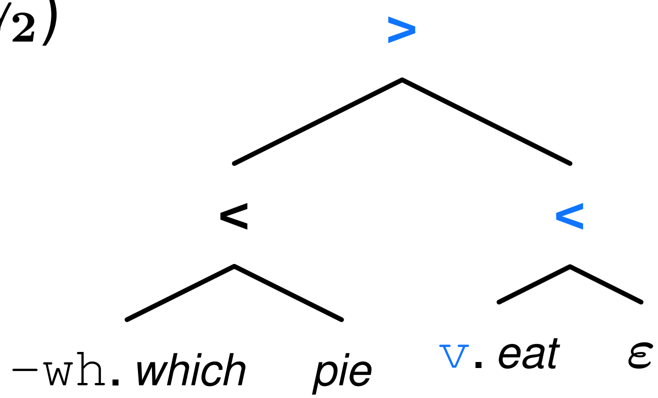
MG-example 2

(γ_3) move(γ_2)



MG-example 2

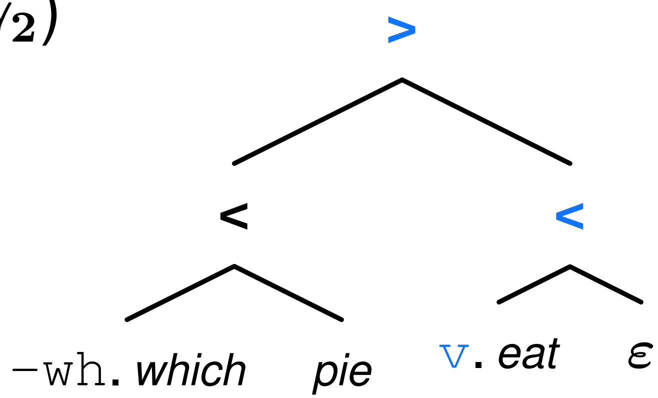
(γ_3) move(γ_2)



(α_3) $=\mathtt{v}.=\mathtt{d}.\tilde{\mathtt{v}}.\ \emptyset$

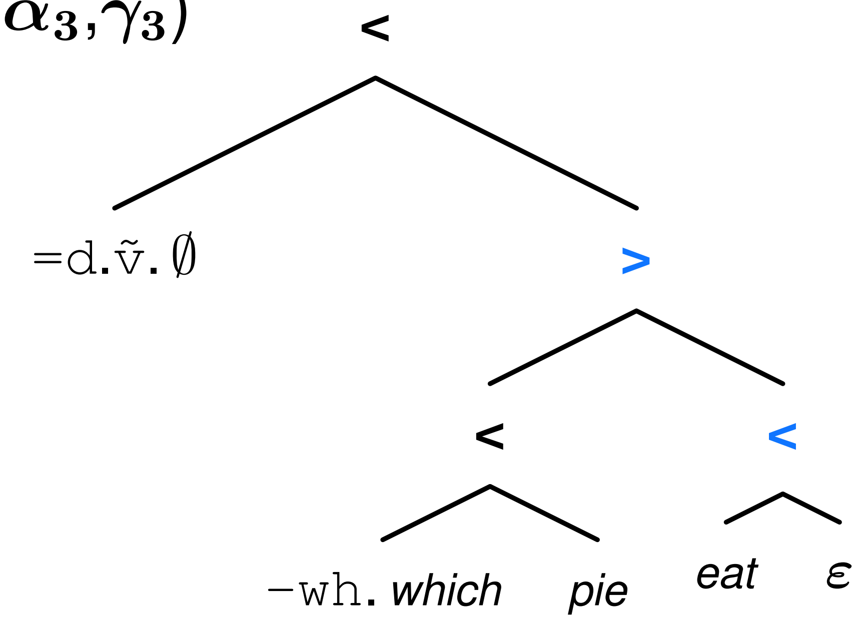
MG-example 2

(γ_3) move(γ_2)



(α_3) $=\mathtt{v}.=\mathtt{d}.\tilde{\mathtt{v}}.\ \emptyset$

(γ_4) merge(α_3,γ_3)



MG-example 2

$(\boldsymbol{\alpha_6})$ `=n.d.-k.` *the*

$(\boldsymbol{\alpha_8})$ `n.` *king*

MG-example 2

$(\boldsymbol{\alpha_6})$ =n.d.−k. *the*

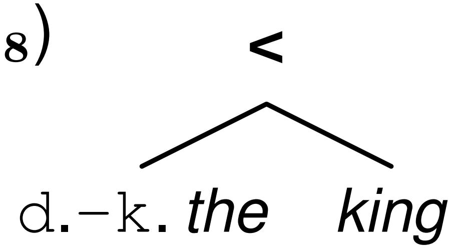
$(\boldsymbol{\alpha_8})$ n. *king*

MG-example 2

(α_6) =n.d.−k. *the*

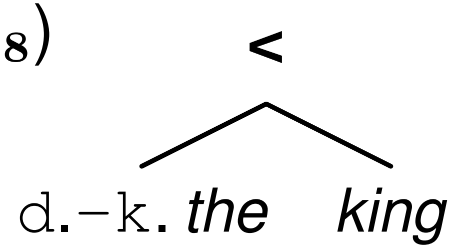
(α_8) n. *king*

(γ_5) merge(α_6, α_8)



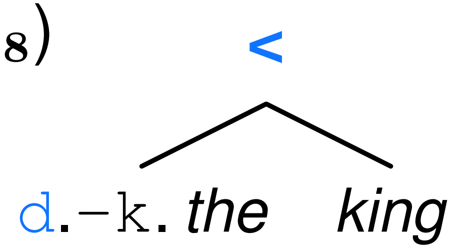
MG-example 2

(γ_5) merge($\boldsymbol{\alpha_6}, \boldsymbol{\alpha_8}$)



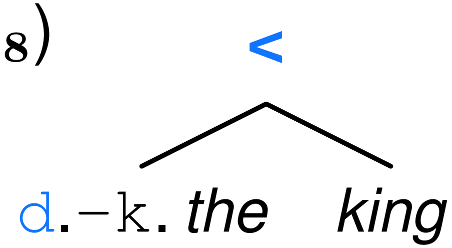
MG-example 2

(γ_5) $\text{merge}(\boldsymbol{\alpha}_6, \boldsymbol{\alpha}_8)$

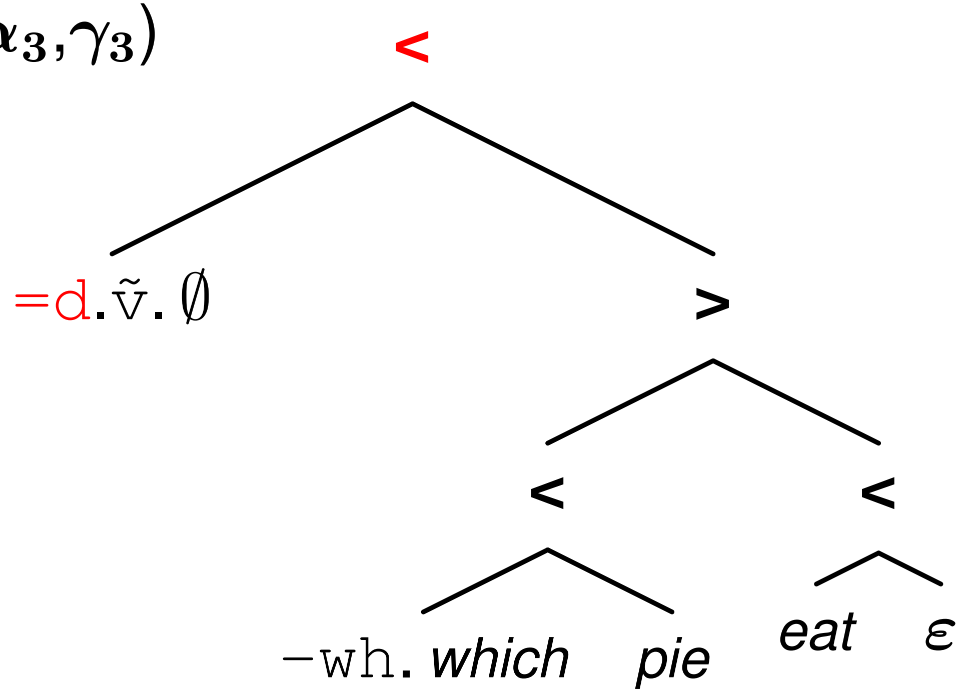


MG-example 2

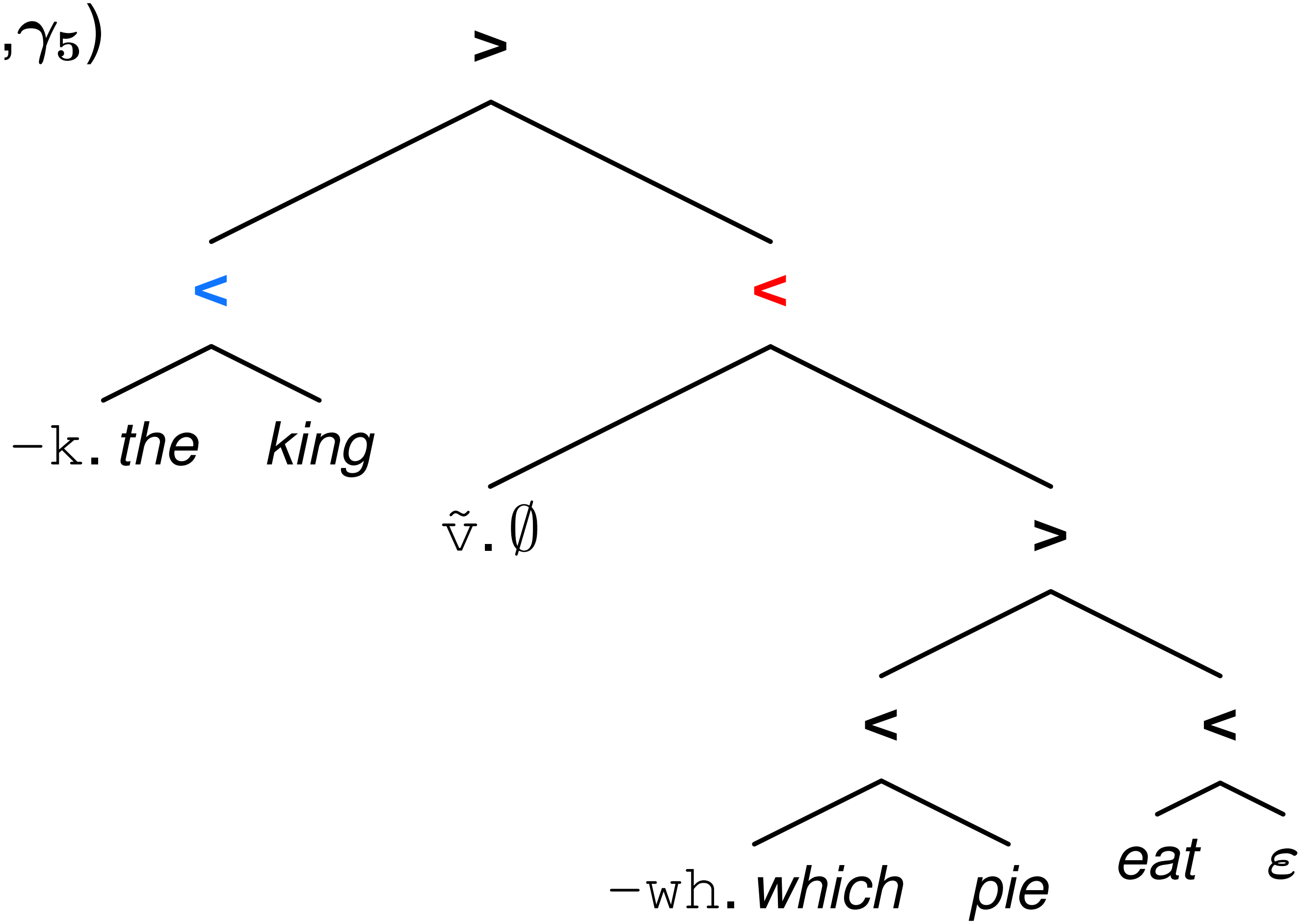
(γ_5) merge($\boldsymbol{\alpha_6}$, $\boldsymbol{\alpha_8}$)



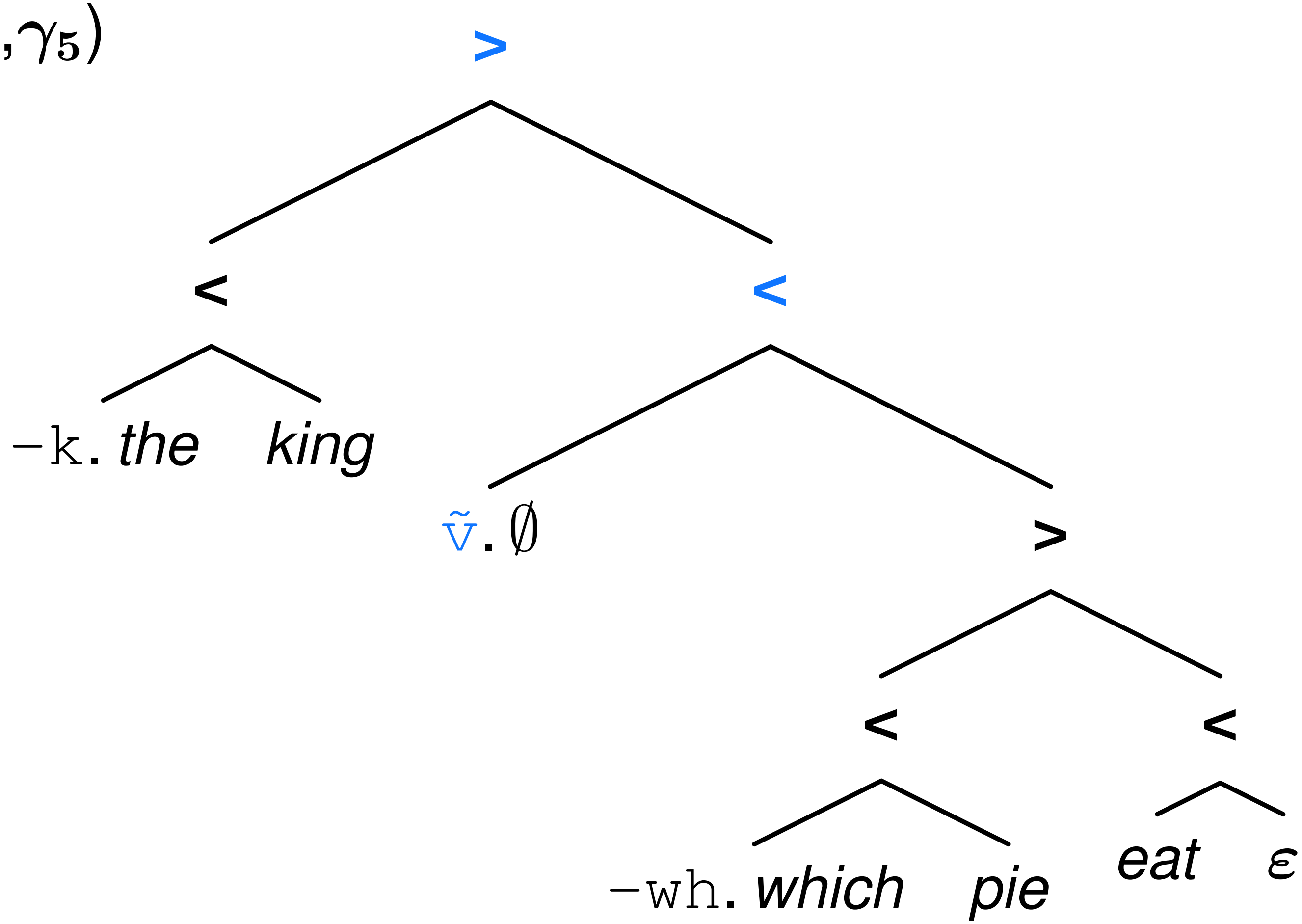
(γ_4) merge($\boldsymbol{\alpha_3}$, $\boldsymbol{\gamma_3}$)



(γ_6) merge(γ_4,γ_5)

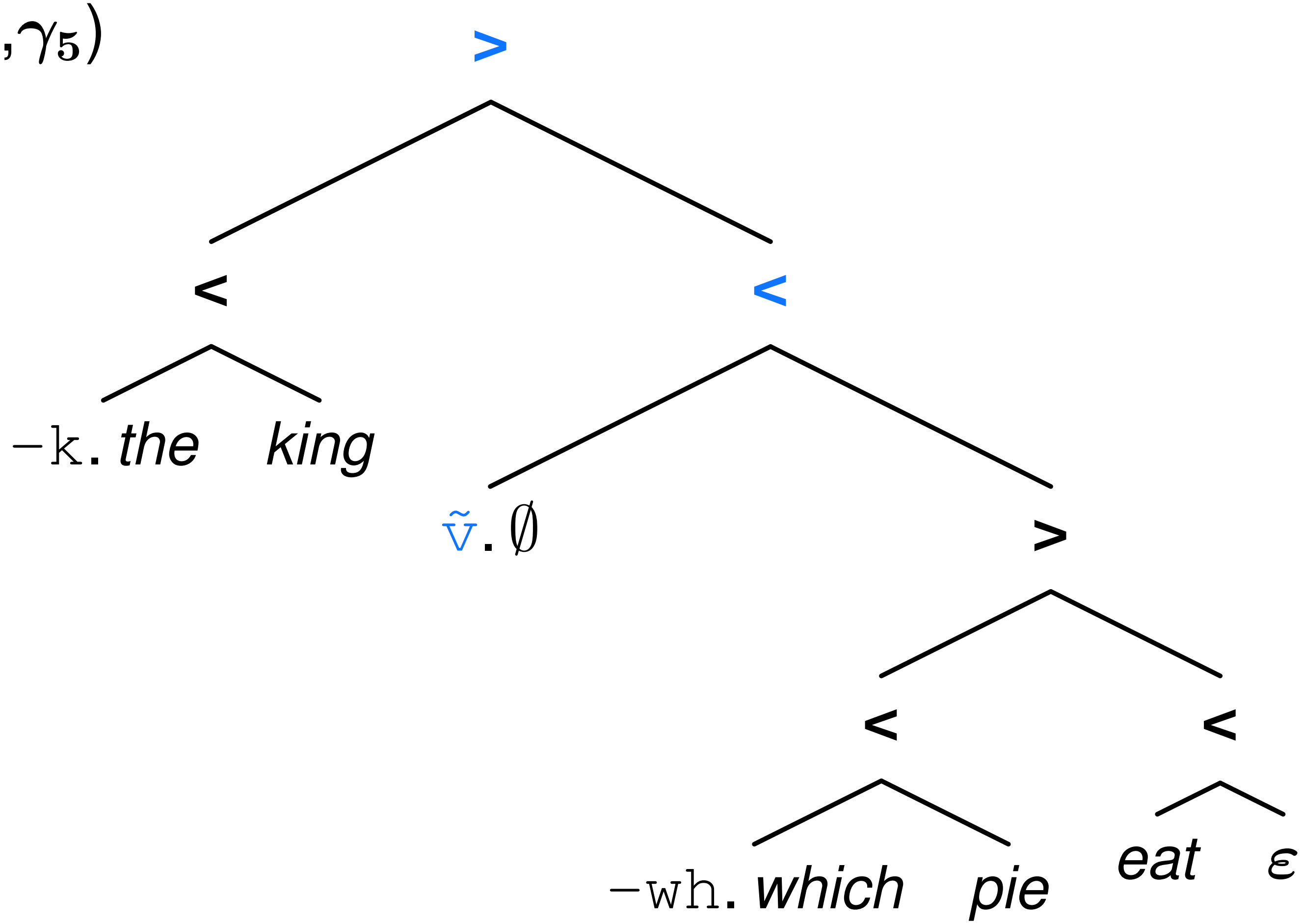


(γ_6) merge(γ_4,γ_5)



MG-example 2

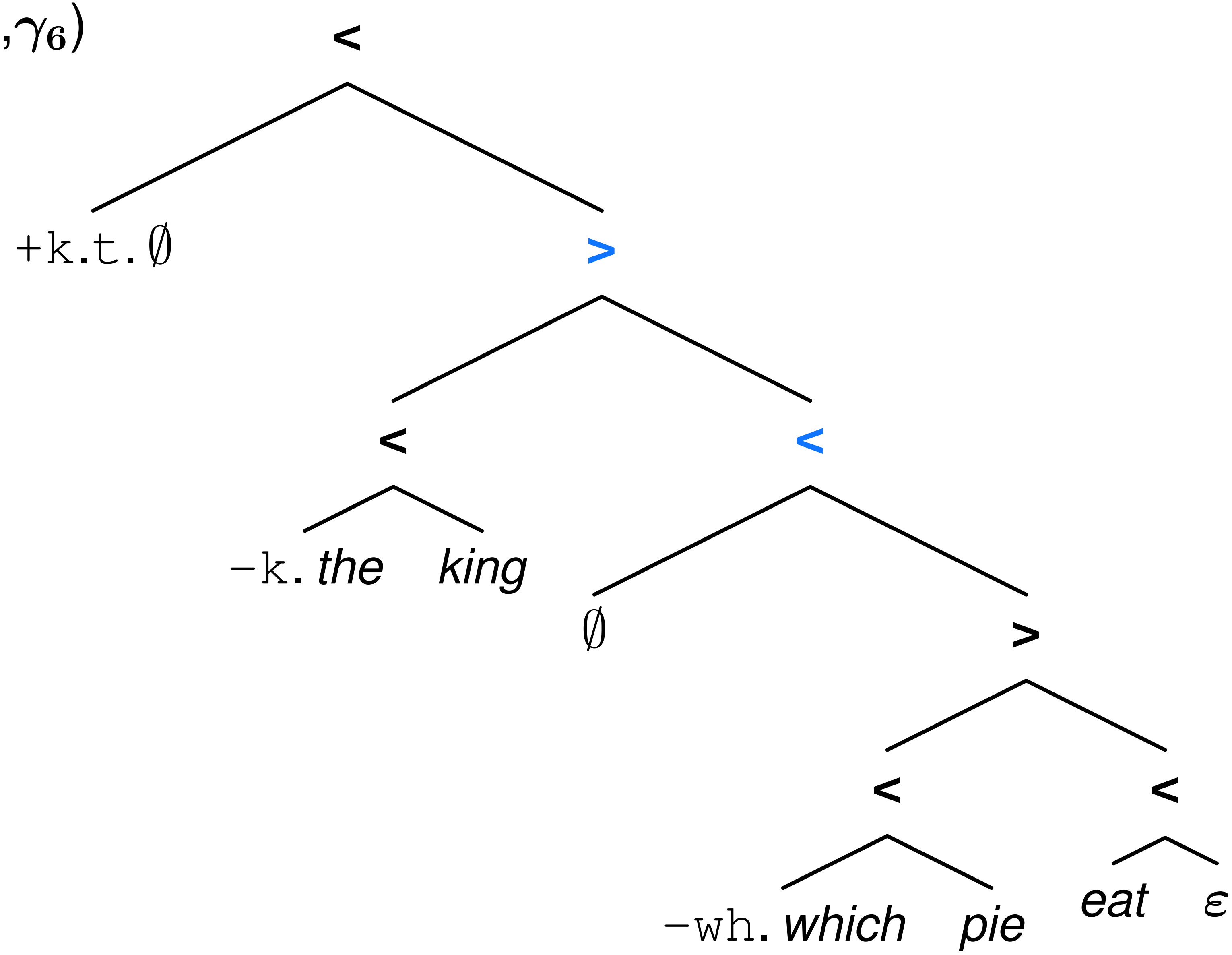
(γ_6) merge(γ_4,γ_5)



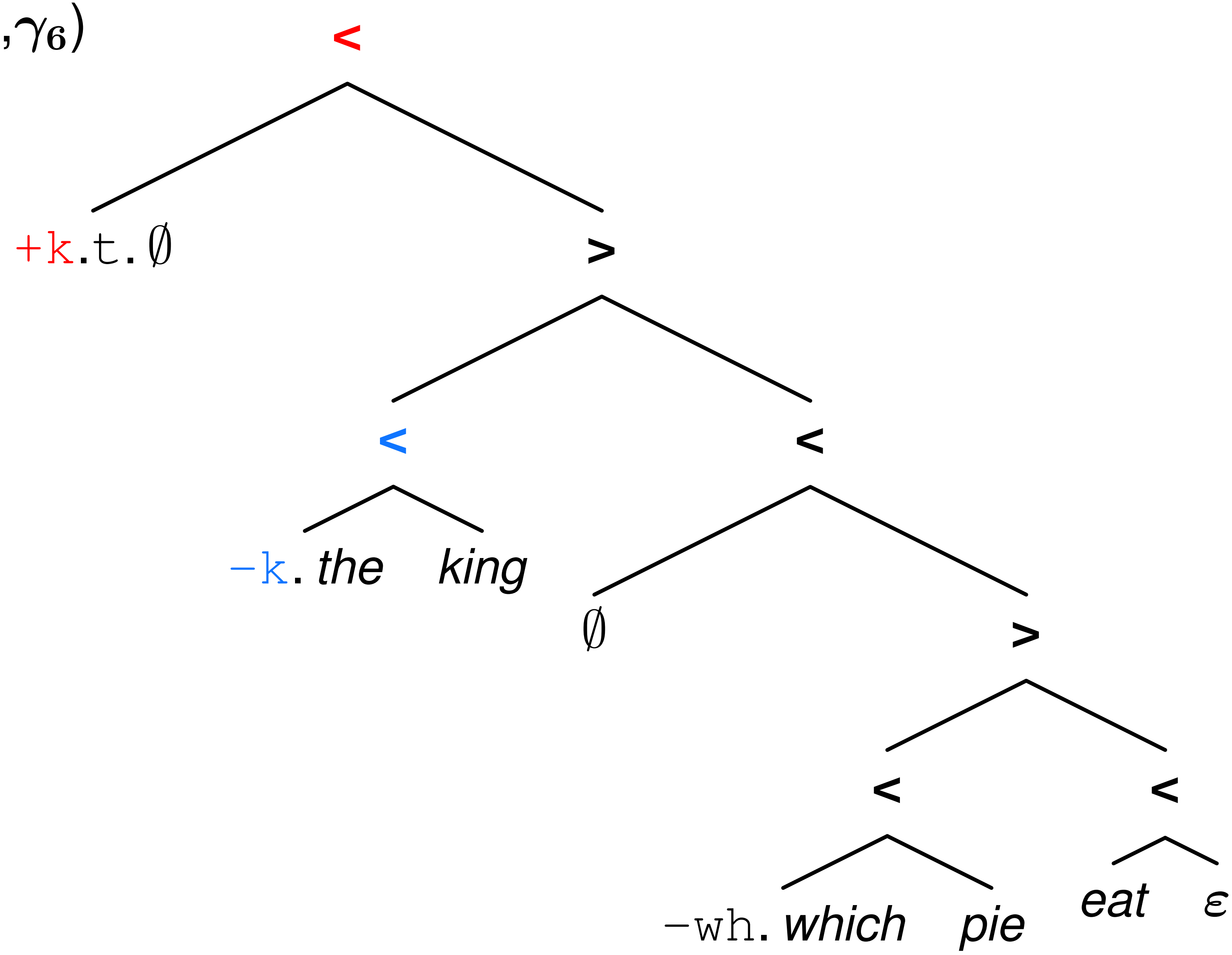
(α_2) $=\tilde{v}.+k.t.\emptyset$

MG-example 2

(γ_7) merge($\boldsymbol{\alpha_2}$,γ_6)

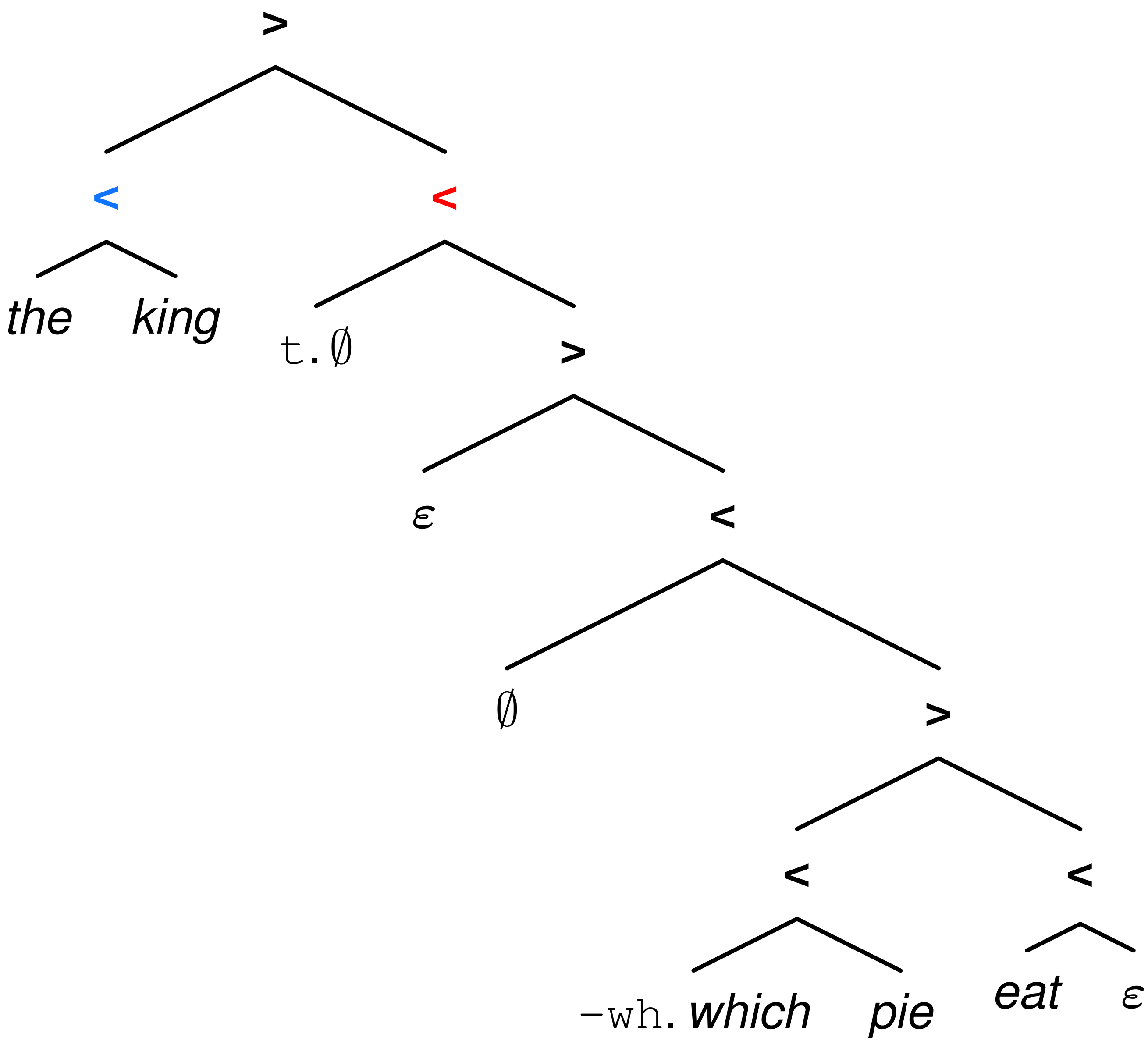


(γ_7) merge($\boldsymbol{\alpha_2}$,γ_6)



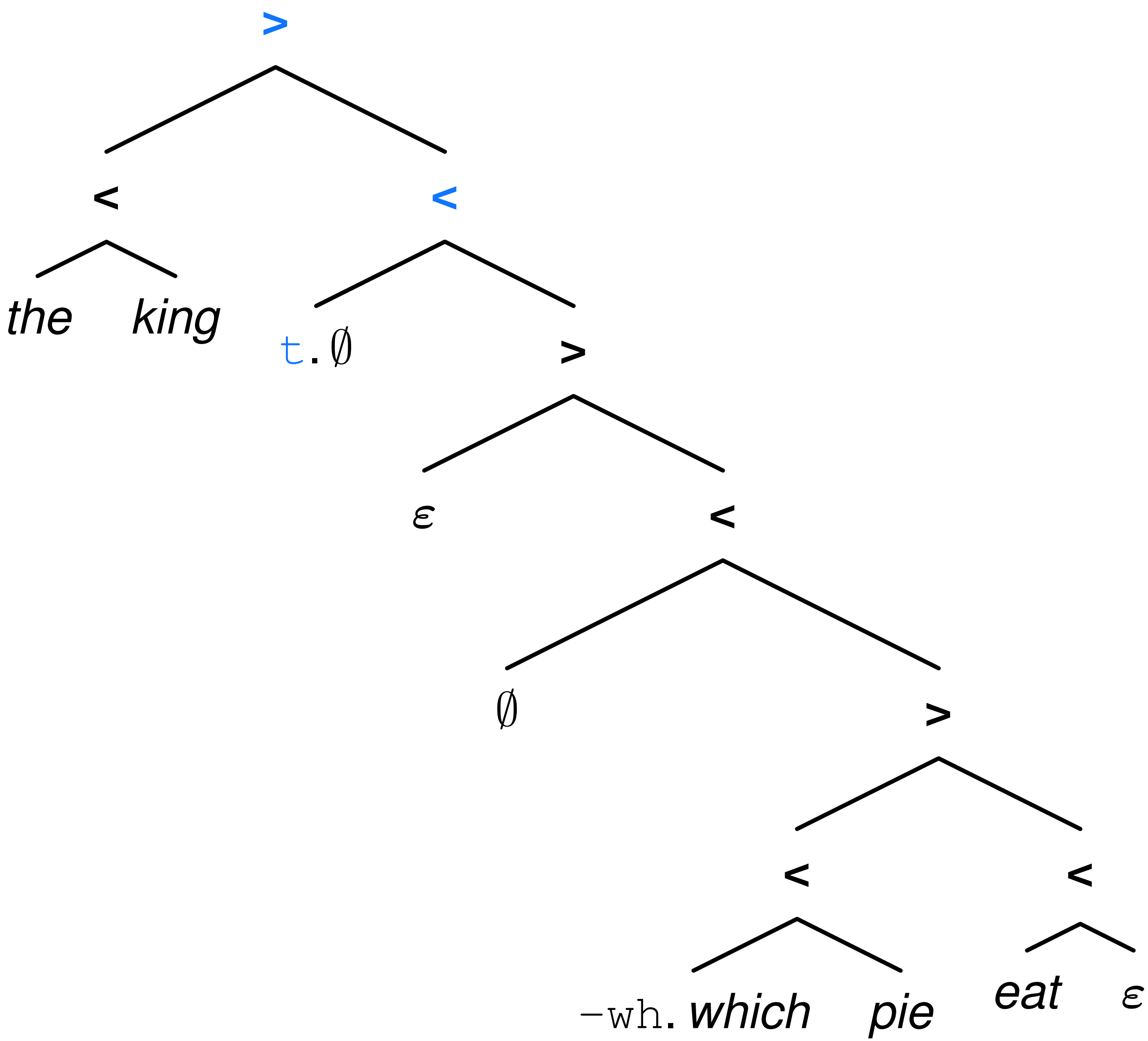
MG-example 2

(γ_8) move(γ_7)

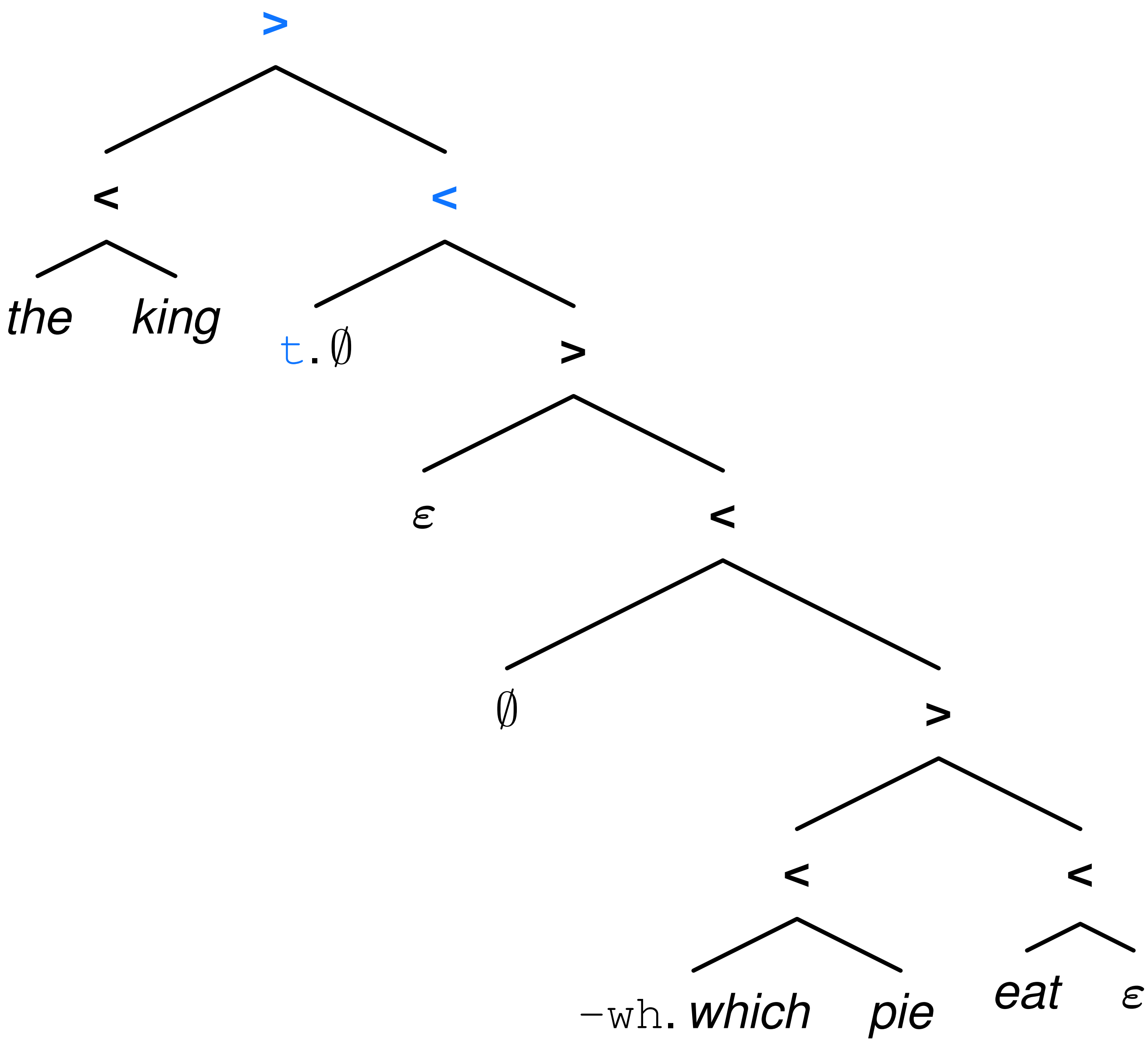


MG-example 2

(γ_8) move(γ_7)



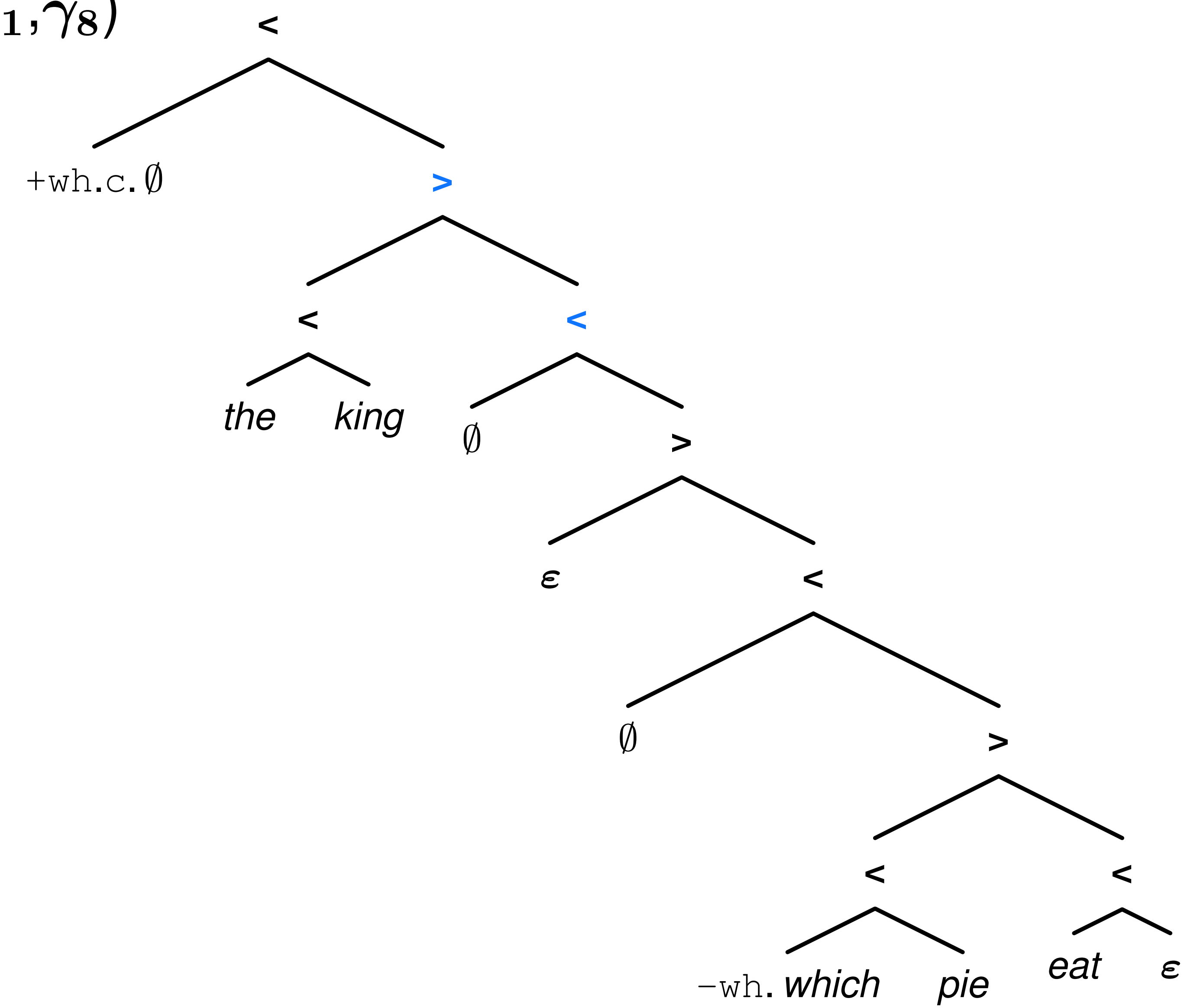
(γ_8) move(γ_7)



(α_1) =t.+wh.c.∅

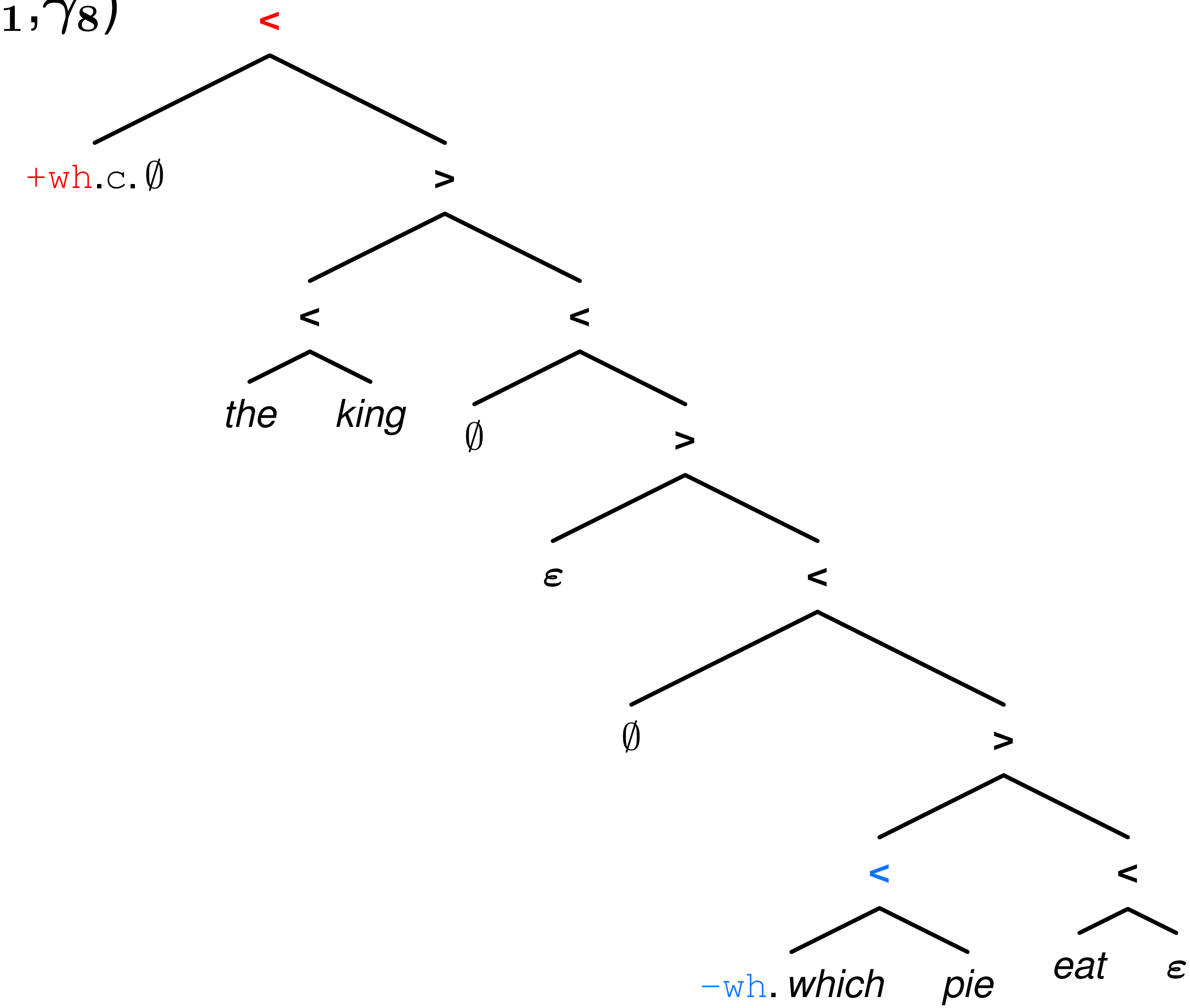
MG-example 2

(γ_9) merge(α_1,γ_8)



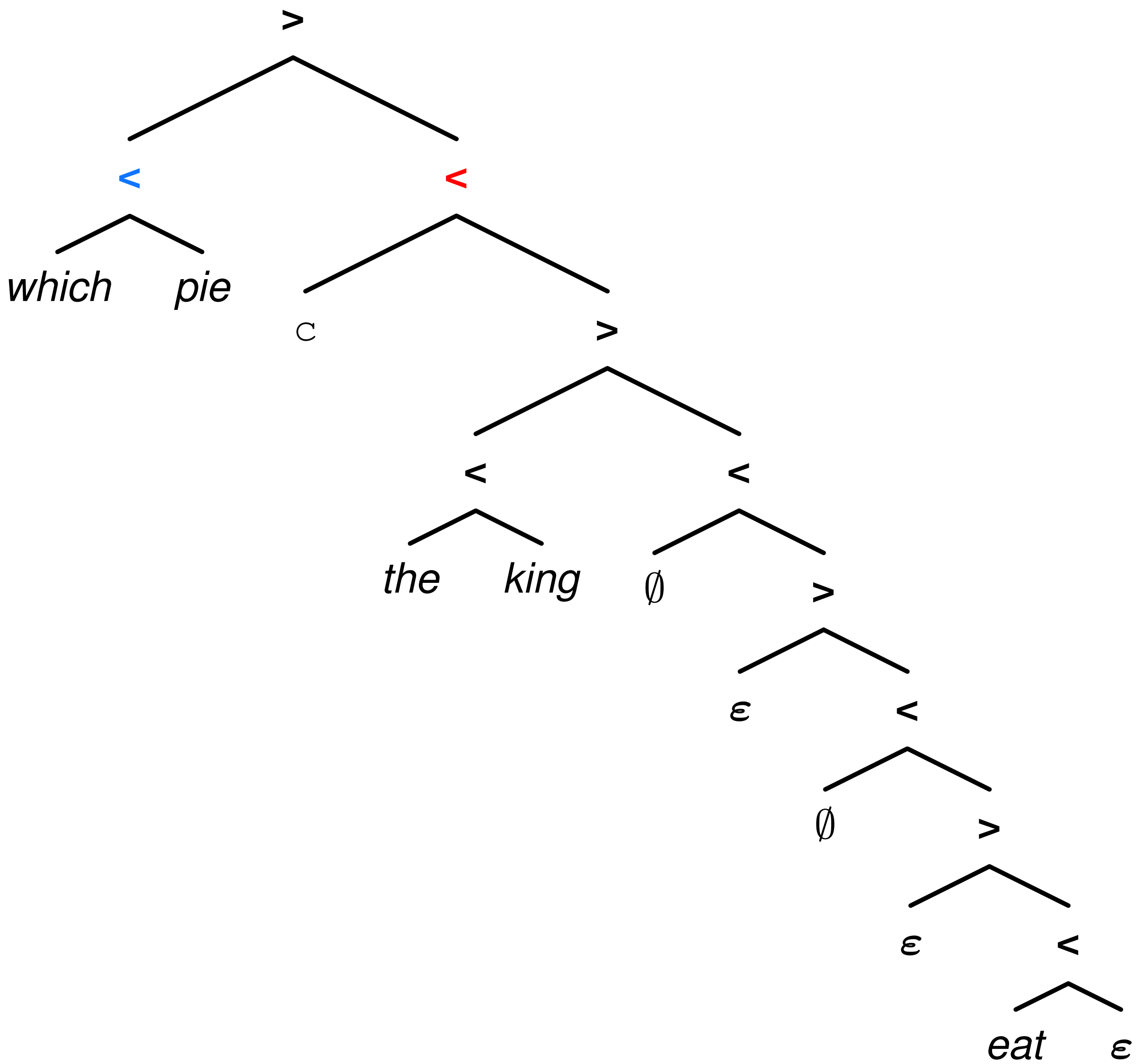
MG-example 2

(γ_9) merge(α_1,γ_8)



MG-example 2

(γ_{10}) move(γ_9)



MG-example 2

(α_0)	=t.c.*that*	(α_5)	v.*laugh*
(α_1)	=t.+wh.c.$\emptyset$	(α_6)	=n.d.−k.*the*
(α_2)	=$\tilde{\text{v}}$.+k.t.$\emptyset$	(α_7)	=n.d.−k.−wh.*which*
(α_3)	=v.=d.$\tilde{\text{v}}$.$\emptyset$	(α_8)	n.*king*
(α_4)	=d.+k.v.*eat*	(α_9)	n.*pie*

MG-example 2

(α_7) $=$n.d.−k.−wh.*which*

(α_9) n.*pie*

MG-example 2

(α_7) =n.d.-k.-wh.*which* < =n.d.-k.-wh , — , — , sim >

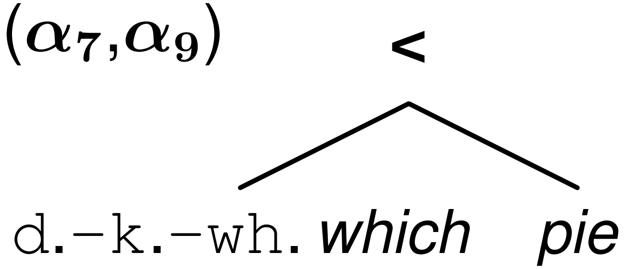
(α_9) n.*pie* < n , — , — , sim >

MG-example 2

(α_7) =n.d.-k.-wh.*which* < =n.d.-k.-wh , — , — , sim >

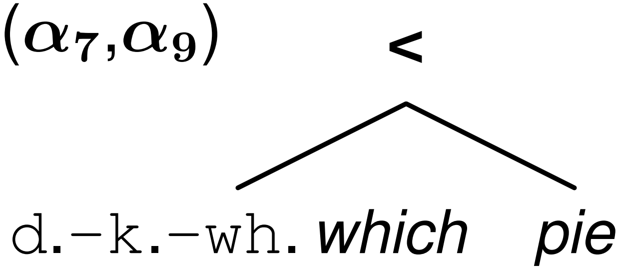
(α_9) n.*pie* < n , — , — , sim >

(γ_1) merge(α_7,α_9) < d.-k.-wh , — , — , com >



MG-example 2

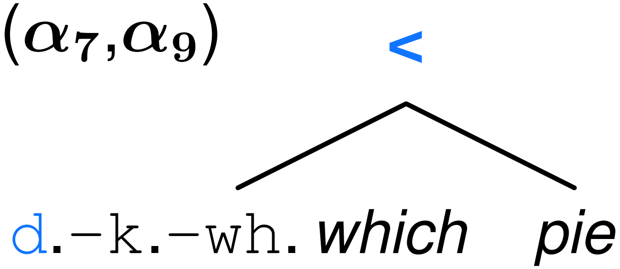
(γ_1) merge($\boldsymbol{\alpha_7}$,$\boldsymbol{\alpha_9}$)



< d.-k.-wh , —, —, com >

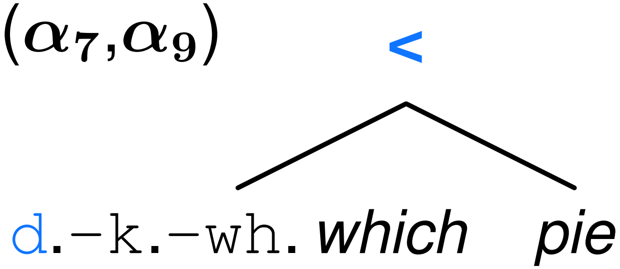
MG-example 2

(γ_1) merge($\boldsymbol{\alpha_7}$,$\boldsymbol{\alpha_9}$) $<$ `d.-k.-wh`, —, —, `com` $>$



MG-example 2

(γ_1) merge(α_7,α_9)

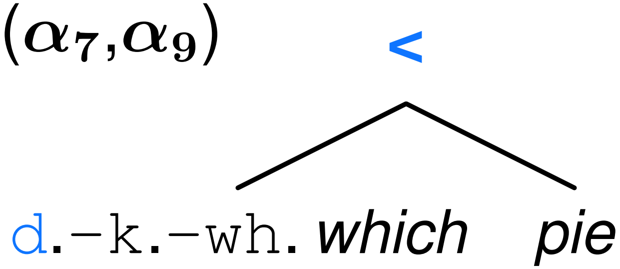


< d.-k.-wh , —, —, com >

(α_4) =d.+k.v.*eat*

< =d.+k.v.-k.-wh , —, —, sim >

(γ_1) merge(α_7,α_9)

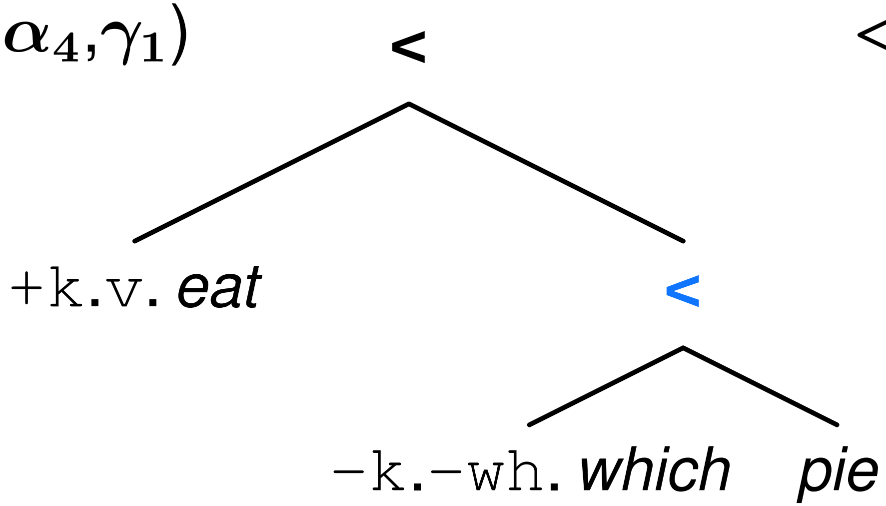


< d.−k.−wh , — , — , com >

(α_4) =d.+k.v.*eat*

< =d.+k.v.−k.−wh , — , — , sim >

(γ_2) merge(α_4,γ_1)

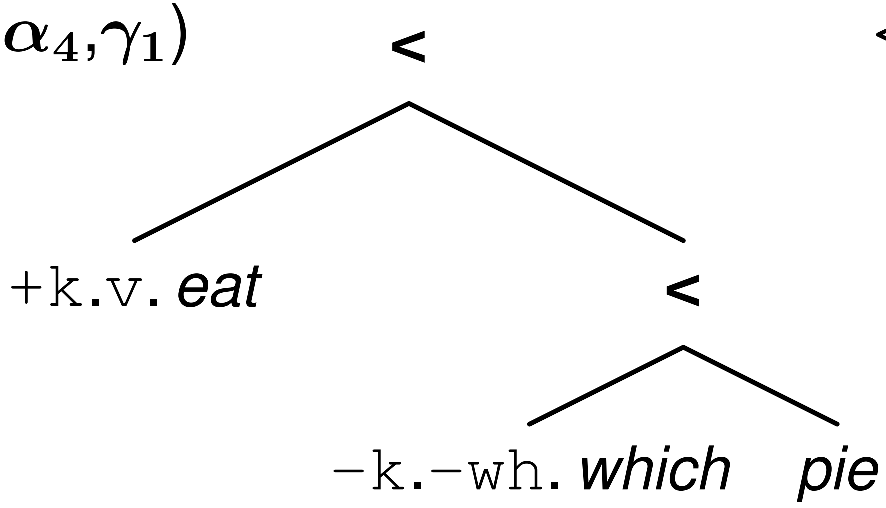


< +k.v , −k.−wh , — , com >

MG-example 2

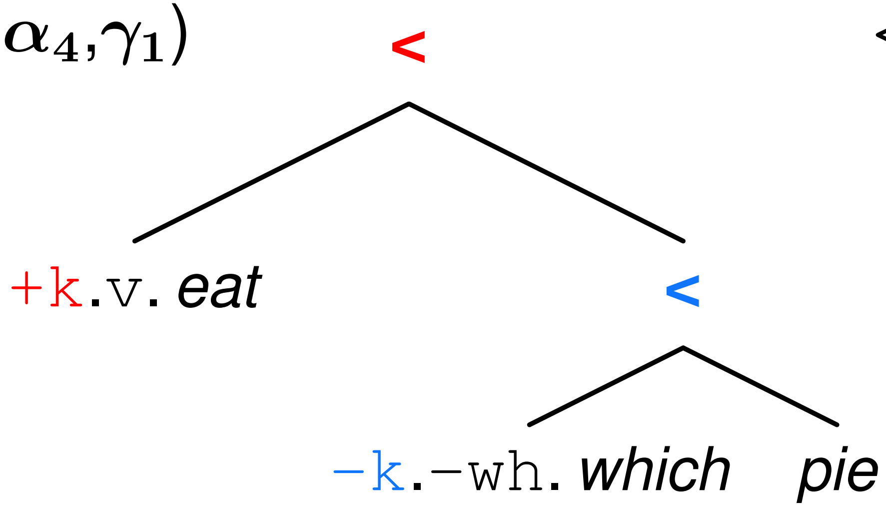
(γ_2) merge(α_4,γ_1)

< +k.v , −k.−wh , — , com >



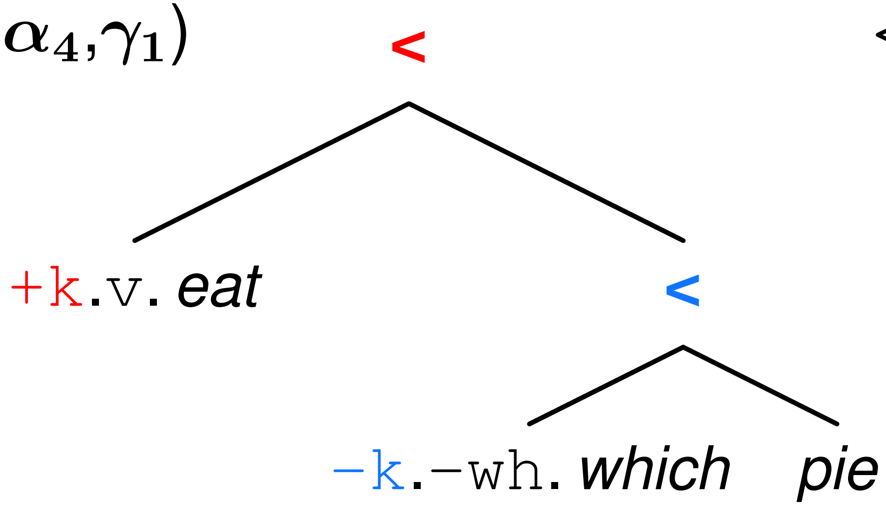
MG-example 2

(γ_2) merge(α_4, γ_1) $\langle$ +k.v , −k.−wh , —, com $\rangle$



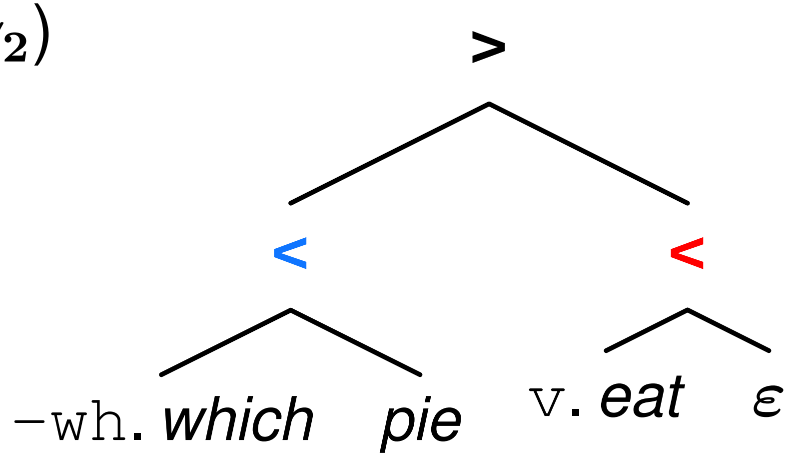
MG-example 2

(γ_2) merge(α_4,γ_1)



< +k.v , -k.-wh , —, com >

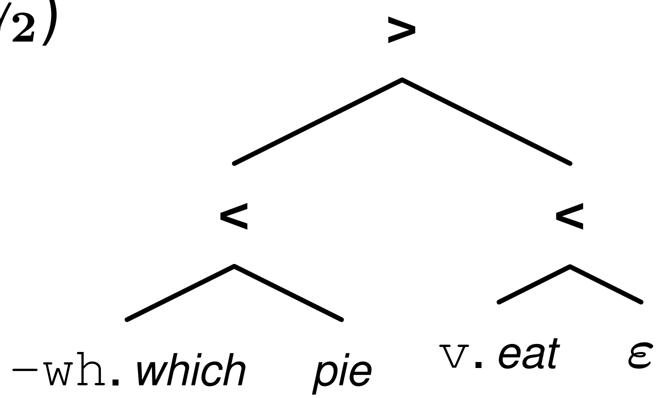
(γ_3) move(γ_2)



< v , —, -wh , com >

MG-example 2

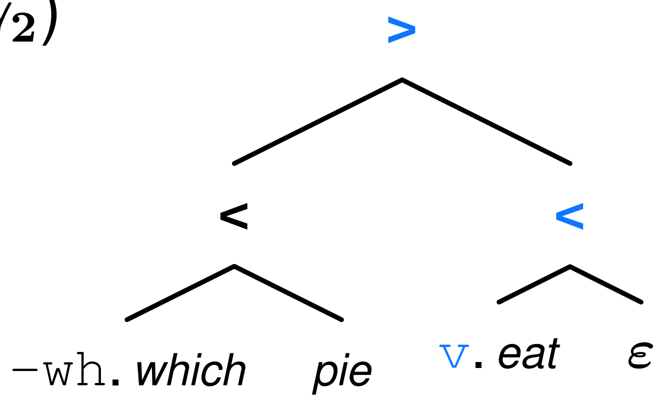
(γ_3) move(γ_2)



$< \texttt{v}, \text{—}, \texttt{-wh}, \texttt{com} >$

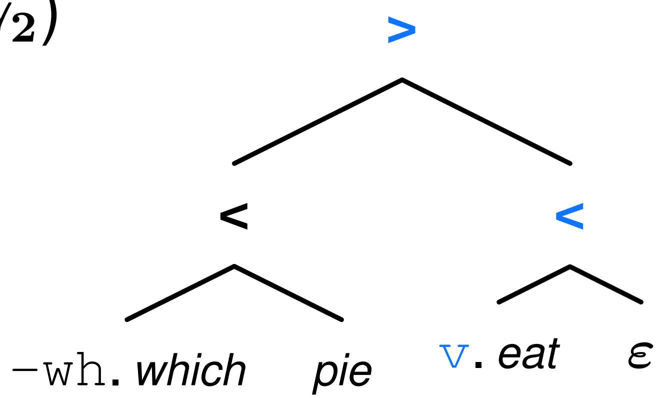
MG-example 2

(γ_3) move(γ_2)



$< \mathtt{v}, —, \mathtt{-wh}, \mathtt{com} >$

(γ_3) move(γ_2)



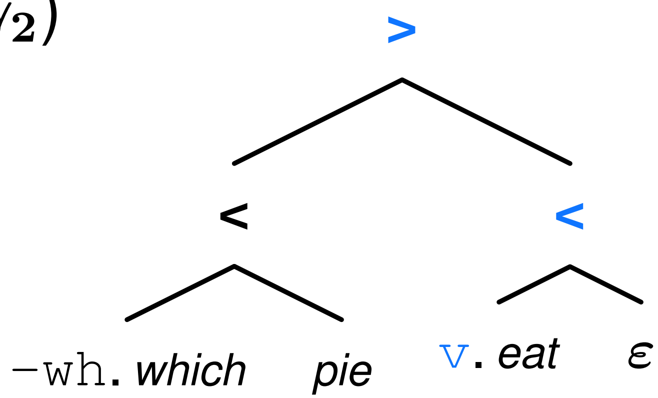
< v , — , −wh , com >

(α_3) =v.=d.ṽ.∅

< =v.=d.ṽ , — , — , sim >

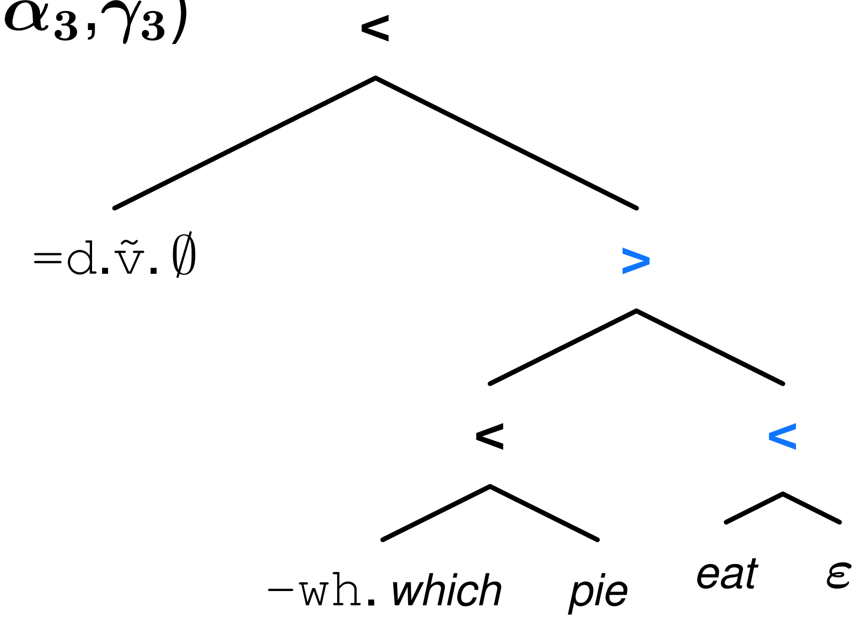
MG-example 2

(γ_3) move(γ_2) $\langle \mathtt{v}, —, \mathtt{-wh}, \mathtt{com} \rangle$



(α_3) $\mathtt{=v.=d.\tilde{v}.}\emptyset$ $\langle \mathtt{=v.=d.\tilde{v}}, —, —, \mathtt{sim} \rangle$

(γ_4) merge(α_3,γ_3) $\langle \mathtt{=d\tilde{v}}, —, \mathtt{-wh}, \mathtt{com} \rangle$



MG-example 2

(α_6) =n.d.-k. *the* < =n.d.-k , —, —, sim >

(α_8) n. *king* < n , —, —, sim >

MG-example 2

(α_6) =n.d.-k. *the* < =n.d.-k , —, —, sim >

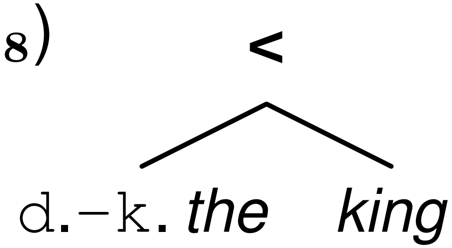
(α_8) n. *king* < n , —, —, sim >

MG-example 2

(α_6) =n.d.−k. *the* < =n.d.−k , —, —, sim >

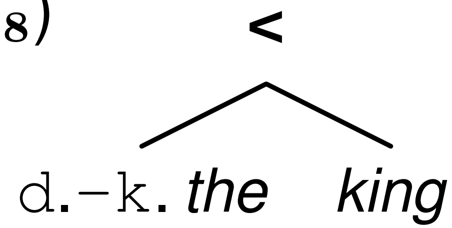
(α_8) n. *king* < n , —, —, sim >

(γ_5) merge(α_6, α_8) < d.−k , —, —, com >



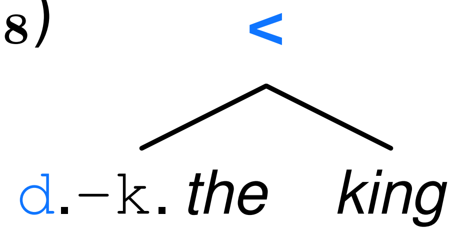
MG-example 2

(γ_5) merge$(\boldsymbol{\alpha}_6, \boldsymbol{\alpha}_8)$



< d.-k , —, —, com >

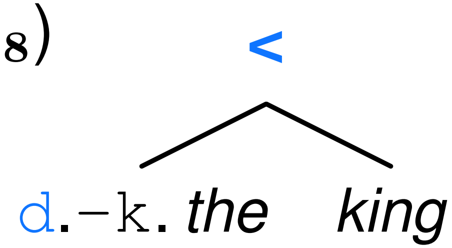
(γ_5) merge($\boldsymbol{\alpha_6}, \boldsymbol{\alpha_8}$)



< d.−k , — , — , com >

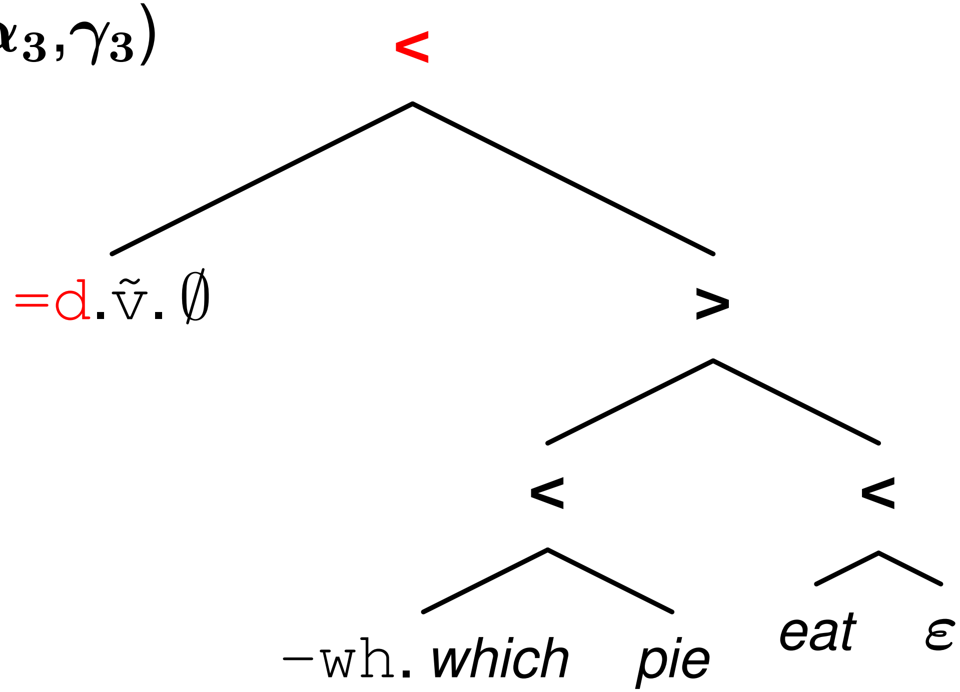
MG-example 2

(γ_5) merge($\boldsymbol{\alpha_6}, \boldsymbol{\alpha_8}$)



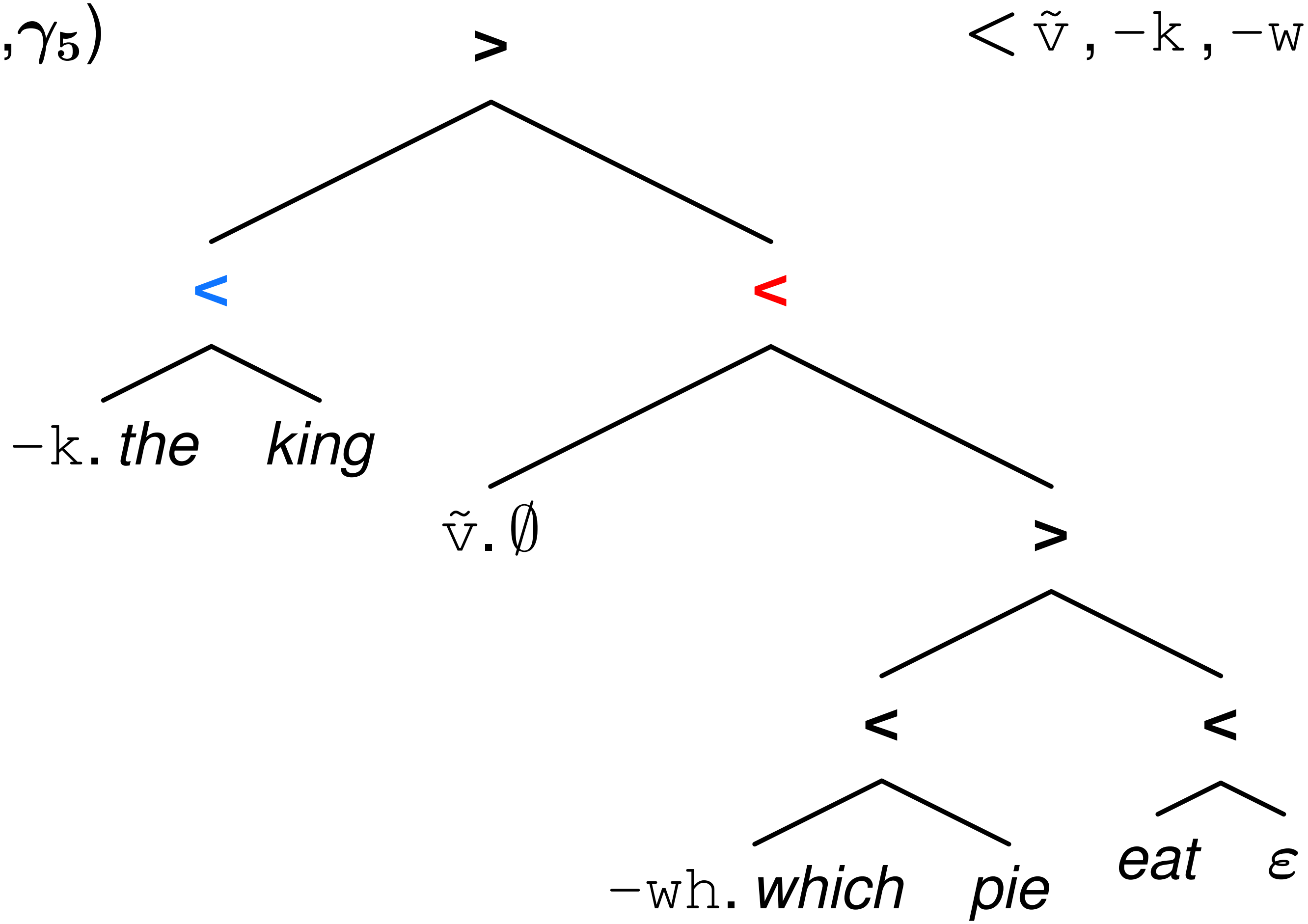
< d.-k , — , — , com >

(γ_4) merge($\boldsymbol{\alpha_3}, \boldsymbol{\gamma_3}$)



MG-example 2

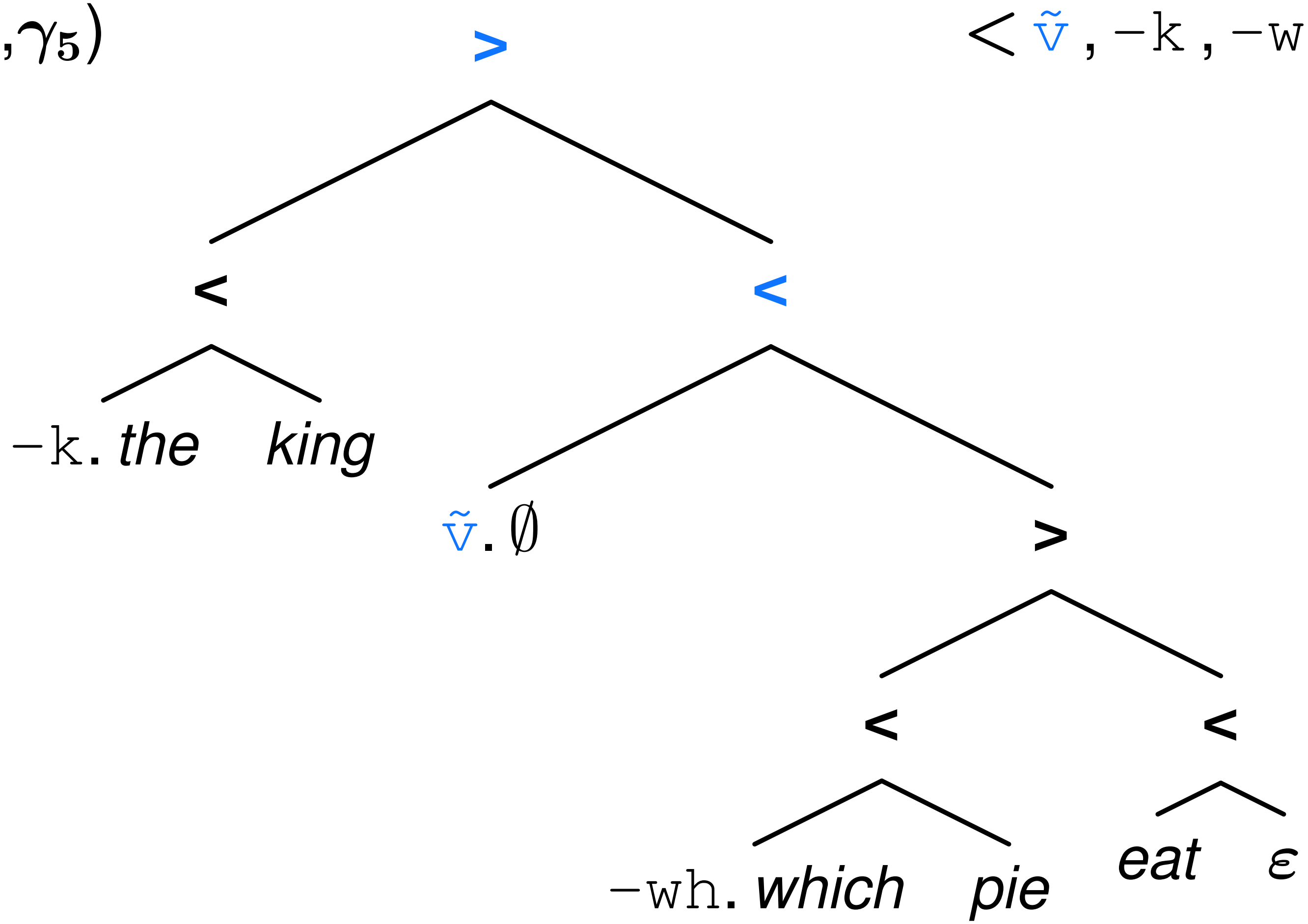
(γ_6) merge(γ_4,γ_5) $<\tilde{v}, -k, -wh, com>$



MG-example 2

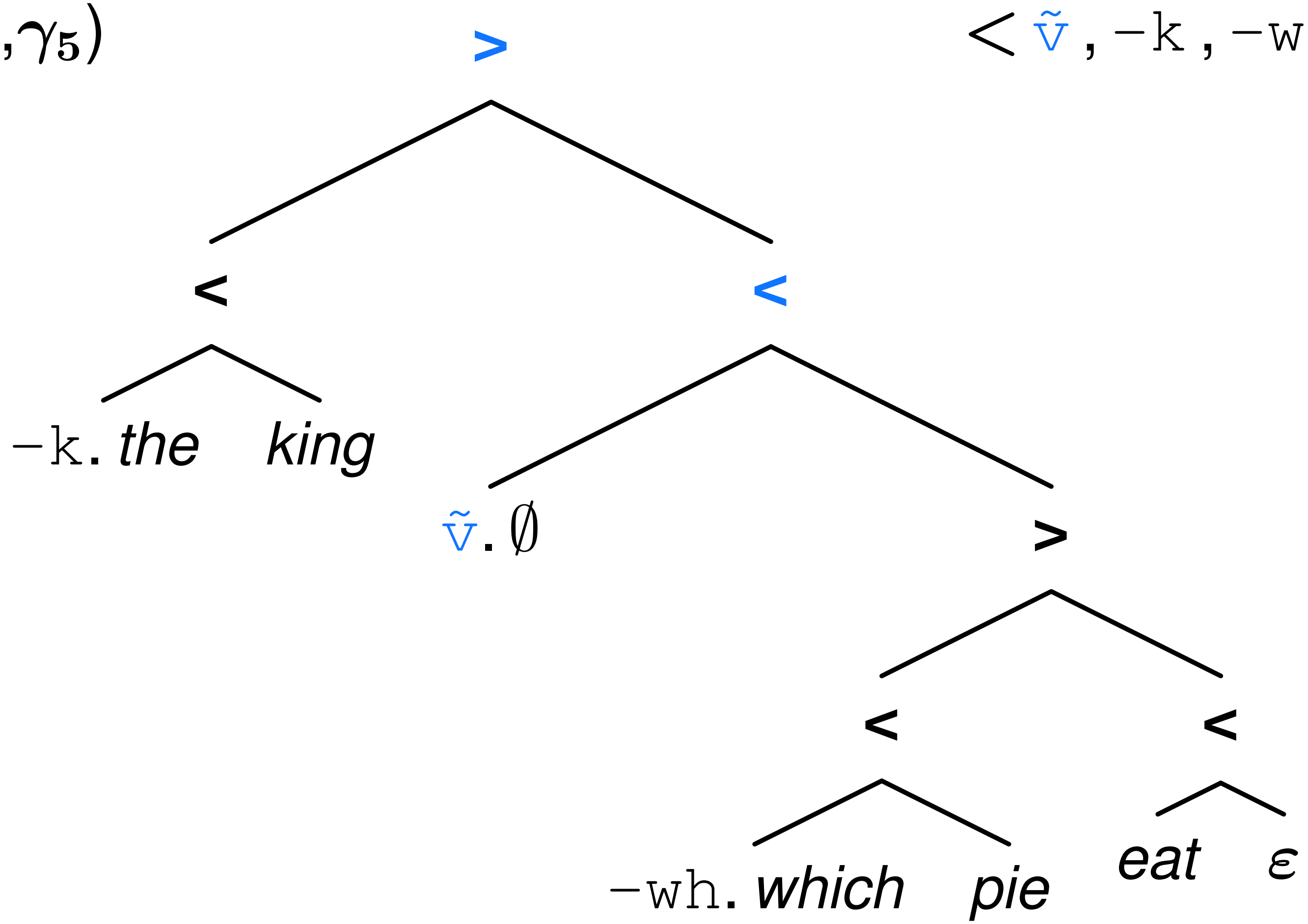
(γ_6) merge(γ_4,γ_5)

$< \tilde{\mathtt{v}}, \mathtt{-k}, \mathtt{-wh}, \mathtt{com} >$



MG-example 2

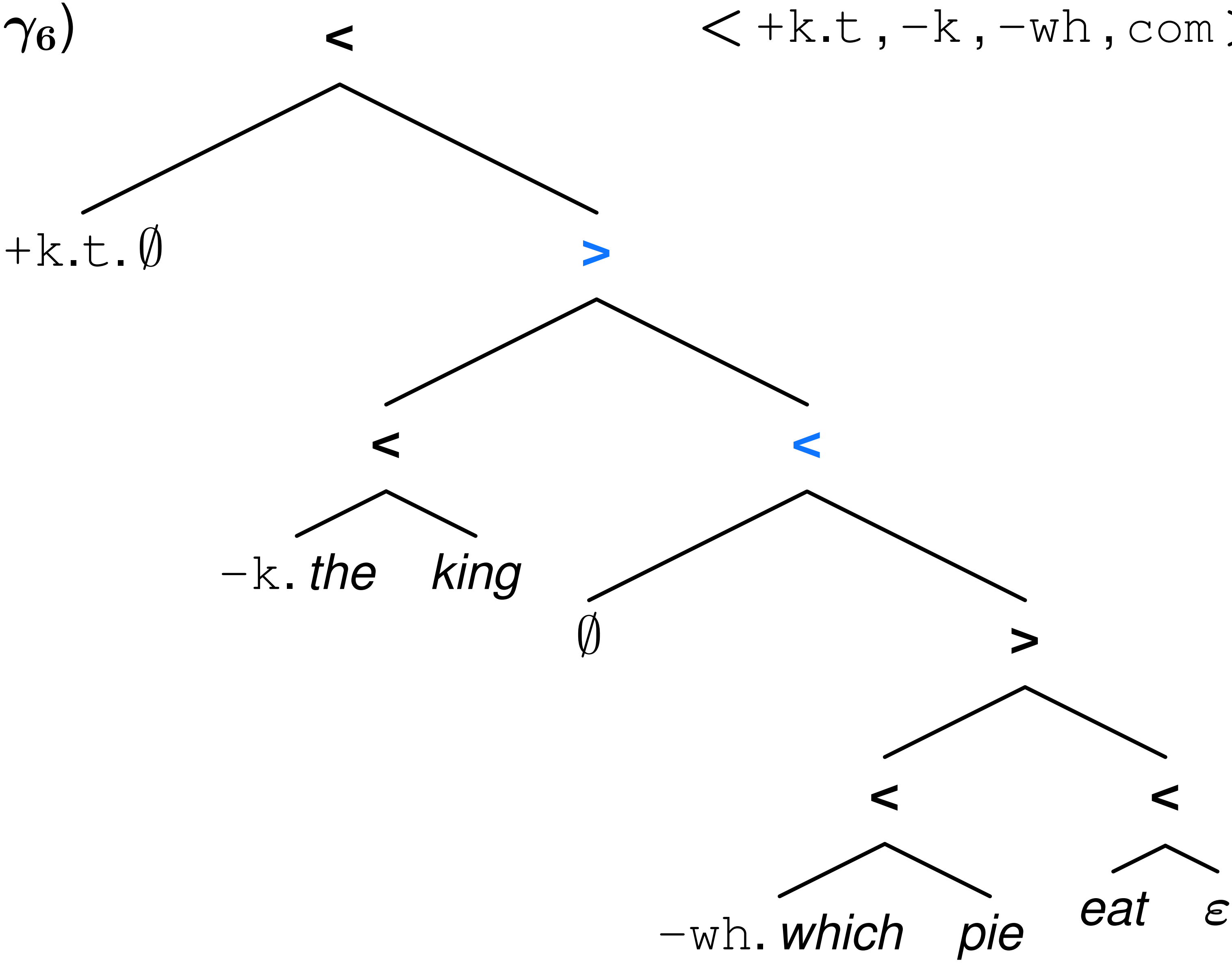
(γ_6) merge(γ_4,γ_5) $\langle\, \tilde{\mathtt{v}}, \mathtt{-k}, \mathtt{-wh}, \mathtt{com} \,\rangle$



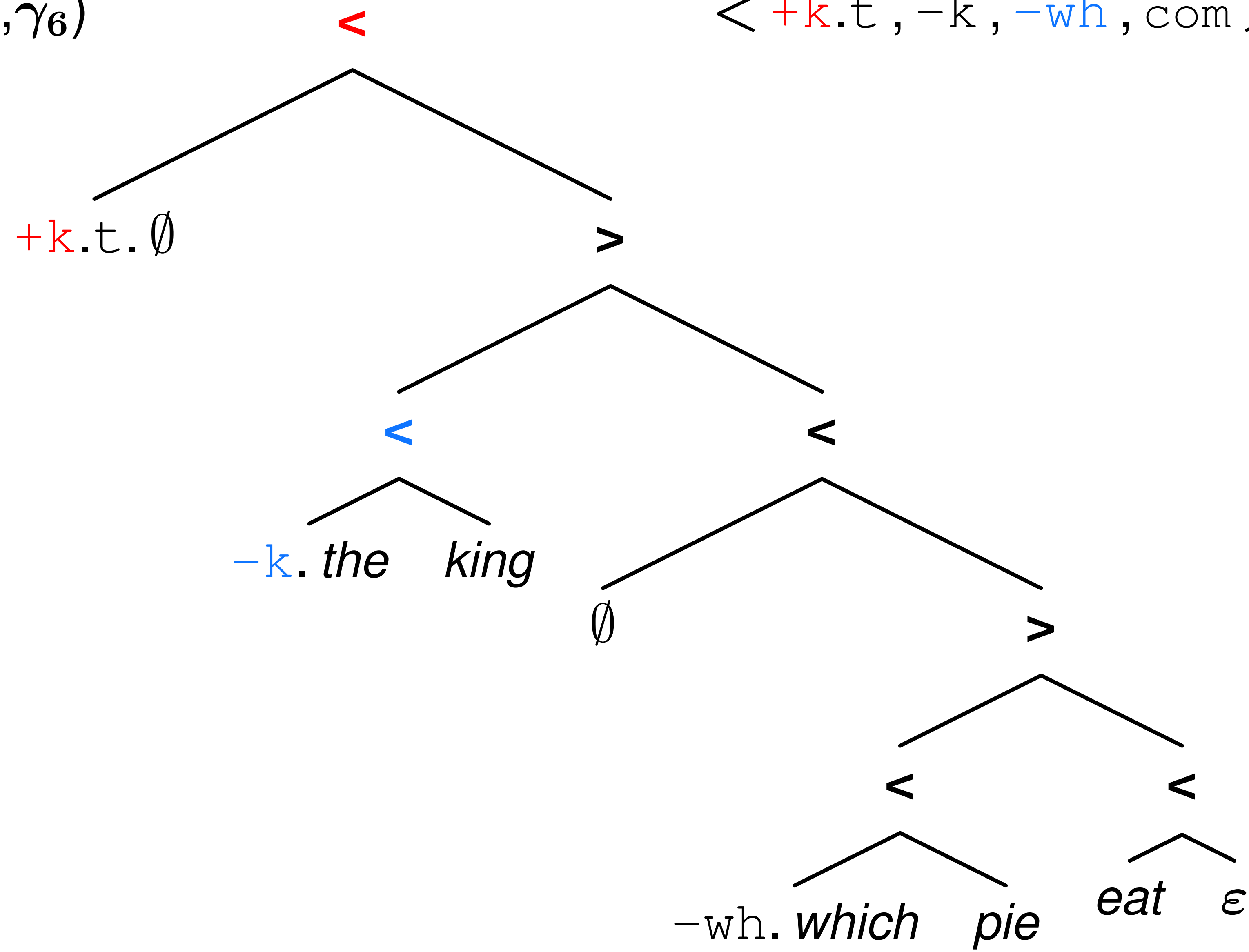
(α_2) $=\tilde{\mathtt{v}}.\mathtt{+k.t.}\emptyset$ $\langle\, =\tilde{\mathtt{v}}.\mathtt{+k.t}, \text{—}, \text{—}, \mathtt{sim} \,\rangle$

MG-example 2

(γ_7) merge(α_2,γ_6) $<$+k.t, −k, −wh, com$>$

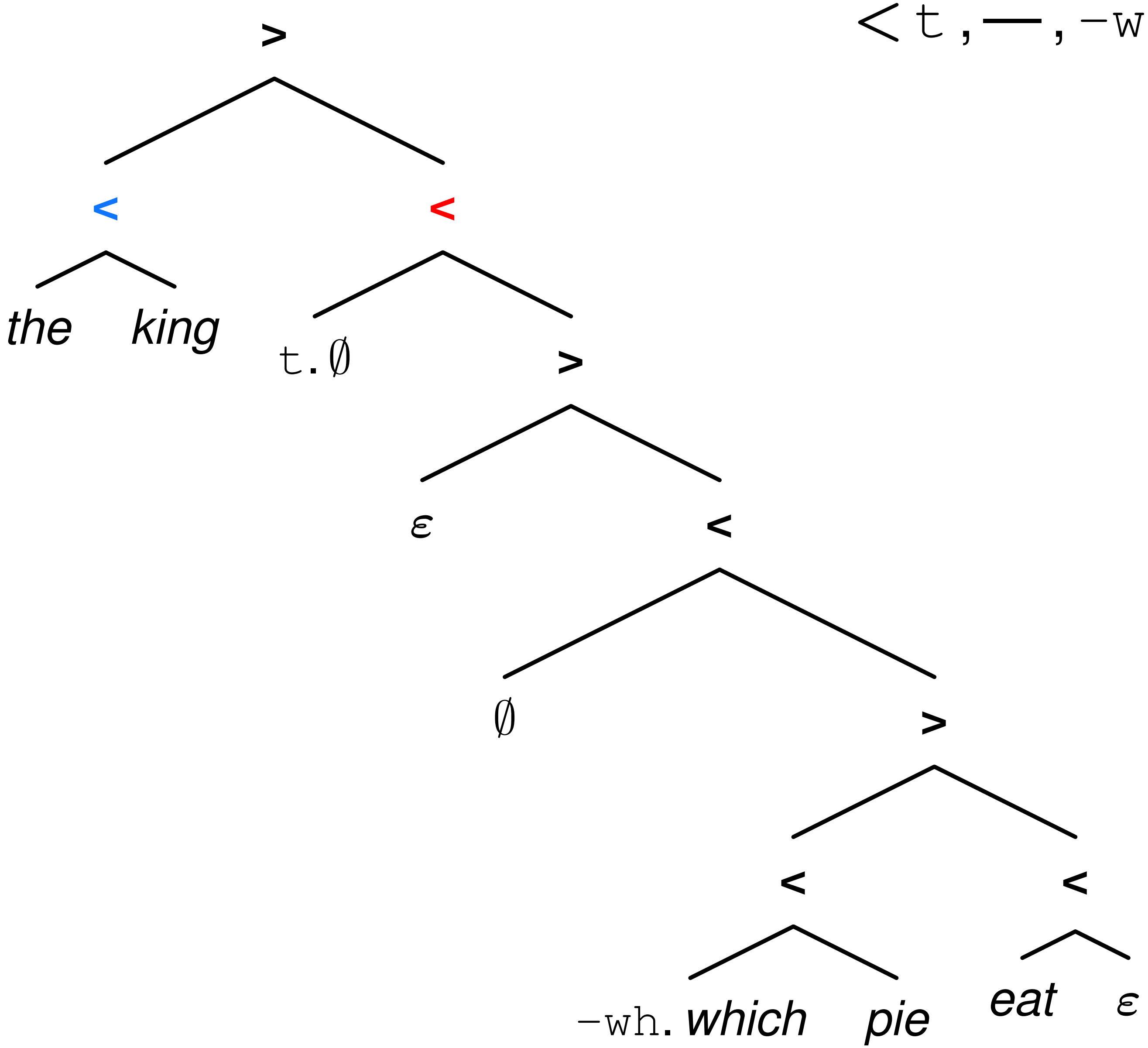


(γ_7) merge($\boldsymbol{\alpha_2}$,$\boldsymbol{\gamma_6}$) < +k.t , -k , -wh , com >

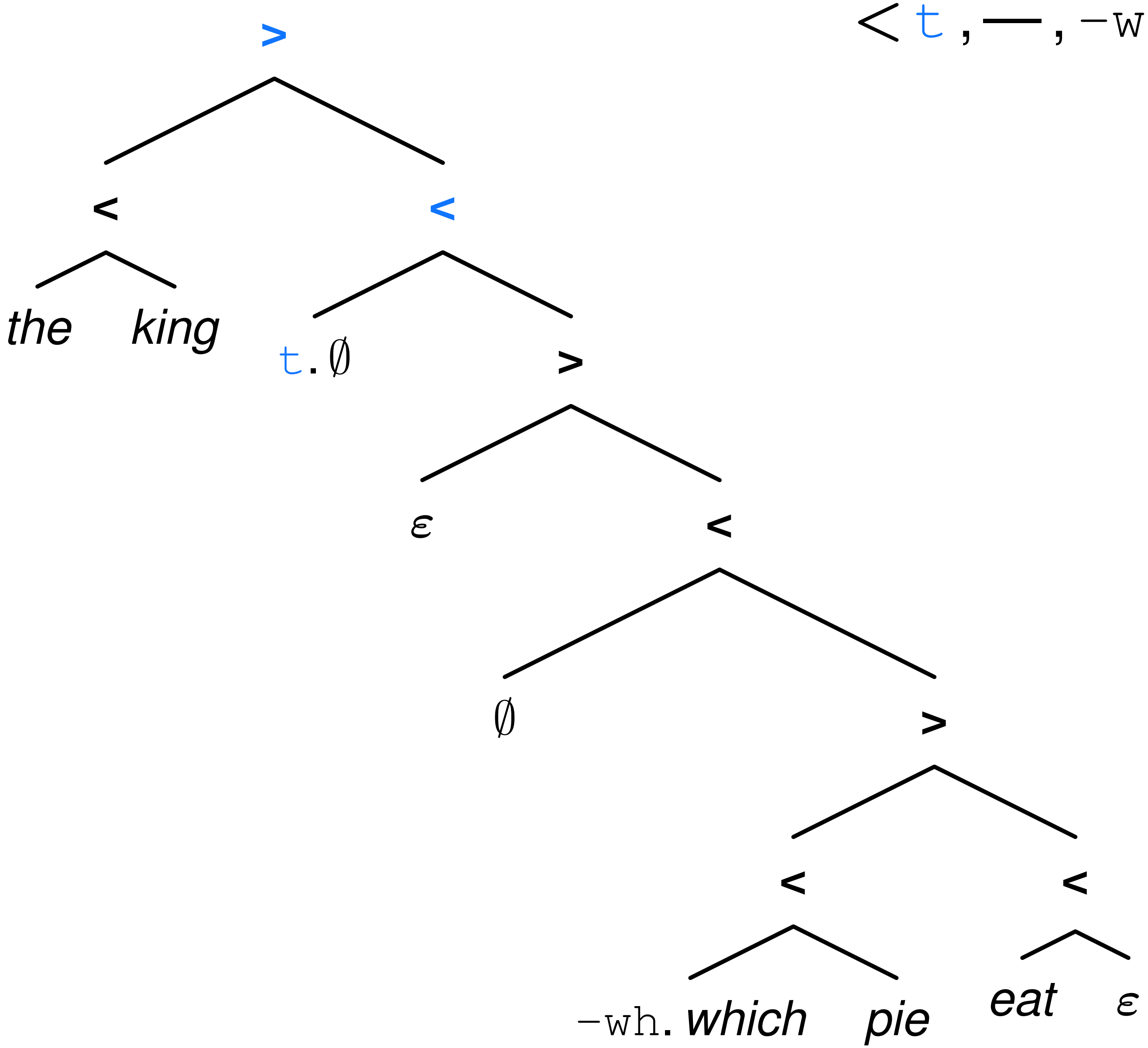


(γ_8) move(γ_7)

<t,—,-wh,com>

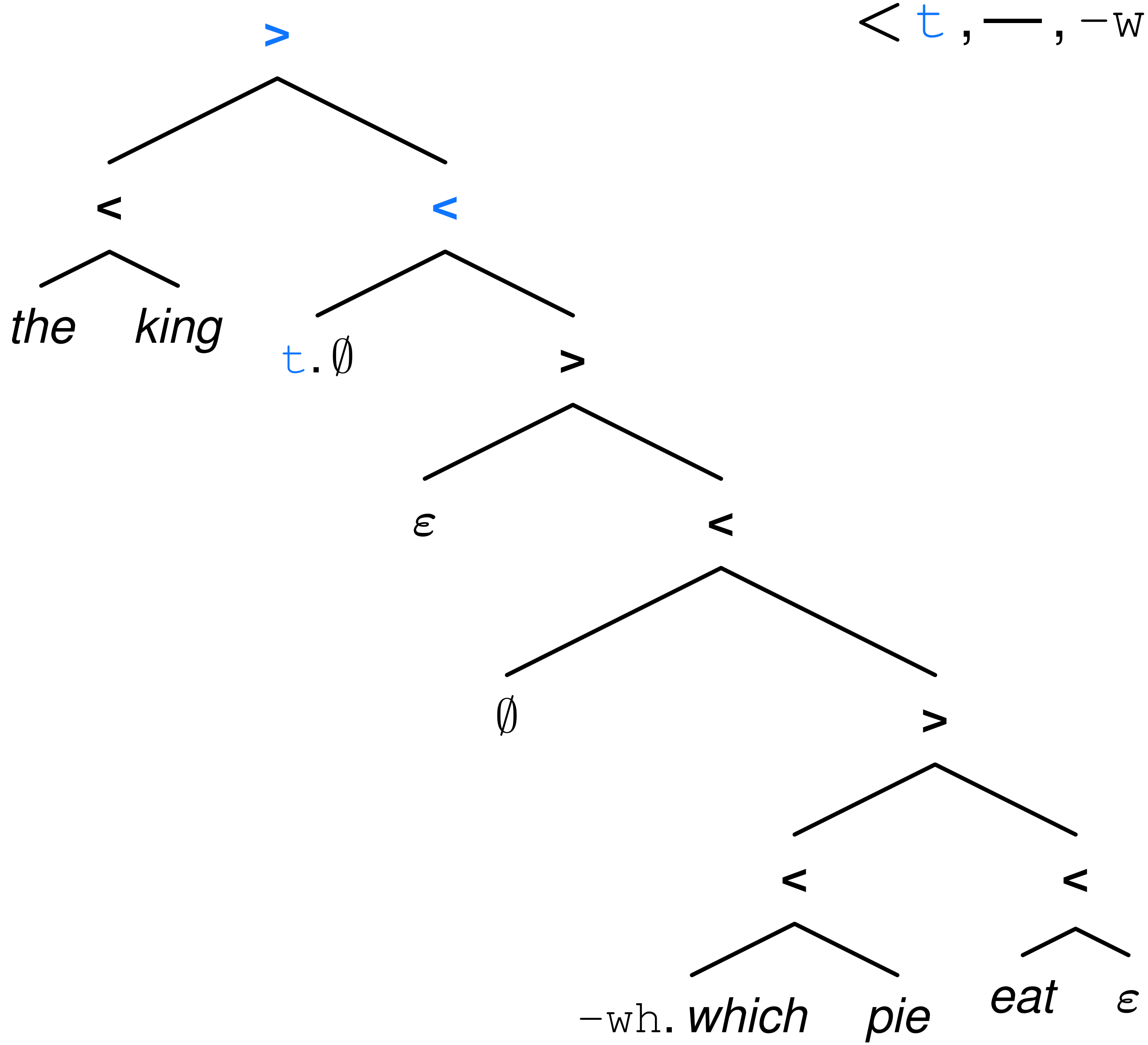


(γ_8) move(γ_7) <t, —, -wh, com>



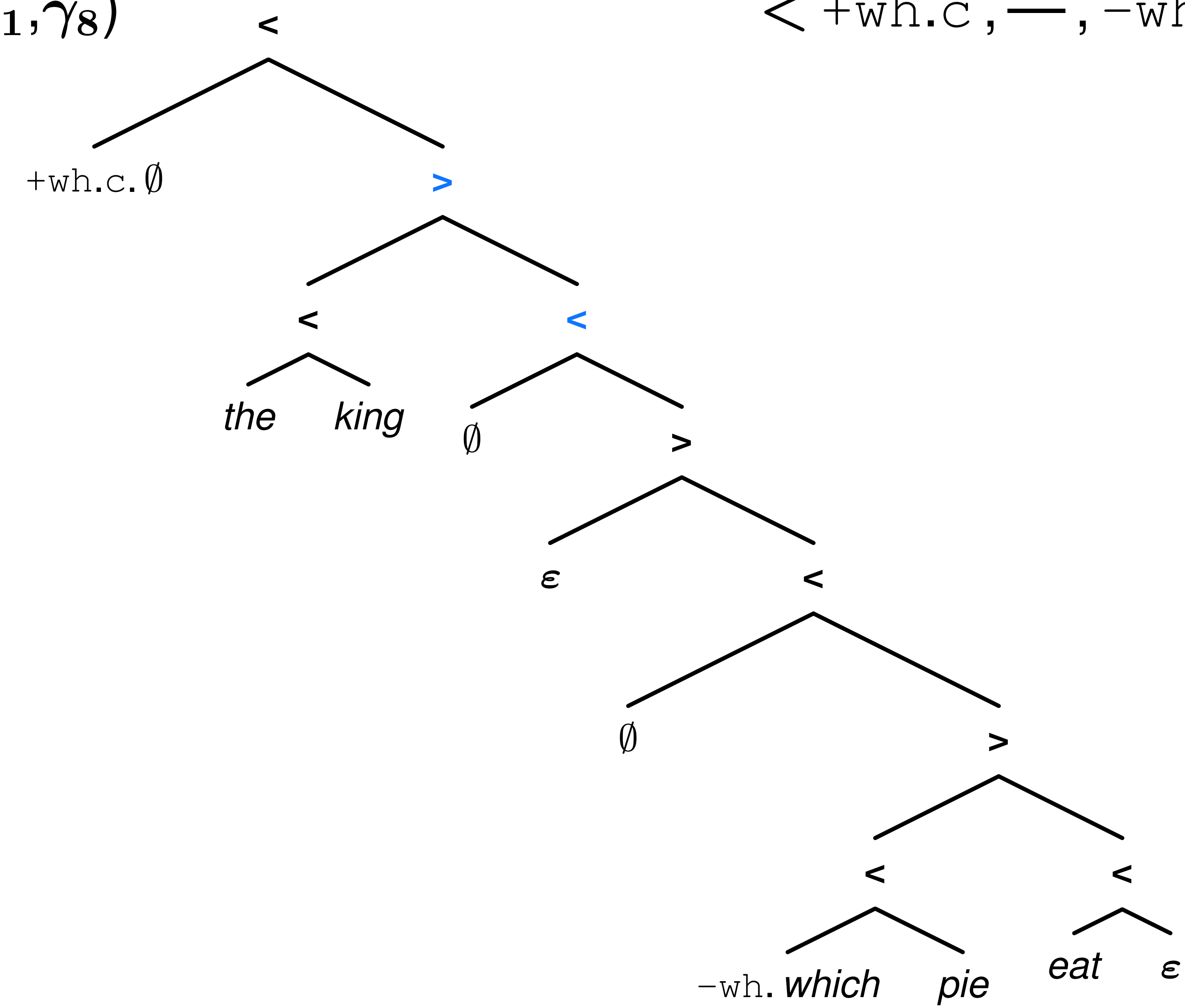
MG-example 2

(γ_8) move(γ_7) $\quad < \mathtt{t}, —, \mathtt{-wh}, \mathtt{com} >$



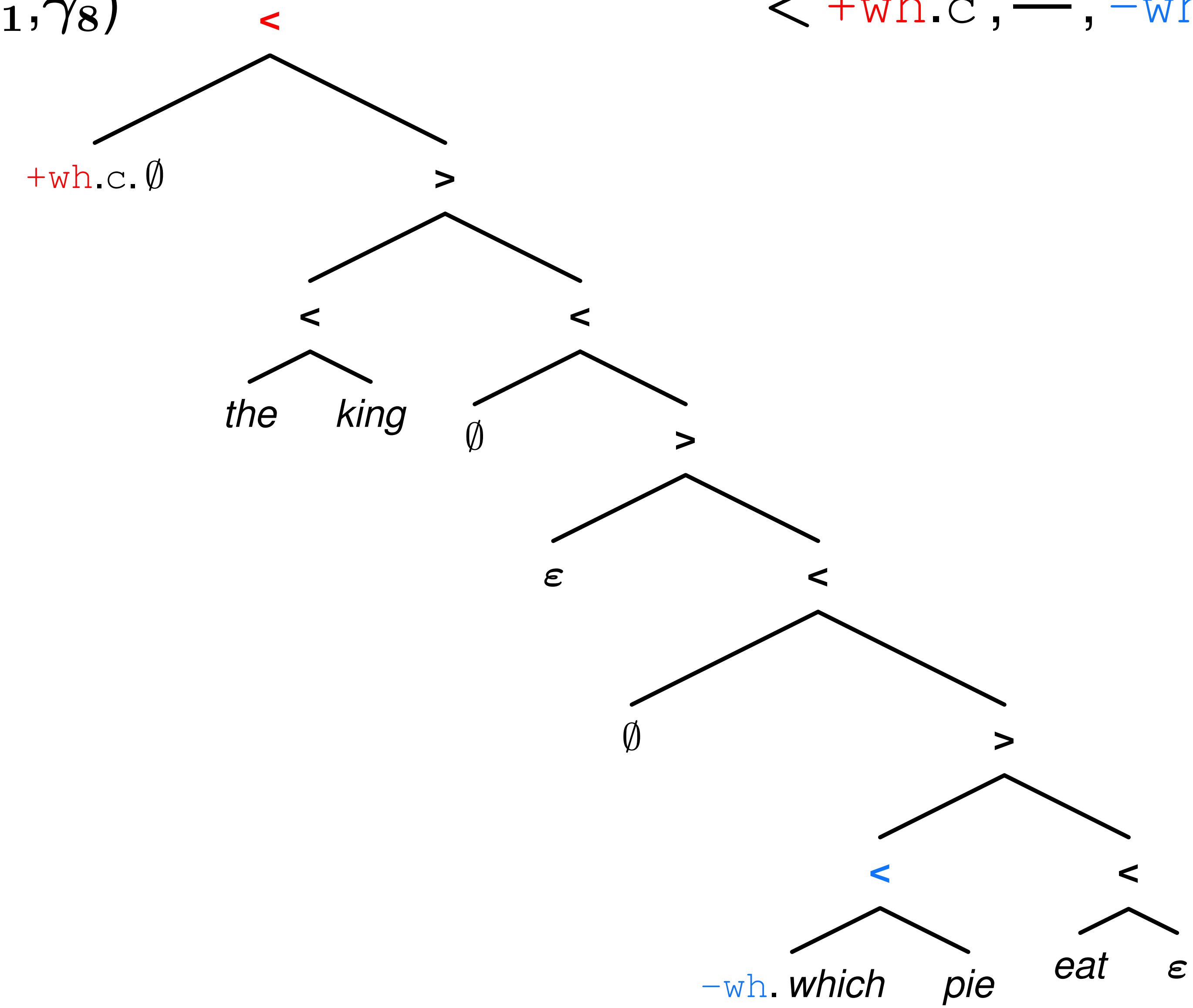
(α_1) $\mathtt{=t.+wh.c.}\emptyset$ $\quad < \mathtt{=t.+wh.c}, \mathtt{-k}, \mathtt{-wh}, \mathtt{sim} >$

(γ_9) merge(α_1,γ_8) $<$ +wh.c , — , -wh , com $>$



MG-example 2

(γ_9) merge(α_1,γ_8) < +wh.c , — , -wh , com >



MG-example 2

(γ_{10}) move(γ_9)

<c,—,—,com>