Modeling Culturally & Emotionally Affected Behavior

Vadim Bulitko, Steven Solomon,
Jonathan Gratch, Michael van Lent

http://ircl.cs.ualberta.ca

UNIVERSITY OF ALBERTA

Acknowledgments

Outline

- Bilateral negotiations (BiLAT)
- Culturally Affected Behavior (CAB)
- EMotion and Adaptation (EMA)
- CEMA = CAB + EMA
- Future work

SASO-ST: Negotiating with Virtual Humans

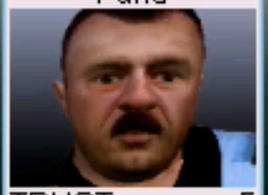
Outline

- Bilateral negotiations (BiLAT)
- Culturally Affected Behavior (CAB)
- EMotion and Adaptation (EMA)
- CEMA = CAB + EMA
- Future work

Cultural Effects in BiLAT

MEETING PARTNER

Farid



TRUST -5

OBJECTIVE

Learn why market is not being used

Get Police Cooperation

PREPARATION

OBJECTIVE REVIEW | MEETING PARTNER | INTENDED OUTCOME | RESEARCH | PREP SHEET | REQUISITIONS

REHEARSAL

REHEARSAL

MEETING

MEETING | NEGOTIATION

AAR

AAR | FOLLOW -UP

TIME

4 D 00:00

Help | Options | Info

Plan	Text
	Accuse of helping insurgents
	Assure Farid that he has the final word regarding Iraqi police matters within his jurisdiction
	Assure of influence with U.S. commanders
	Assure of good U.S. intentions
	NEGOTIATION
	Discuss insurgent attack on the bridge
	Explain to Farid why the U.S. built the market
	Tell Farid the U.S. wants to cooperate and work with the Iraqi police
	Accuse Farid of Iraqi police abuse in the new market

Plan | Say | Ask | Do | Give

Keyword Search

Negotiation | Leave meeting

Social Science underpinnings

Social Science underpinnings

- **Schemas**: frameworks for organizing knowledge and actions such as scripts, stereotypes and worldviews. [DiMaggio 97]
  - Conventionalized cultural behaviors
  - Cultural norms, Biases

Social Science underpinnings

- **Schemas**: frameworks for organizing knowledge and actions such as scripts, stereotypes and worldviews. [DiMaggio 97]
  - Conventionalized cultural behaviors
  - Cultural norms, Biases
- **Theory of mind**: the ability to understand that others have beliefs, desires and intentions that are different from one's own. [Nichols & Stich 2003]
  - Cultural awareness
  - Biases

Social Science underpinnings

- **Schemas**: frameworks for organizing knowledge and actions such as scripts, stereotypes and worldviews. [DiMaggio 97]
  - Conventionalized cultural behaviors
  - Cultural norms, Biases
- **Theory of mind**: the ability to understand that others have beliefs, desires and intentions that are different from one's own. [Nichols & Stich 2003]
  - Cultural awareness
  - Biases
- **Shared Symbols**: members of a culture share a common mapping from perceived symbols (objects, gestures, words…) to internal concepts. [Warner 1959, Shweder & Levine 2003]
  - Culturally-specific perception
  - Cross cultural misperception

Examples of Socio-Cultural States

agent is threatened

participant
is respectful

agent is
observant of Islam

agent is respectful
of modesty

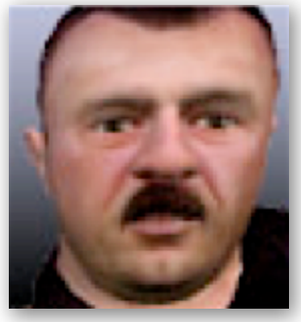
agent is familiar
with participant

CAB in a nutshell

- Agent is selecting among alternative courses of action (i.e., plans)
- The plan with the highest utility wins
- Utility of a plan is a sum of utilities of its states
- Utility of a state is belief * state utility

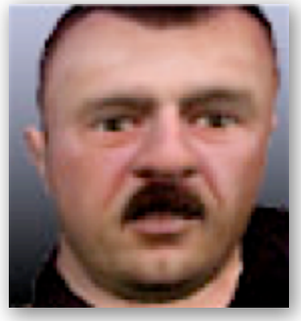
CAB: Example

CAB: Example



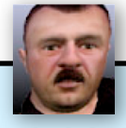
CAB: Example

Plan A

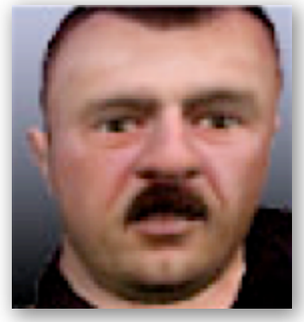


CAB: Example

Plan A

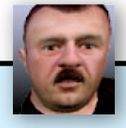


perform normal police duties



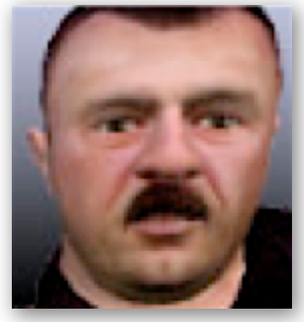
CAB: Example

Plan A

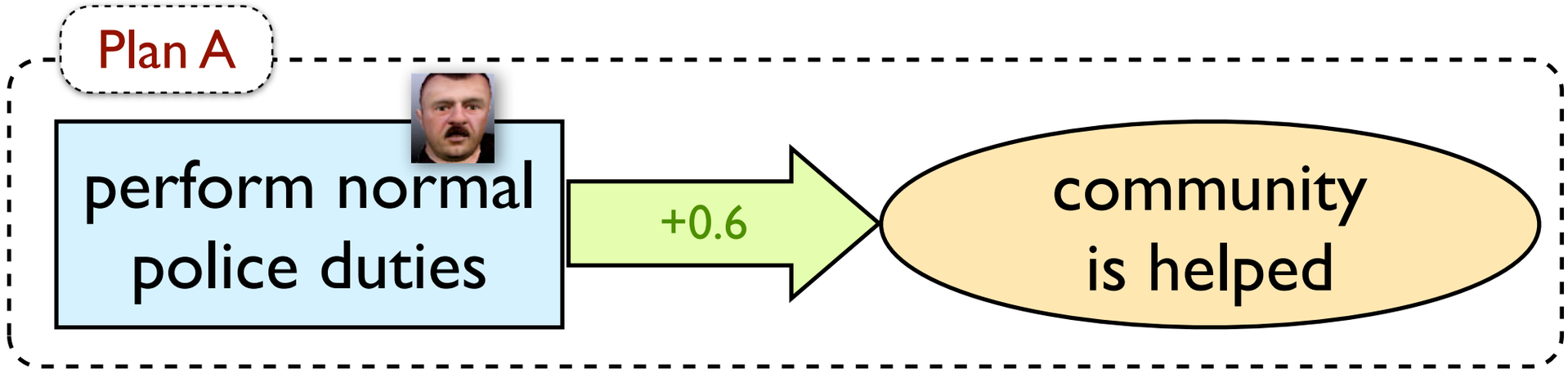


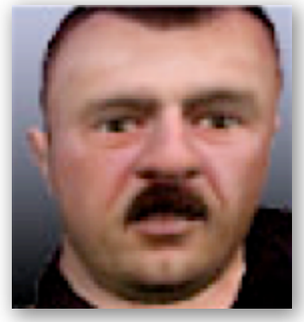
perform normal police duties

+0.6



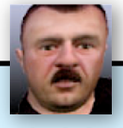
CAB: Example





CAB: Example

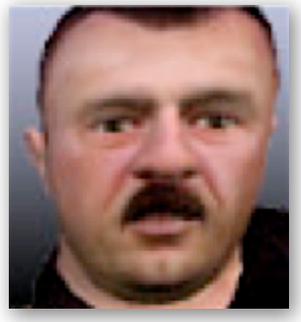
Plan A



perform normal police duties

+0.6

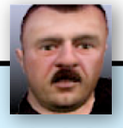
community is helped



Plan B

CAB: Example

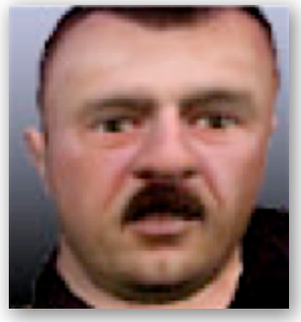
Plan A



perform normal police duties

+0.6

community is helped

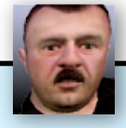


Plan B

give financial aid

CAB: Example

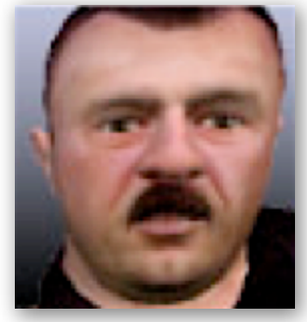
Plan A



perform normal police duties

+0.6

community is helped



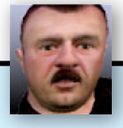
Plan B

give financial aid

+0.6

CAB: Example

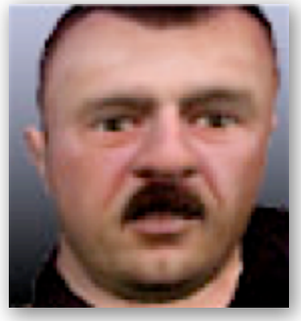
Plan A



perform normal police duties

+0.6

community is helped



Plan B

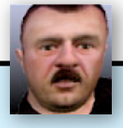
give financial aid

+0.6

community is helped

CAB: Example

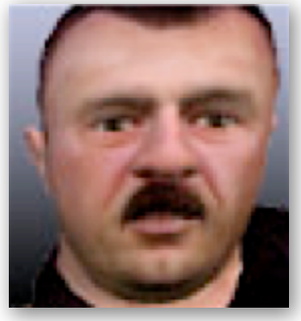
Plan A



perform normal police duties

+0.6

community is helped



Plan B

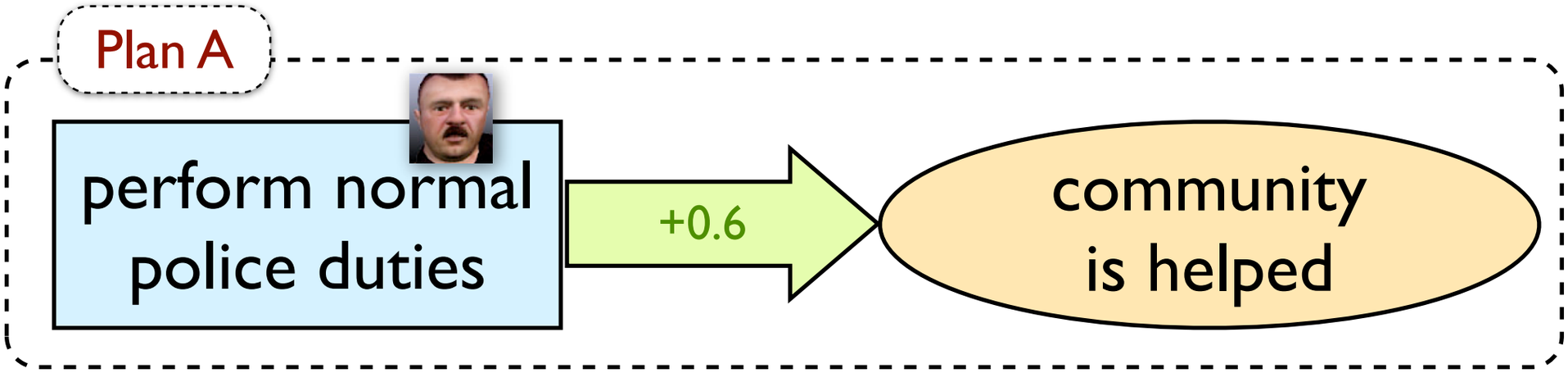
give financial aid

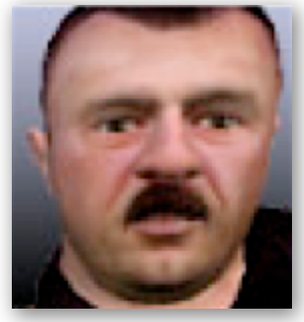
+0.6

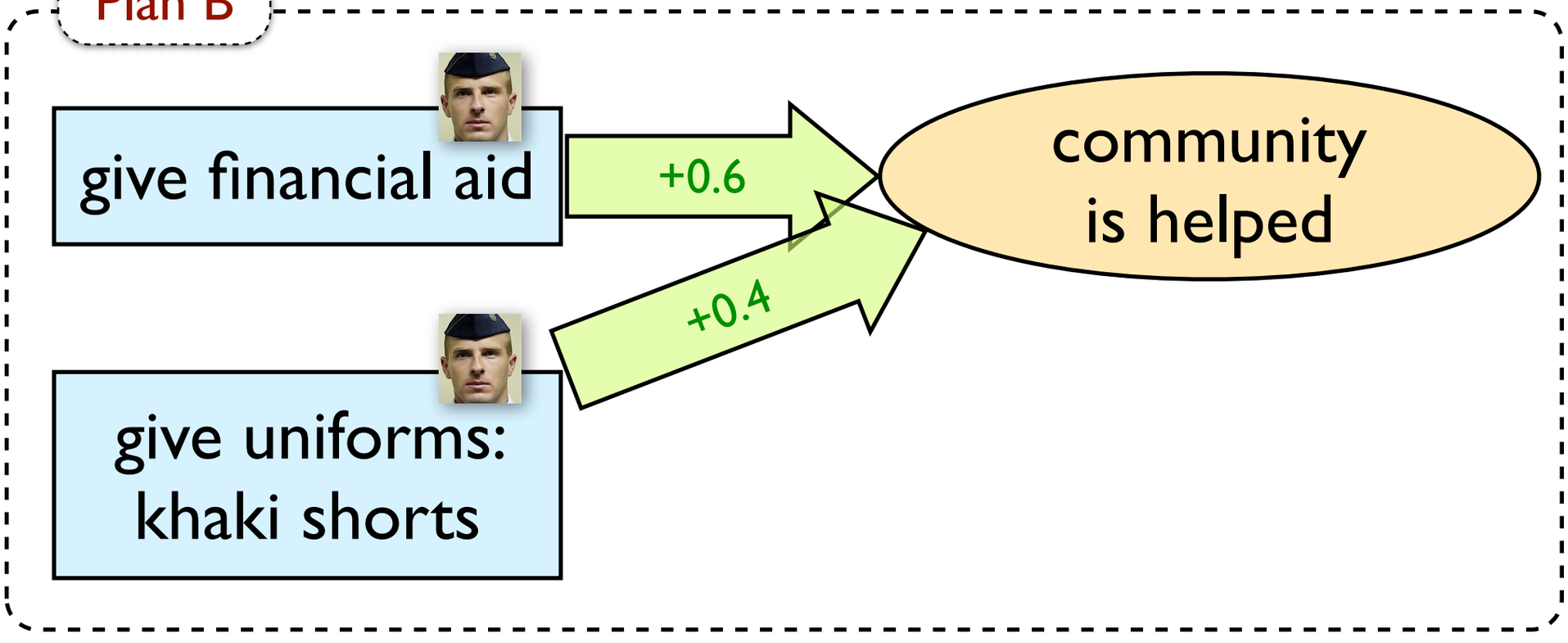
community is helped

give uniforms: khaki shorts

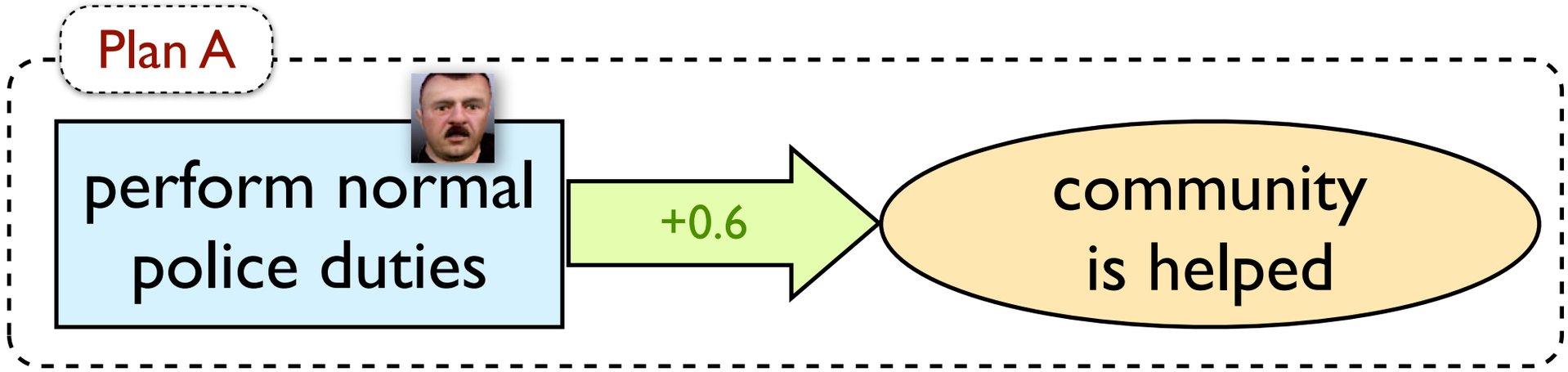
CAB: Example

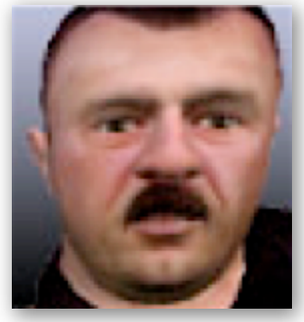

Plan A
perform normal police duties
+0.6
community is helped

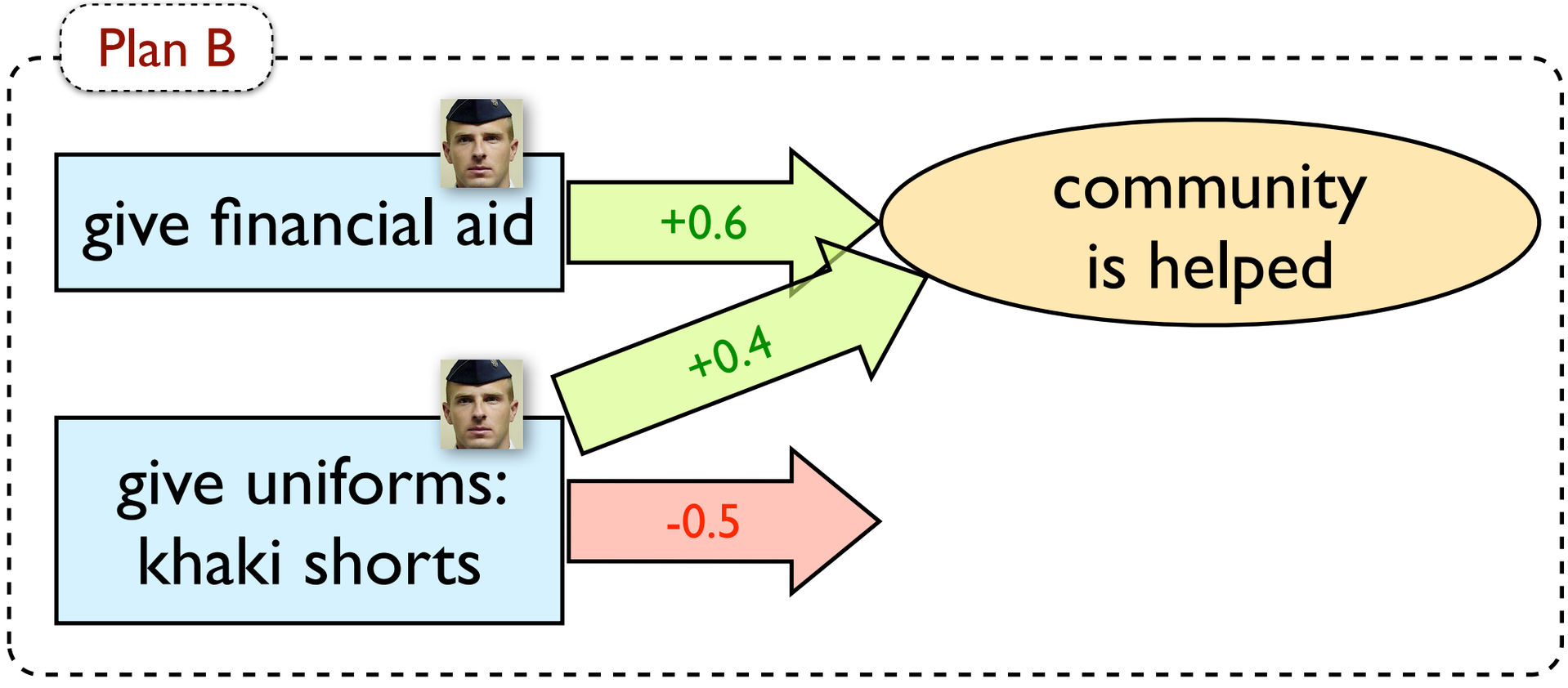



Plan B
give financial aid
+0.6
give uniforms: khaki shorts
+0.4
community is helped

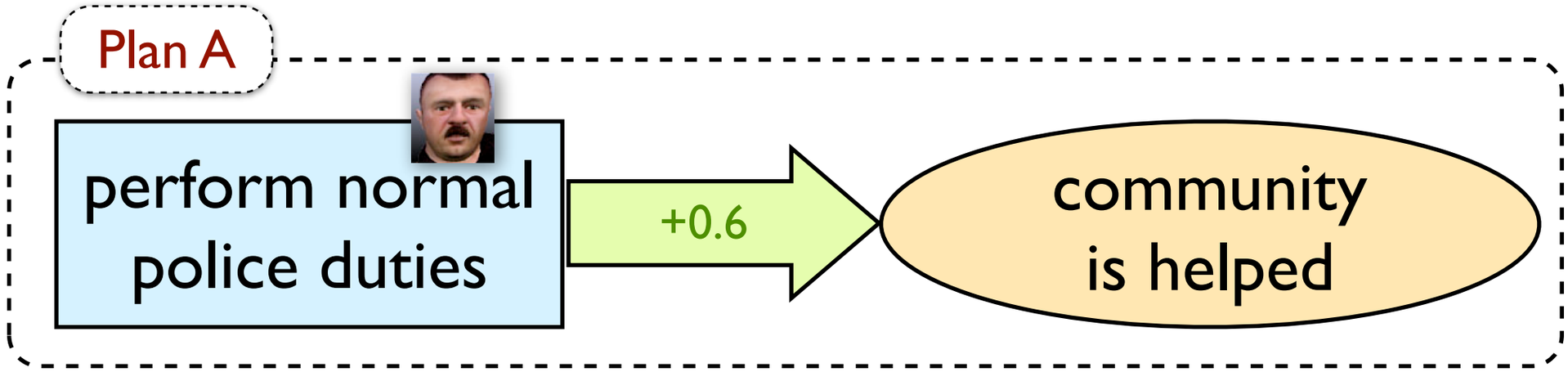
CAB: Example

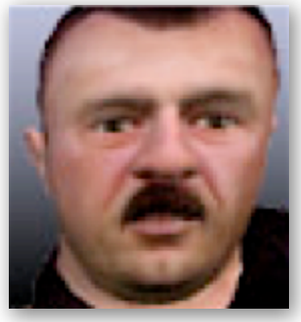

Plan A
perform normal police duties
+0.6
community is helped



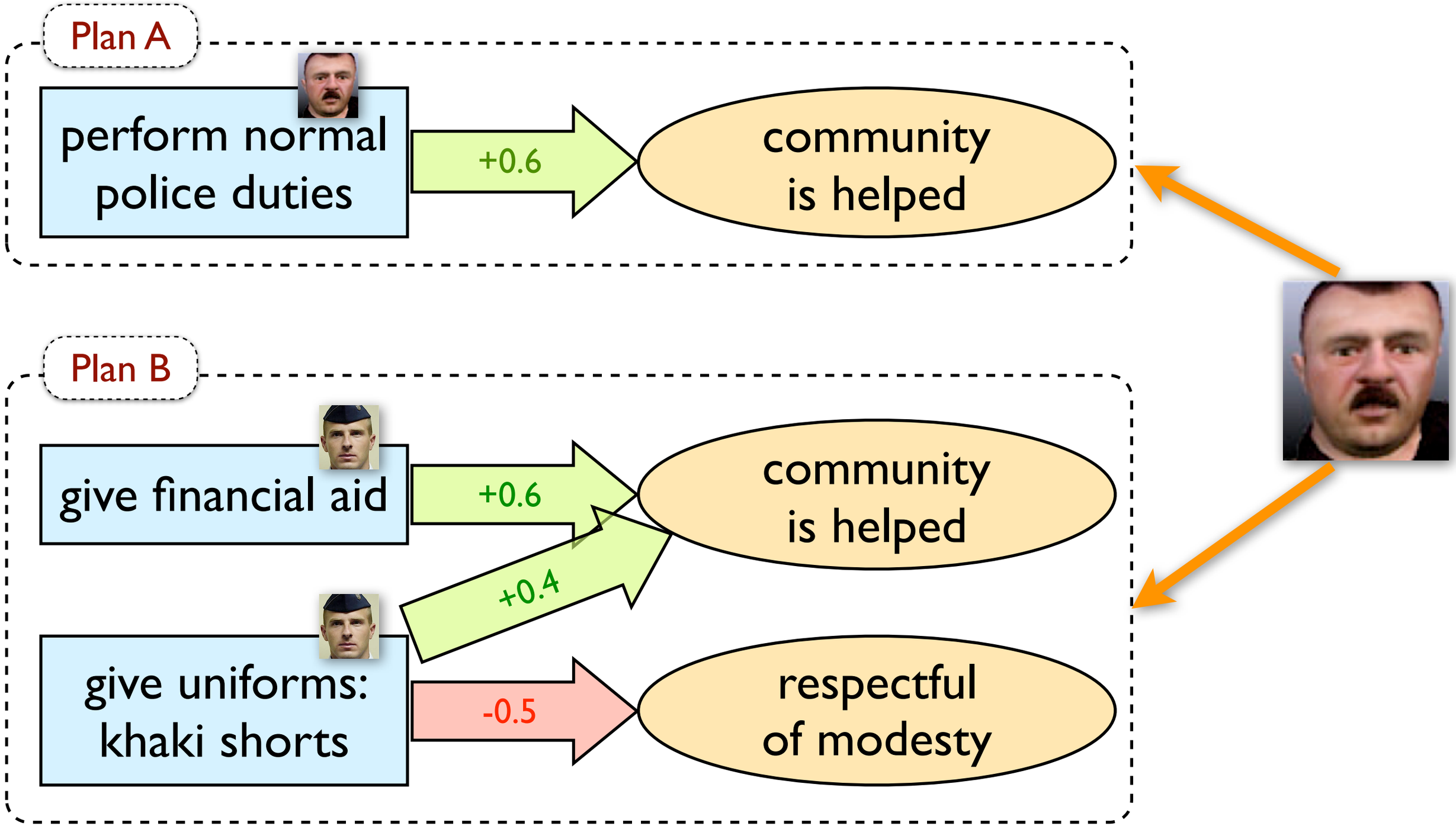

Plan B
give financial aid
+0.6
community is helped
+0.4
give uniforms: khaki shorts
-0.5

CAB: Example

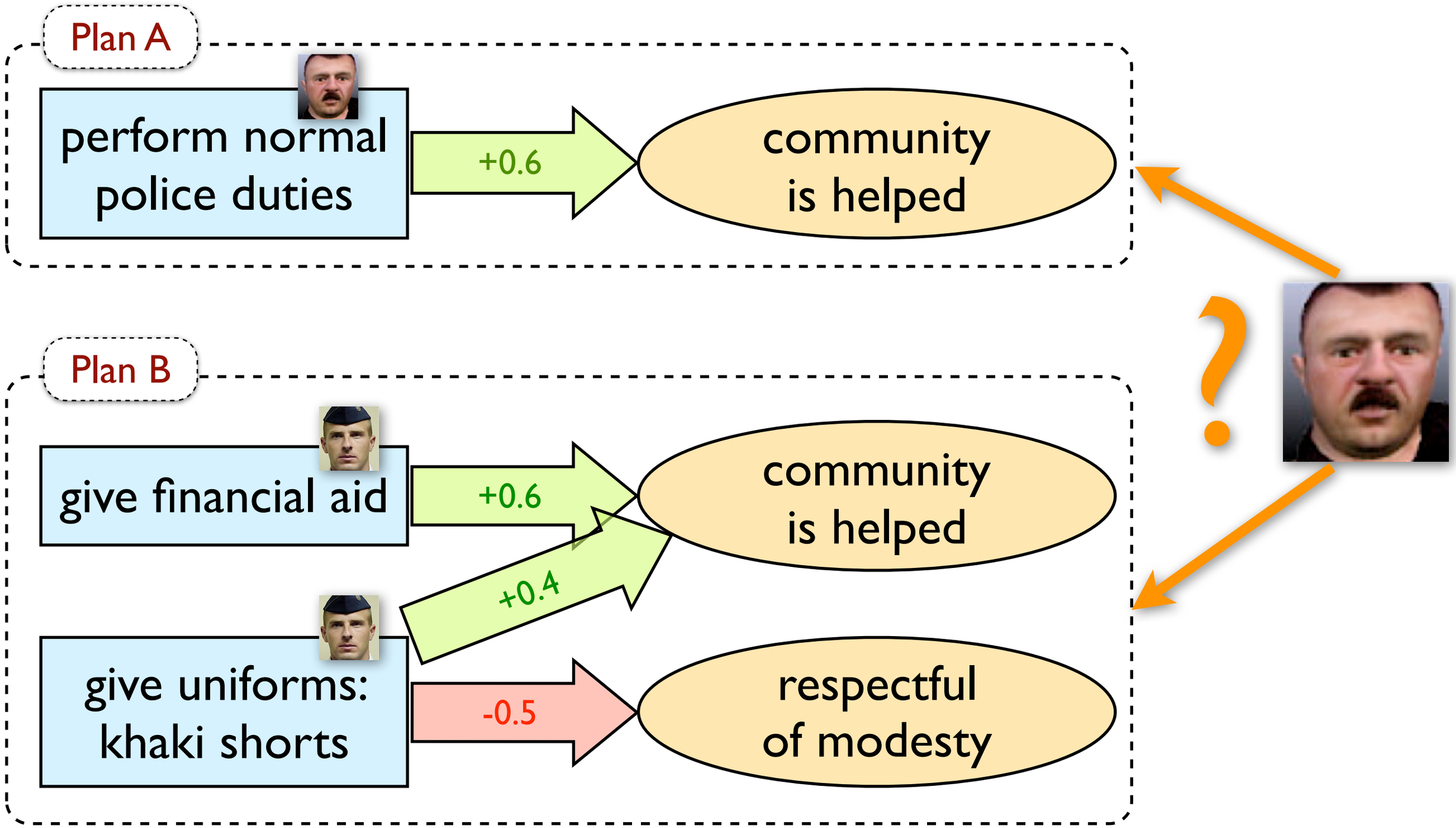

Plan A
perform normal police duties
+0.6
community is helped
Plan B
give financial aid
+0.6
community is helped
+0.4
give uniforms: khaki shorts
-0.5
respectful of modesty



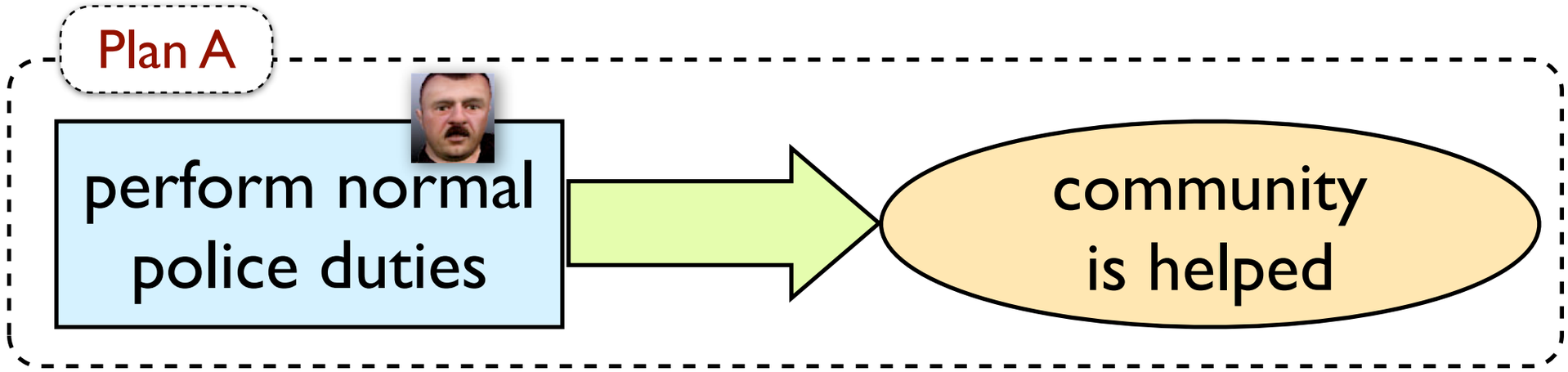
CAB: Example

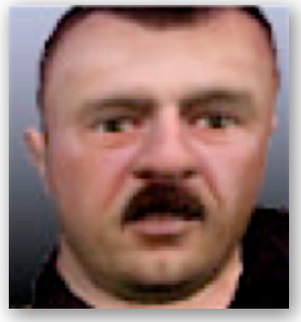

Plan A
perform normal police duties
+0.6
community is helped
Plan B
give financial aid
+0.6
+0.4
give uniforms: khaki shorts
-0.5
respectful of modesty

CAB: Example

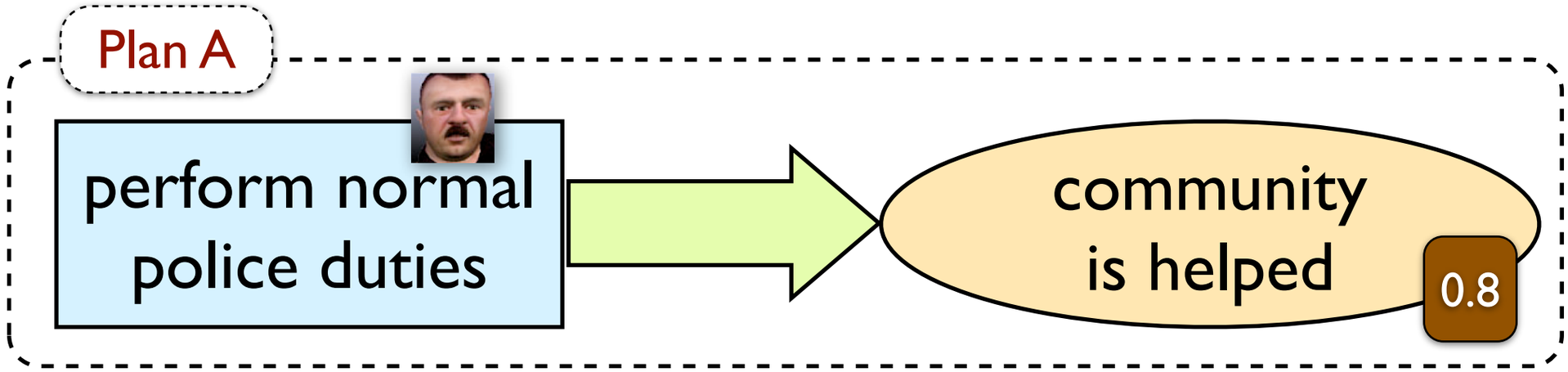

Plan A
perform normal police duties
+0.6
community is helped
Plan B
give financial aid
+0.6
+0.4
give uniforms: khaki shorts
-0.5
respectful of modesty
?

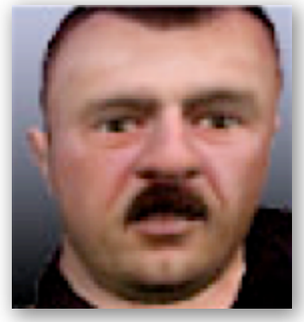
CAB: Example

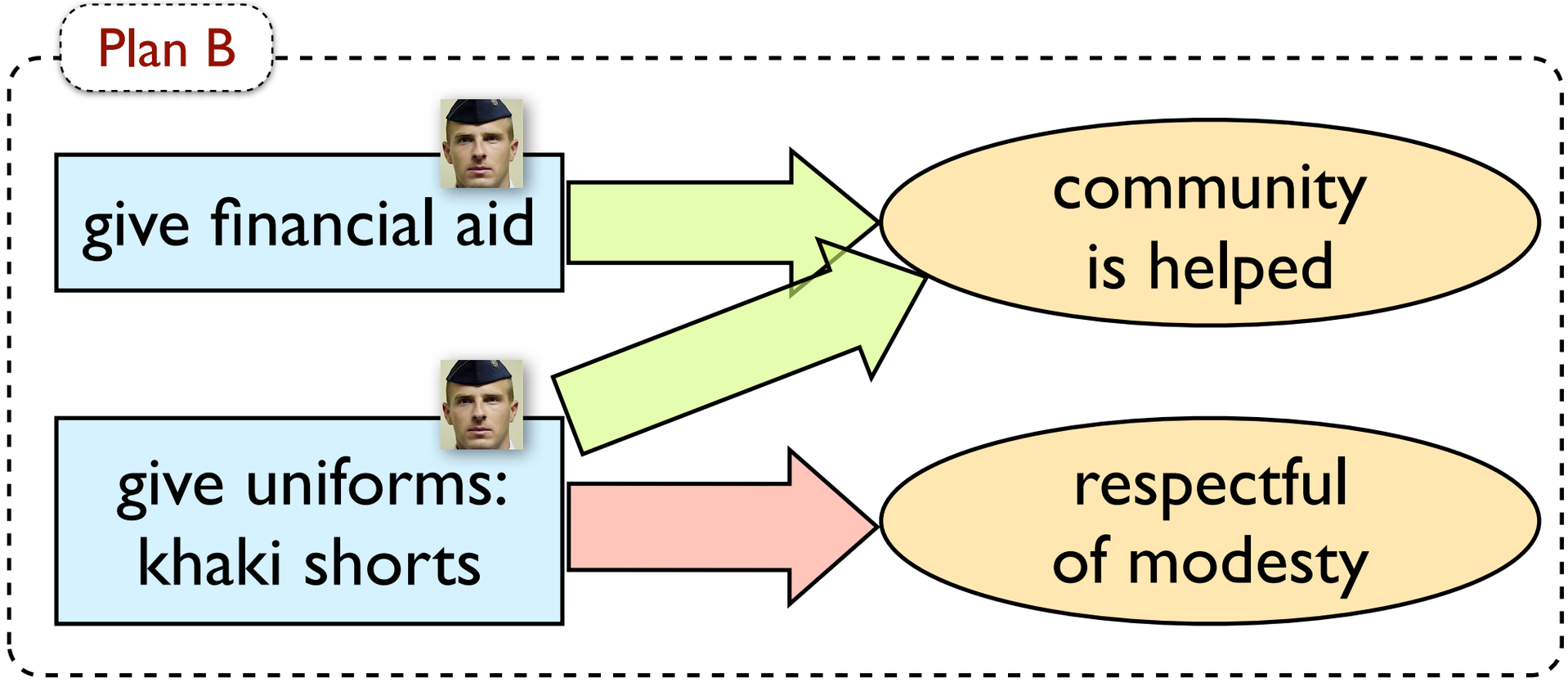

Plan A
perform normal police duties
community is helped
Plan B
give financial aid
give uniforms: khaki shorts
community is helped
respectful of modesty



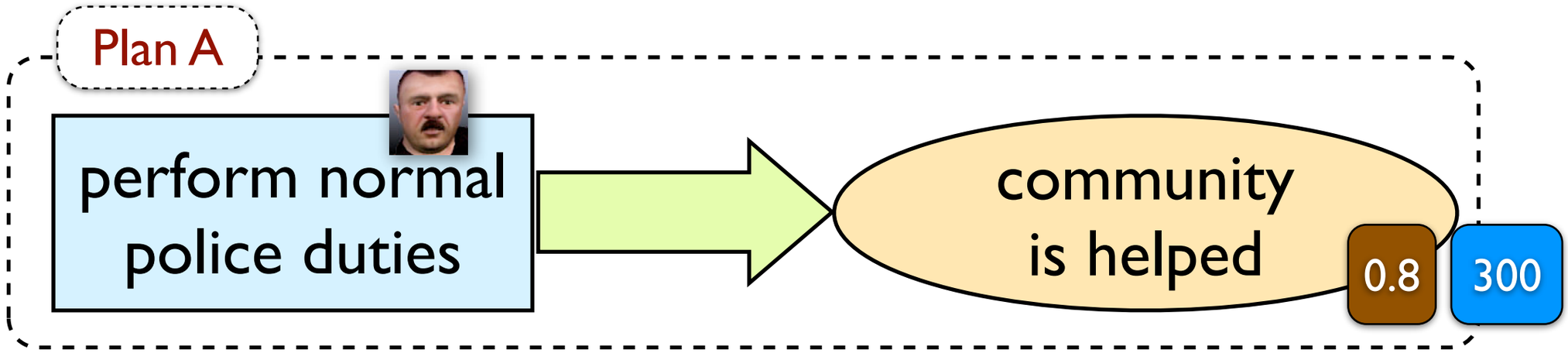
CAB: Example

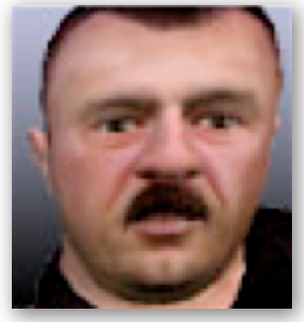

Plan A
perform normal police duties
community is helped
0.8

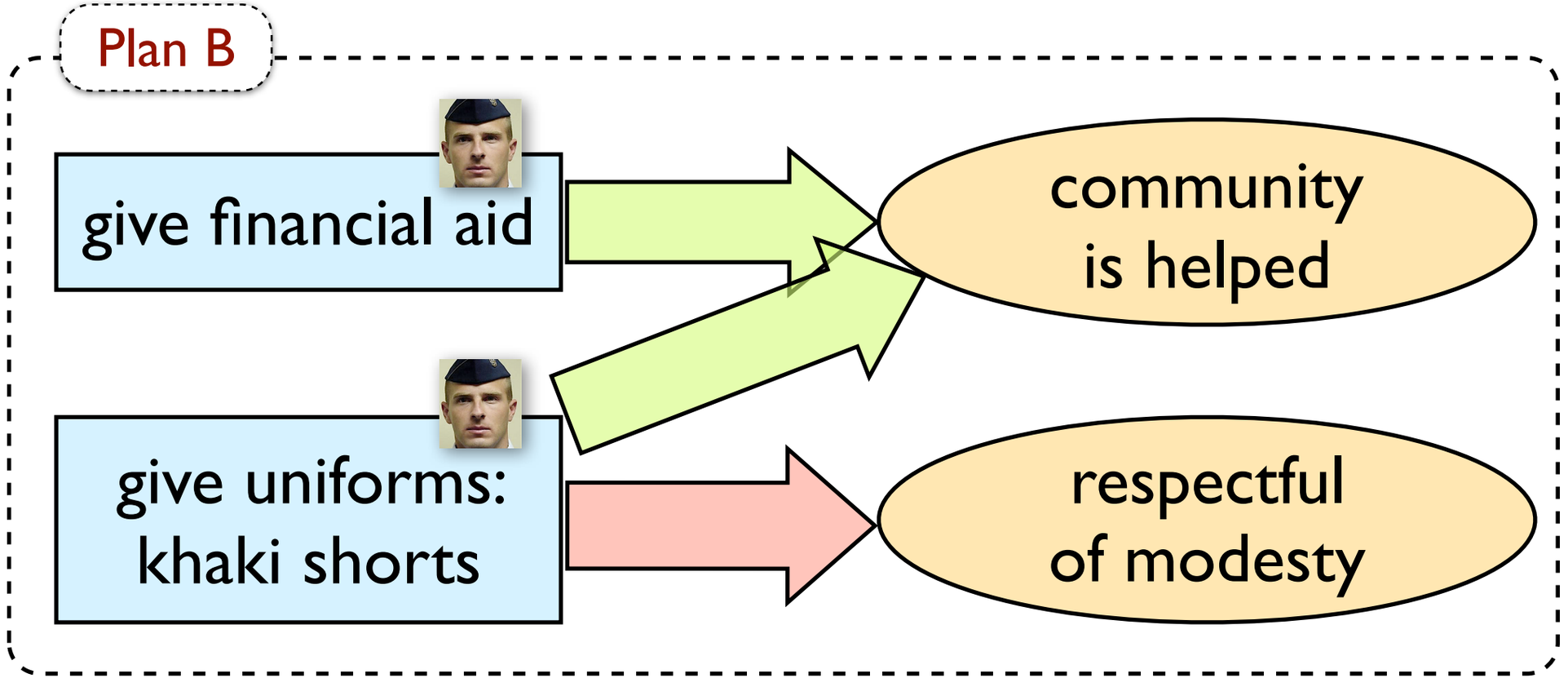



Plan B
give financial aid
give uniforms: khaki shorts
community is helped
respectful of modesty

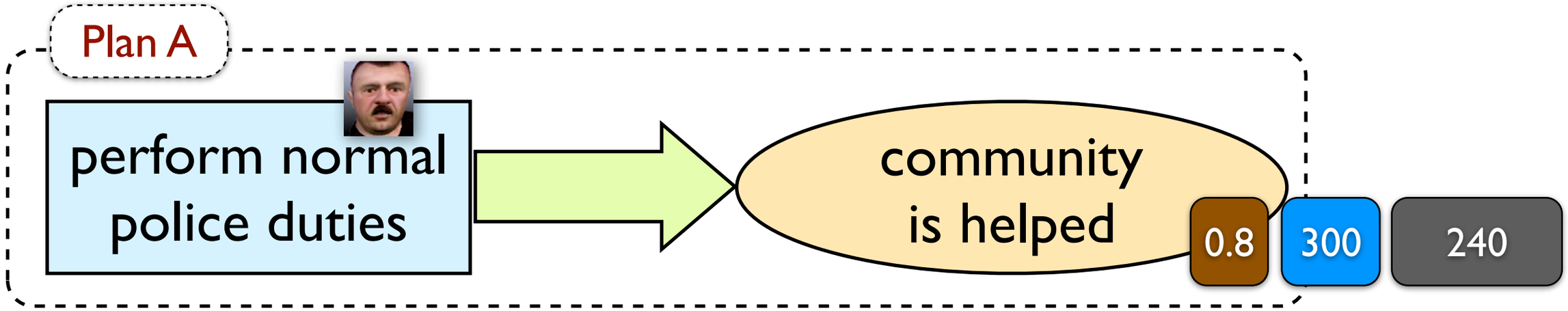
CAB: Example

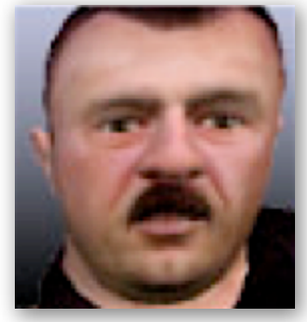

Plan A
perform normal police duties
community is helped
0.8
300

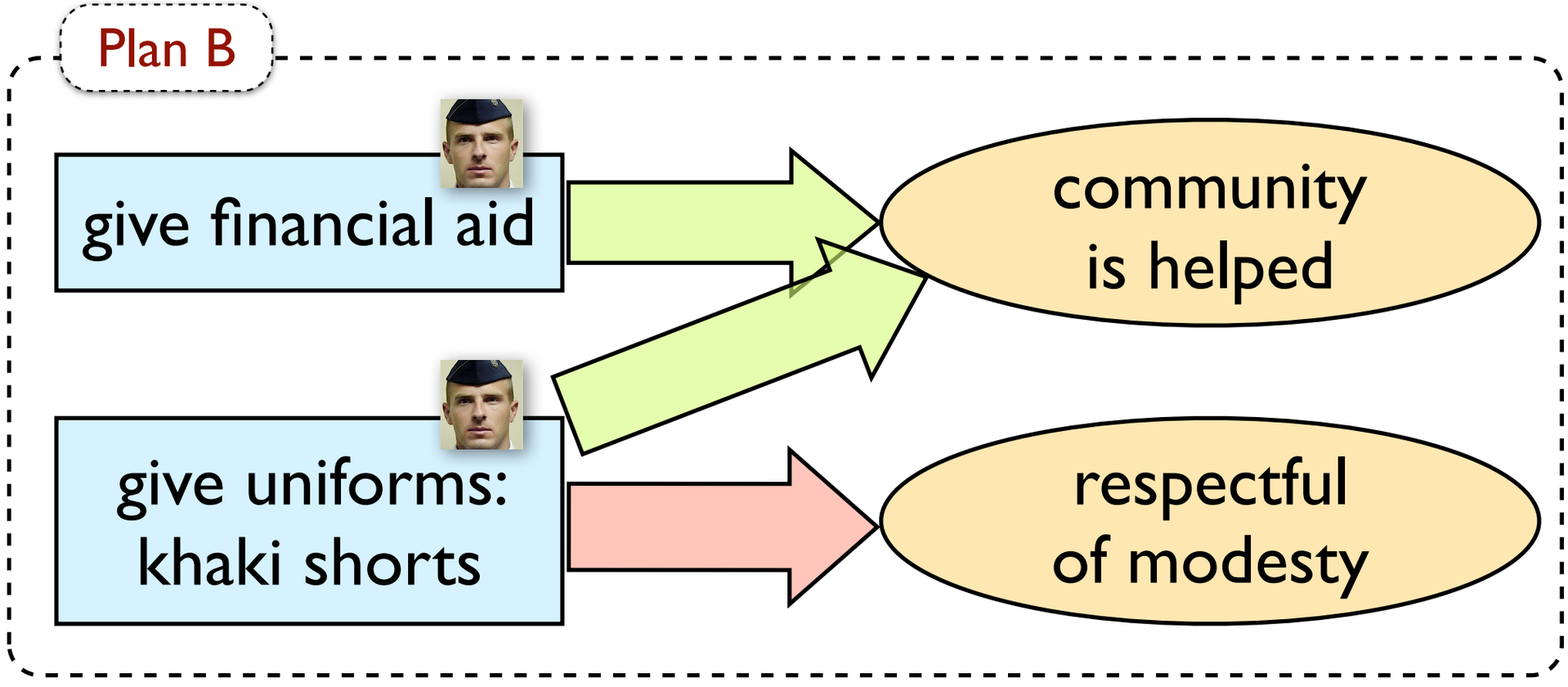



Plan B
give financial aid
give uniforms: khaki shorts
community is helped
respectful of modesty

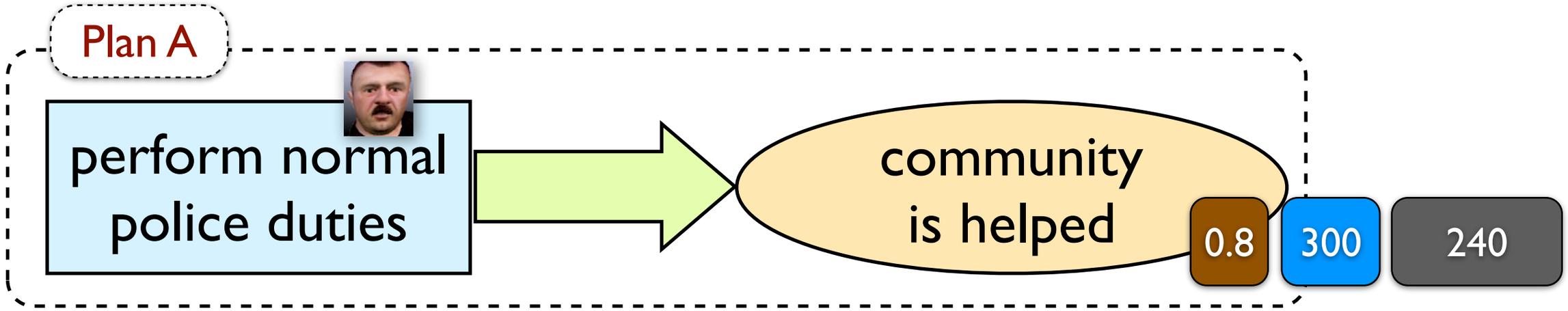
CAB: Example

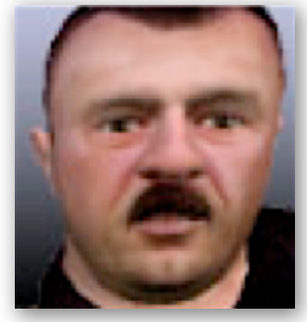

Plan A
perform normal police duties
community is helped
0.8
300
240

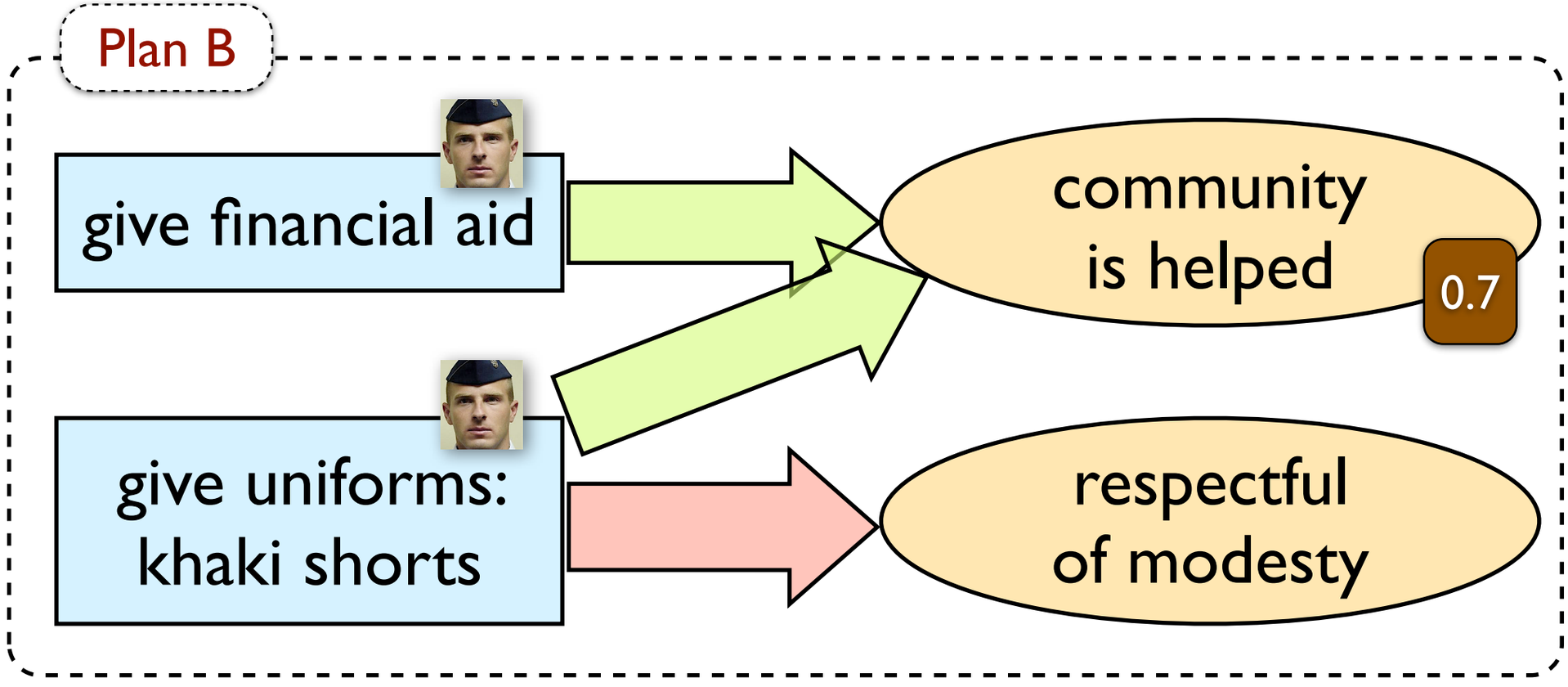



Plan B
give financial aid
give uniforms: khaki shorts
community is helped
respectful of modesty

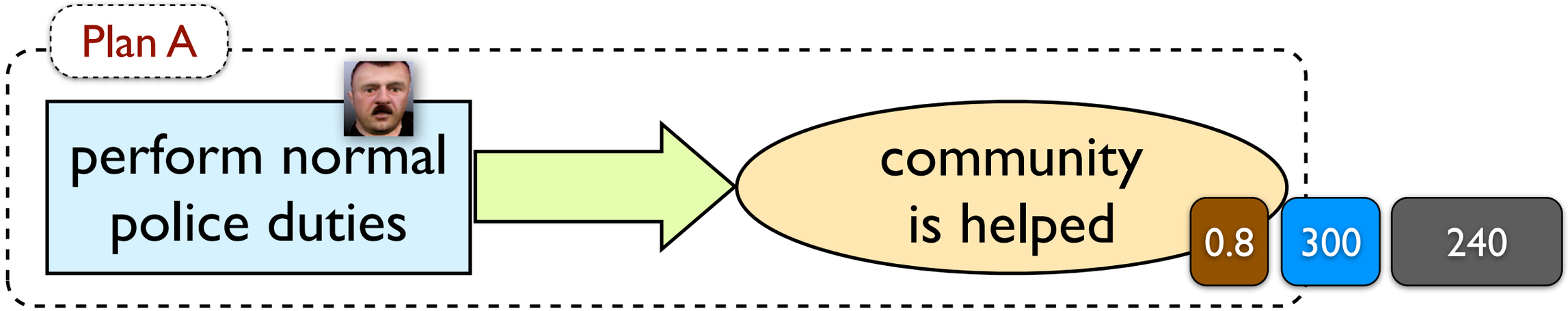
CAB: Example

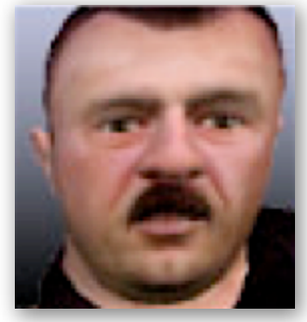

Plan A
perform normal police duties
community is helped
0.8
300
240

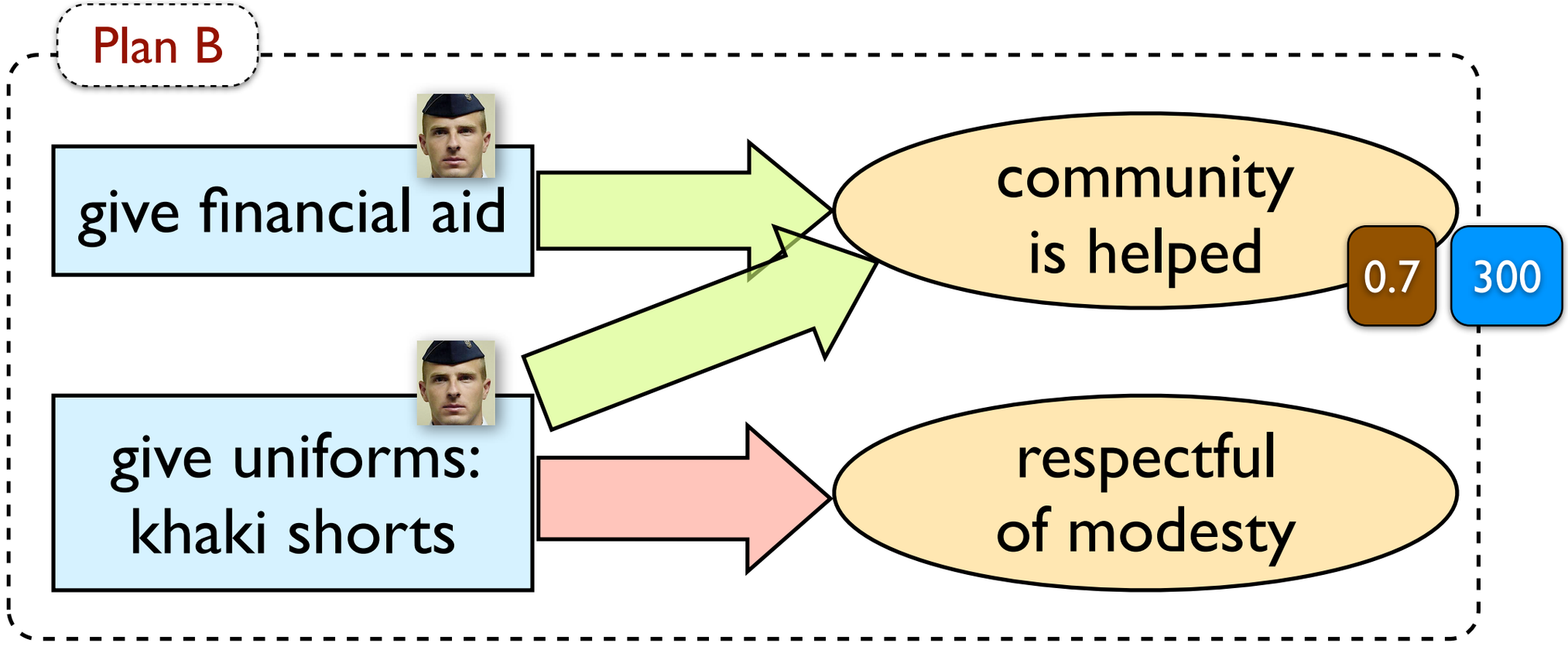



Plan B
give financial aid
give uniforms: khaki shorts
community is helped
0.7
respectful of modesty

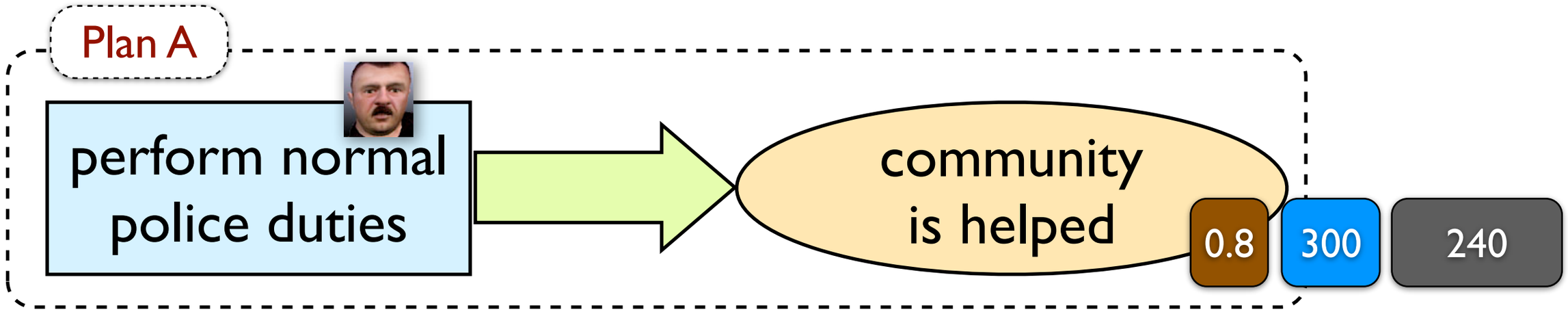
CAB: Example

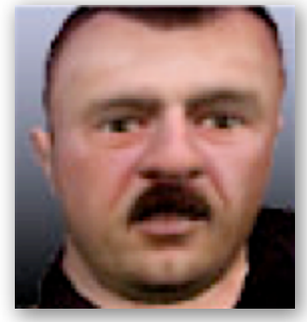

Plan A
perform normal police duties
community is helped
0.8
300
240

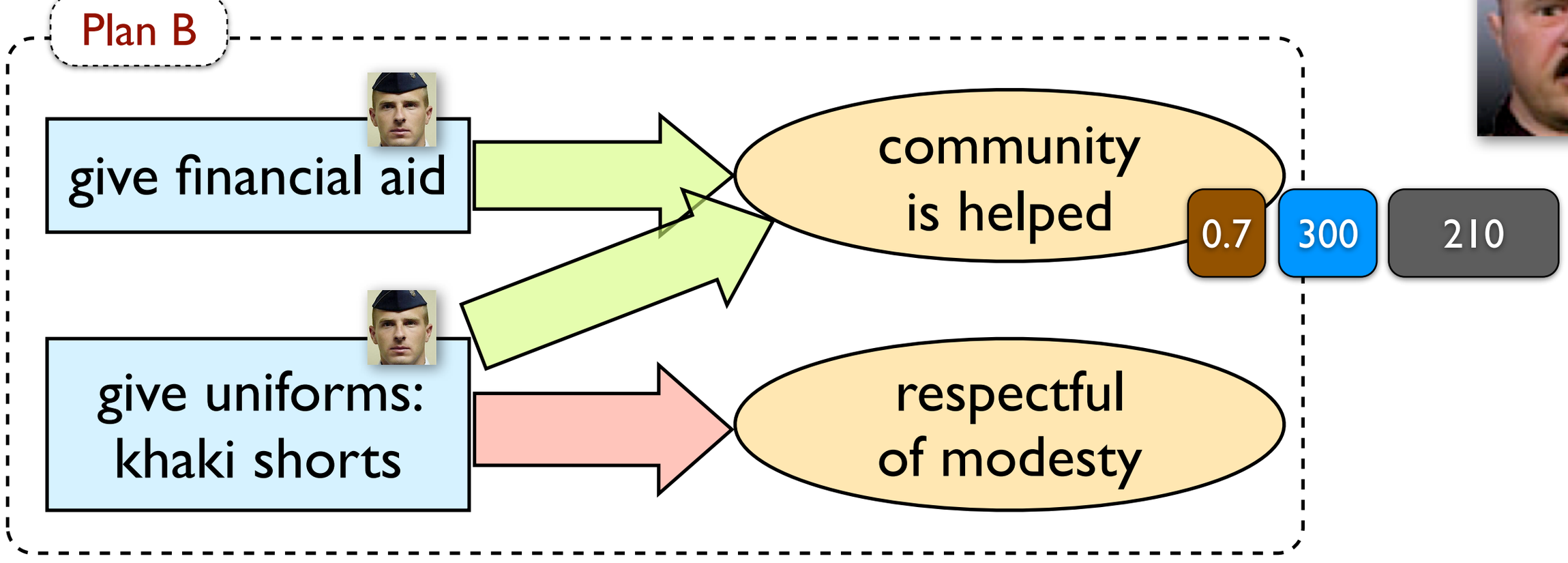



Plan B
give financial aid
give uniforms: khaki shorts
community is helped
0.7
300
respectful of modesty

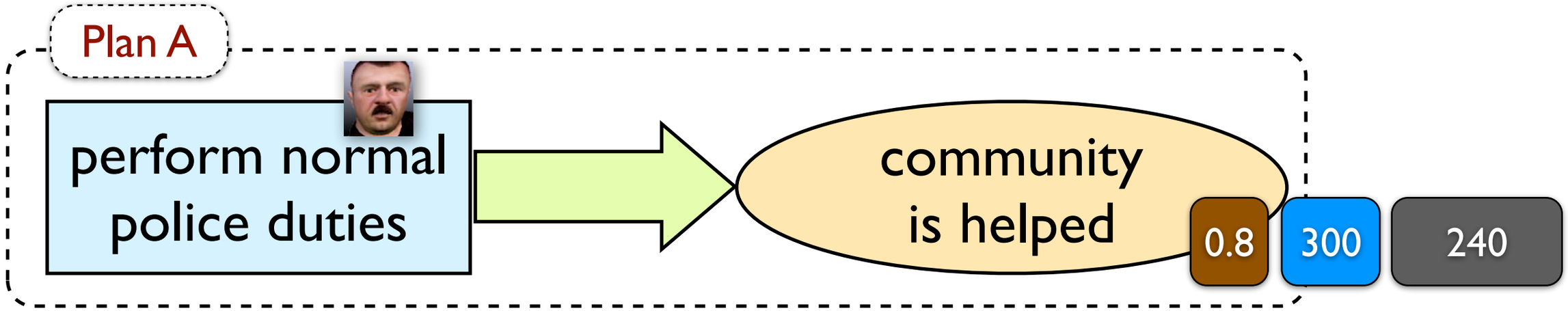
CAB: Example

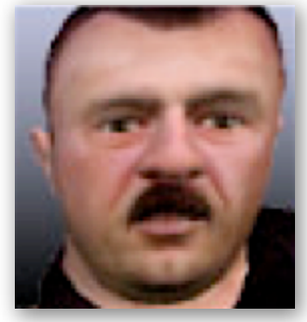

Plan A
perform normal police duties
community is helped
0.8
300
240

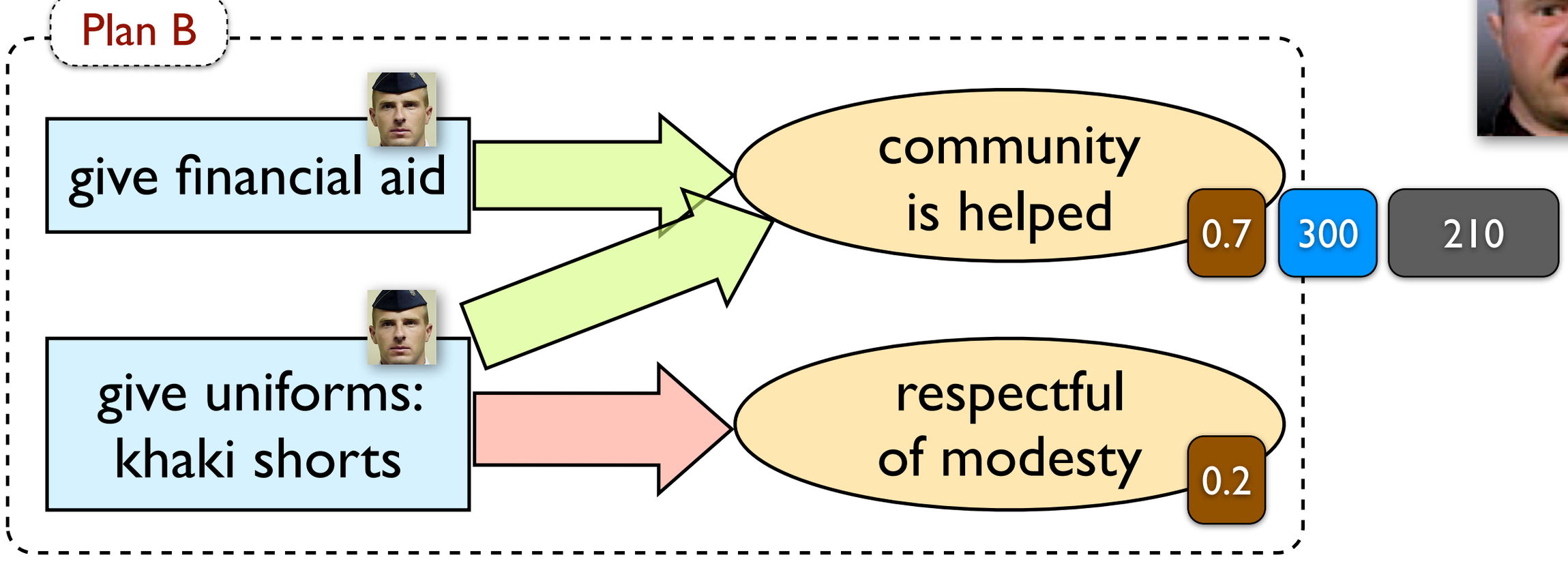



Plan B
give financial aid
give uniforms: khaki shorts
community is helped
respectful of modesty
0.7
300
210

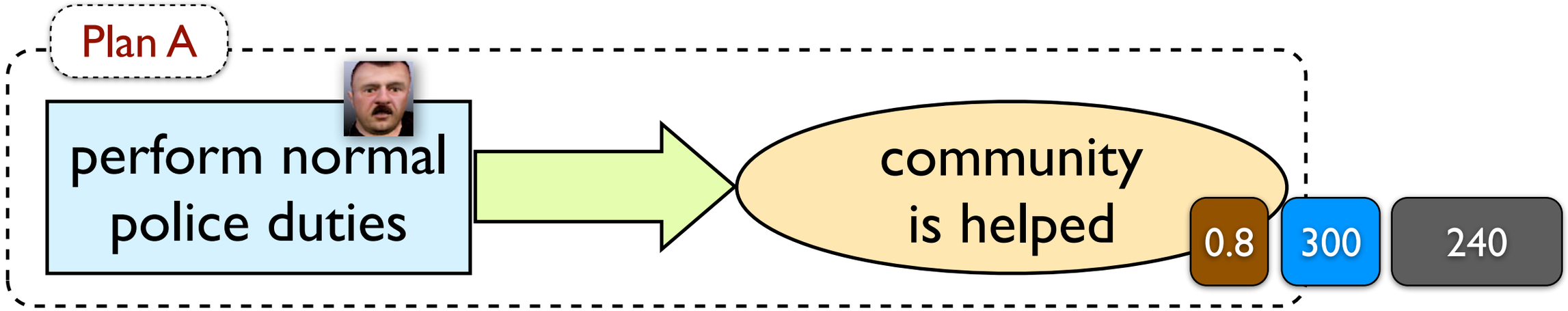
CAB: Example

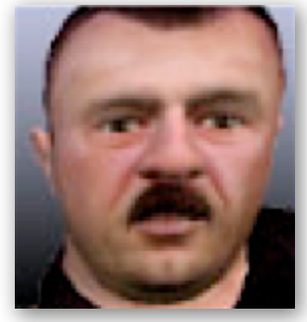

Plan A
perform normal police duties
community is helped
0.8
300
240

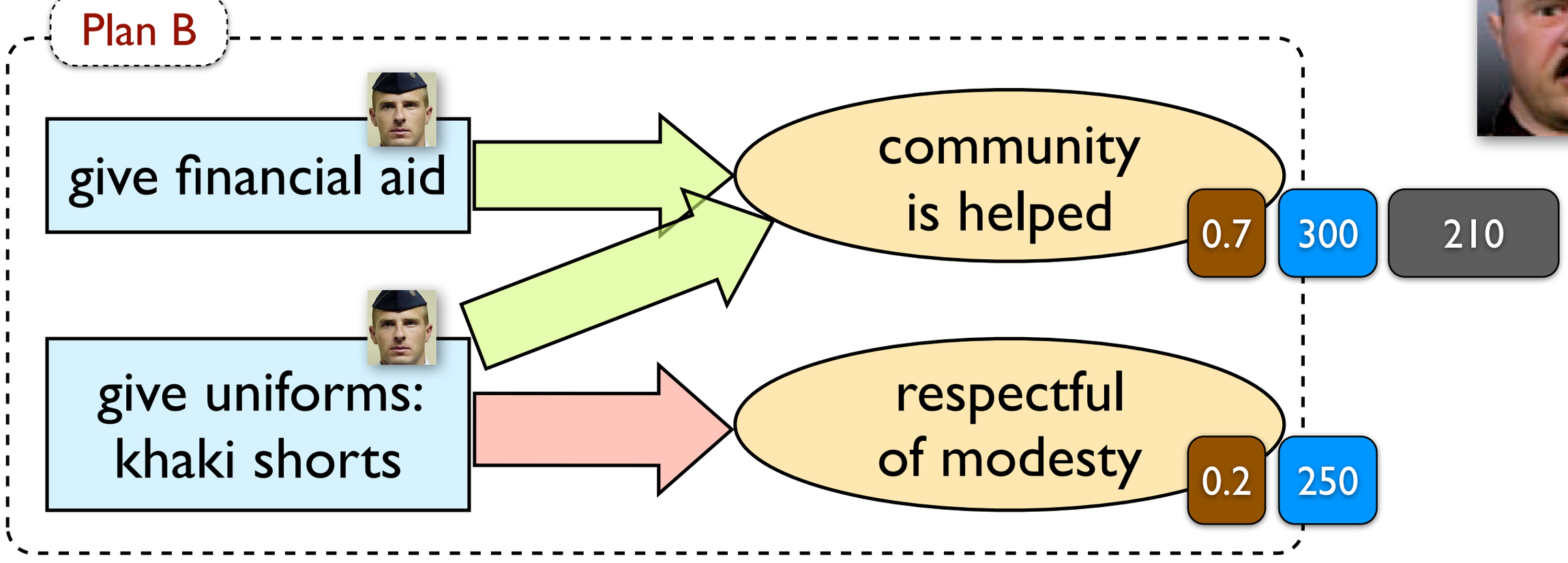



Plan B
give financial aid
give uniforms: khaki shorts
community is helped
0.7
300
210
respectful of modesty
0.2

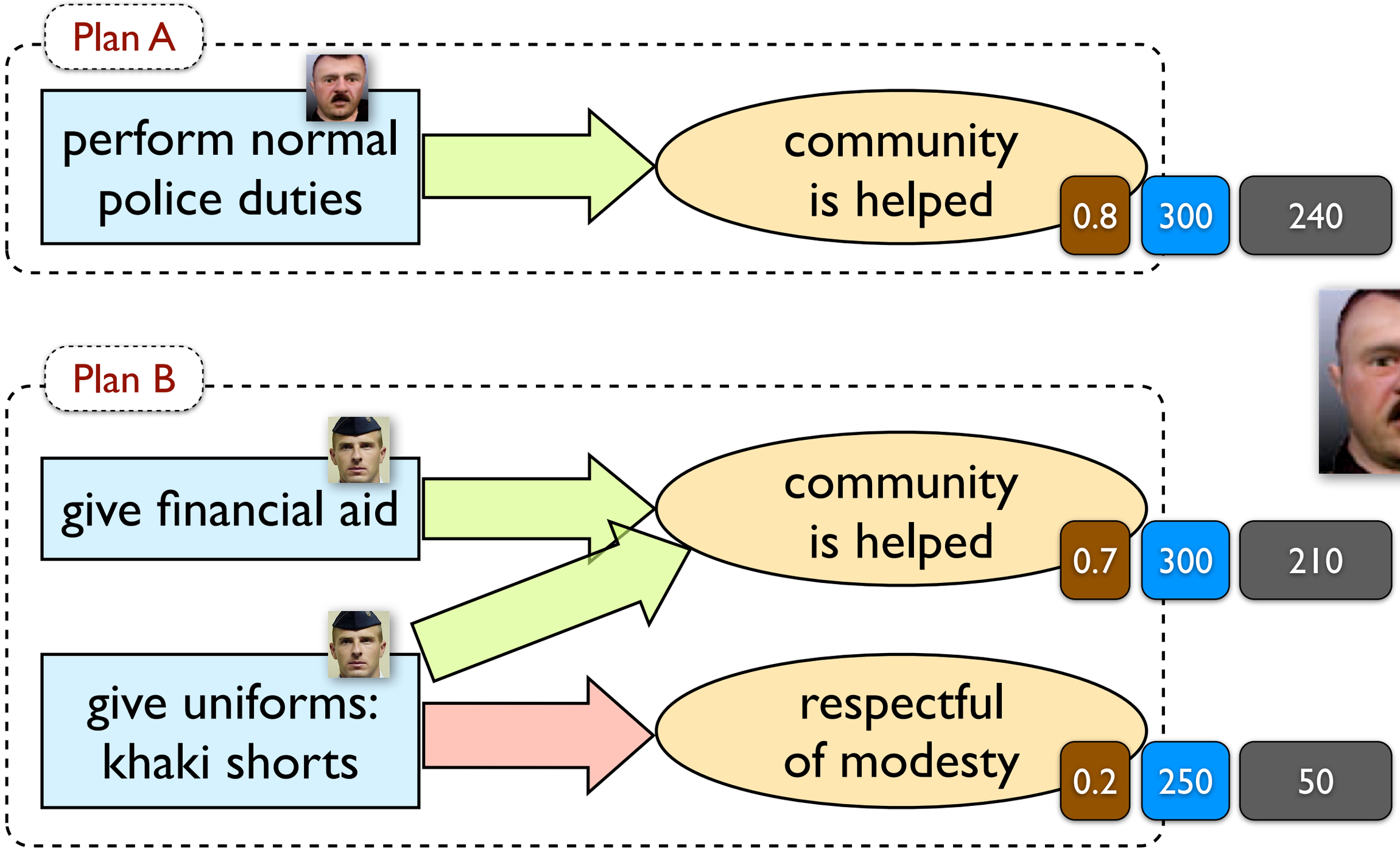
CAB: Example


Plan A
perform normal police duties
community is helped
0.8
300
240

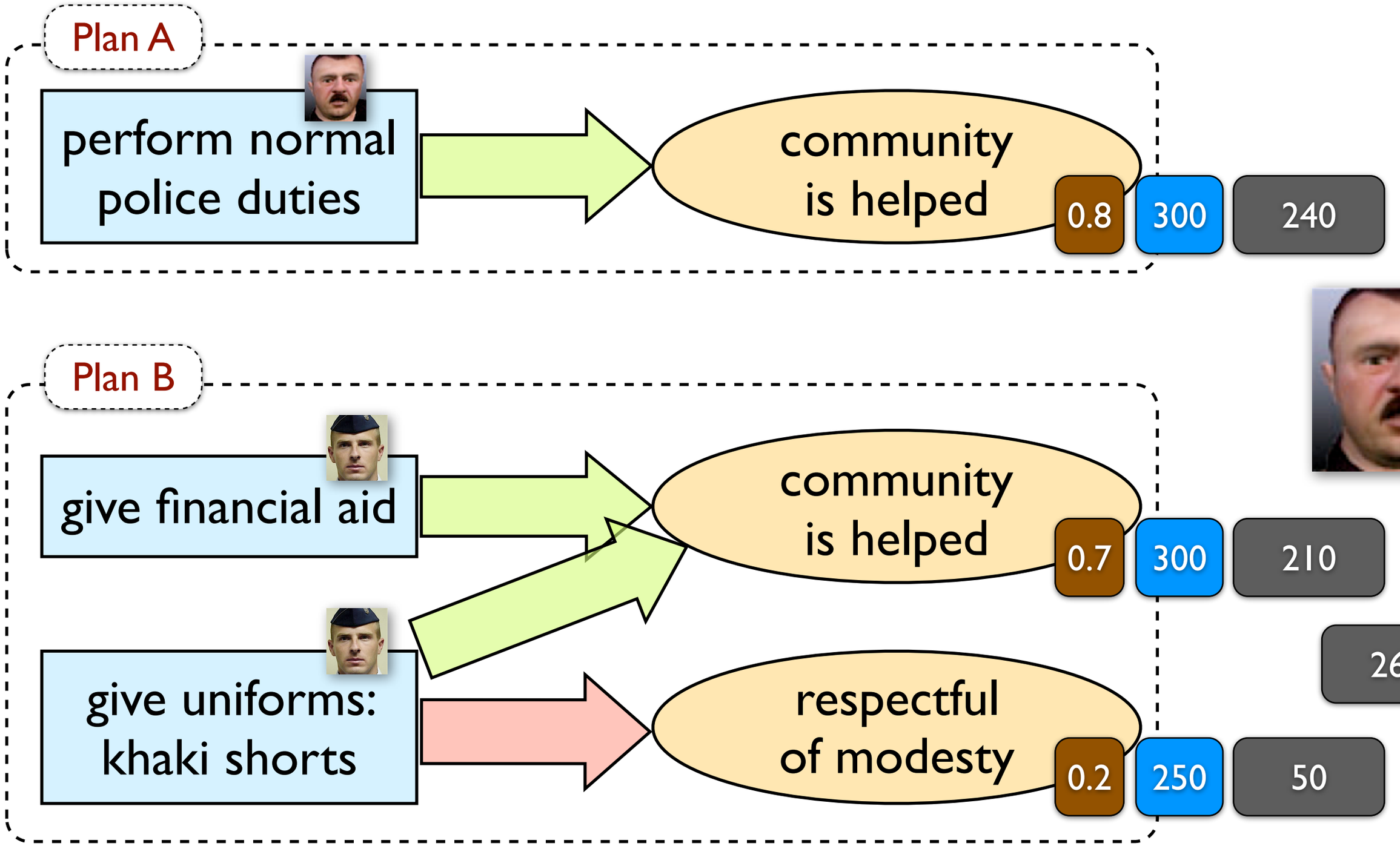



Plan B
give financial aid
give uniforms: khaki shorts
community is helped
0.7
300
210
respectful of modesty
0.2
250

CAB: Example

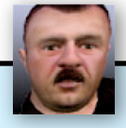

Plan A
perform normal police duties
community is helped
0.8
300
240
Plan B
give financial aid
give uniforms: khaki shorts
community is helped
0.7
300
210
respectful of modesty
0.2
250
50

CAB: Example


Plan A
perform normal police duties
community is helped
0.8
300
240
Plan B
give financial aid
give uniforms: khaki shorts
community is helped
0.7
300
210
respectful of modesty
0.2
250
50
260

CAB: Example

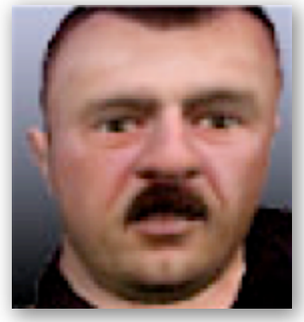
Plan A



perform normal police duties

community is helped

240



Plan B

give financial aid

give uniforms: khaki shorts

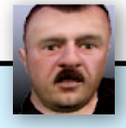
community is helped

respectful of modesty

260

CAB: Example

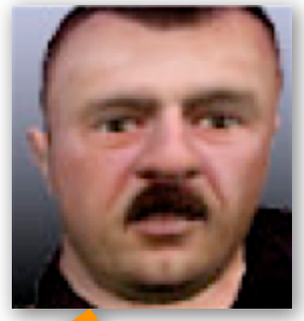
Plan A



perform normal police duties

community is helped

240



Plan B

give financial aid

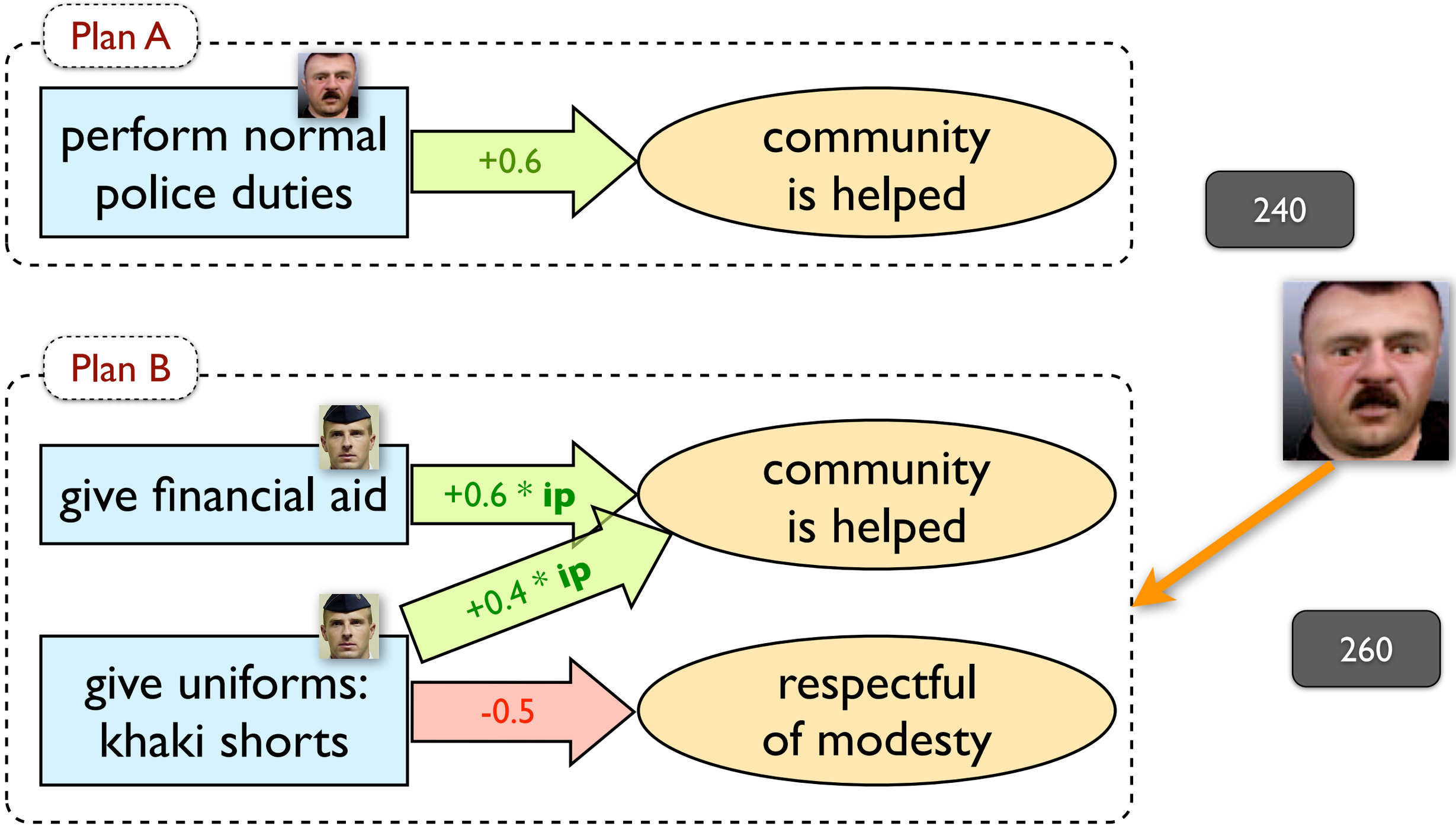
give uniforms: khaki shorts

community is helped

respectful of modesty

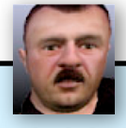
260

CAB: Example


Plan A
perform normal police duties
+0.6
community is helped
240
Plan B
give financial aid
+0.6 * ip
community is helped
+0.4 * ip
give uniforms: khaki shorts
-0.5
respectful of modesty
260

CAB: Example

Plan A

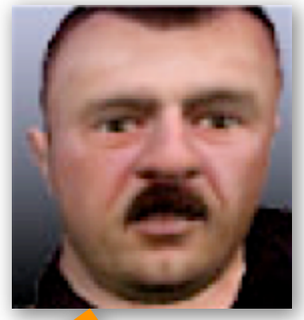


perform normal police duties

+0.6

community is helped

240



Plan B

give financial aid

+0.6 * ip

+0.4 * ip

community is helped

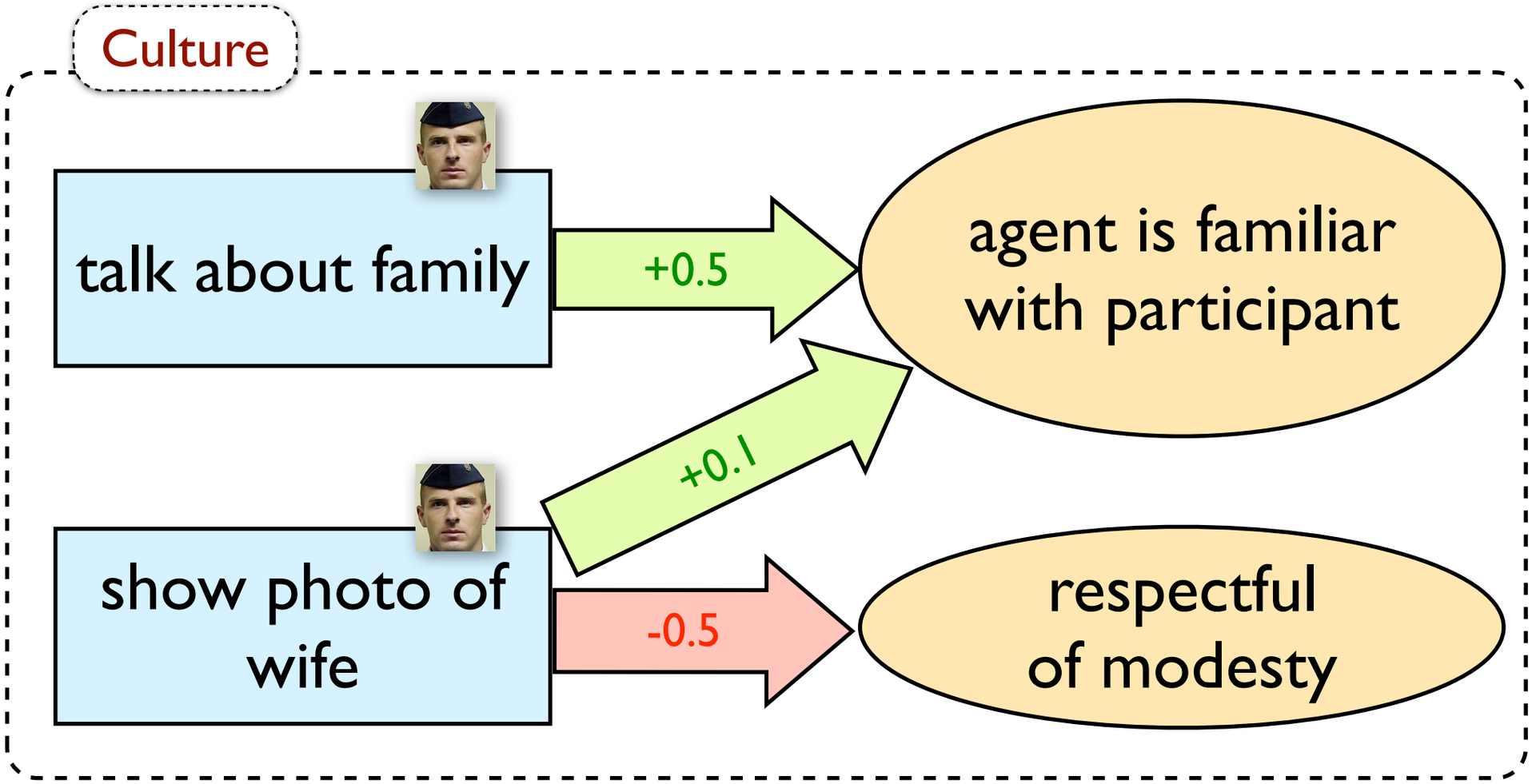
give uniforms: khaki shorts

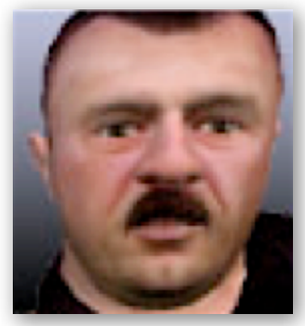
-0.5

respectful of modesty

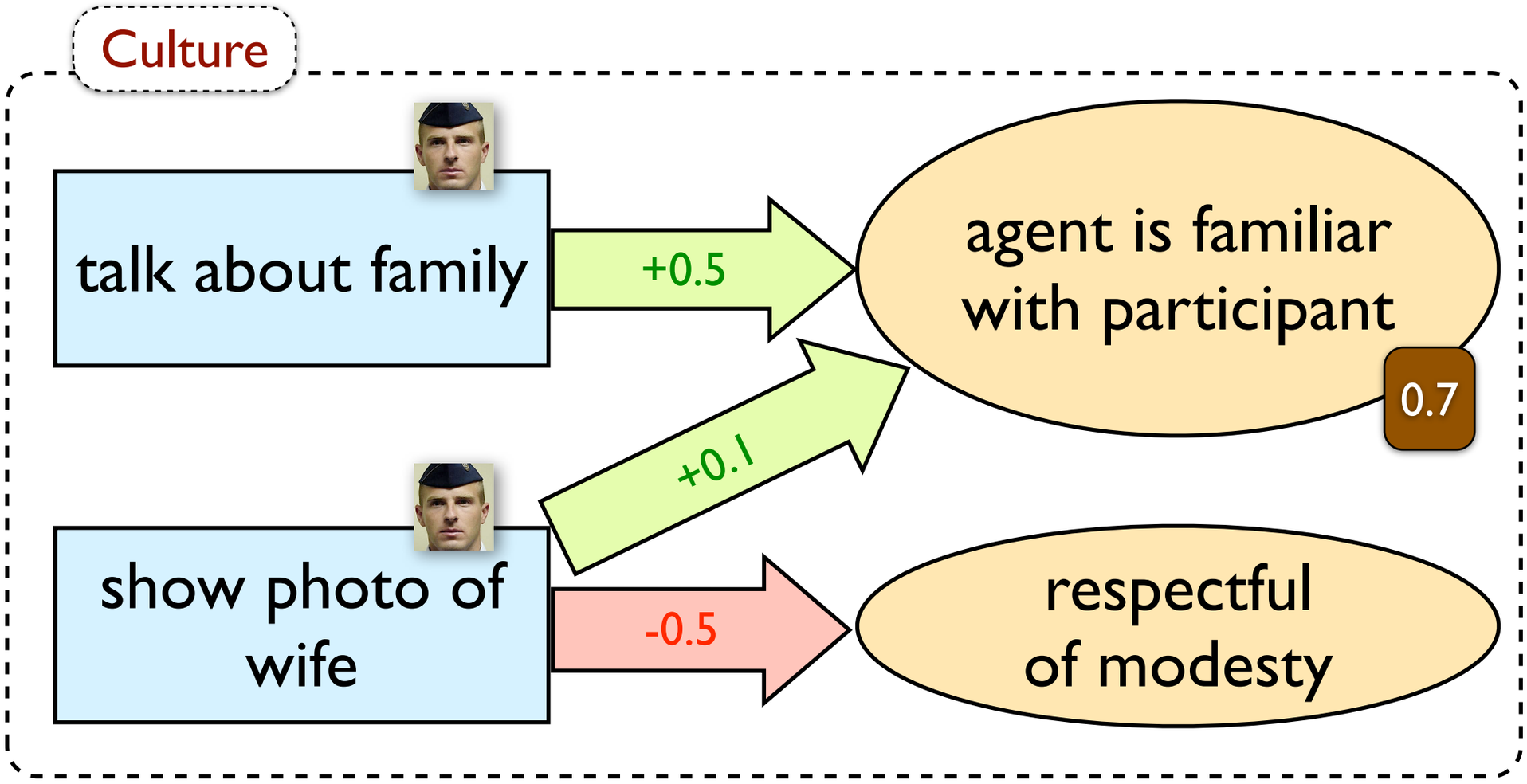
260

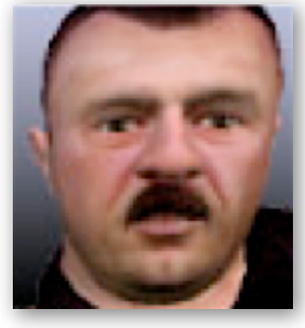
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
+0.1
show photo of wife
-0.5
respectful of modesty

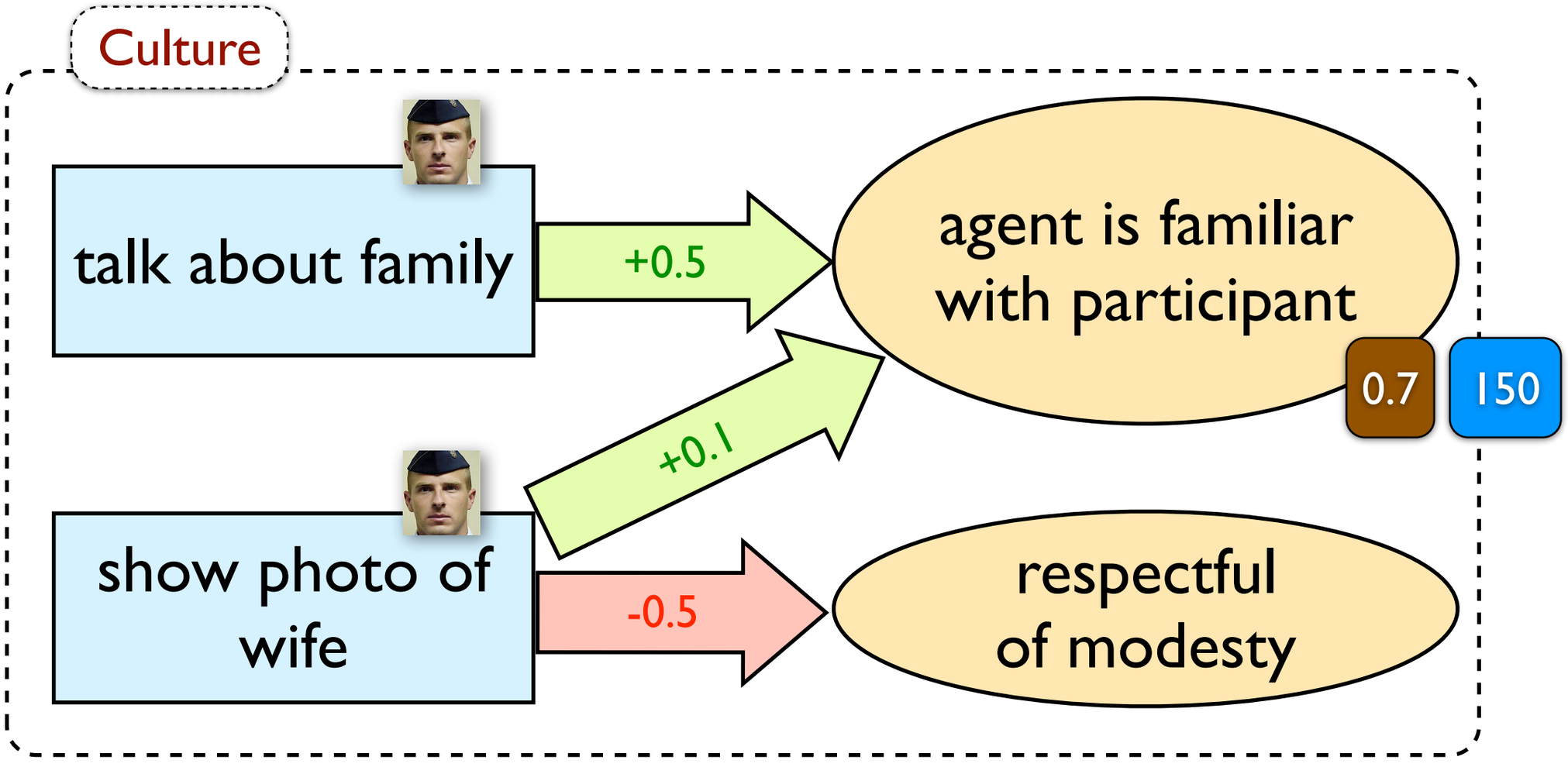


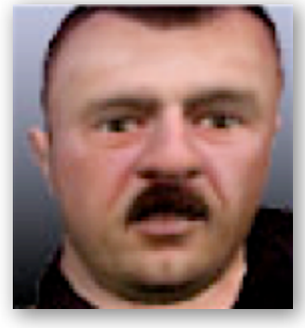
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
+0.1
show photo of wife
-0.5
respectful of modesty

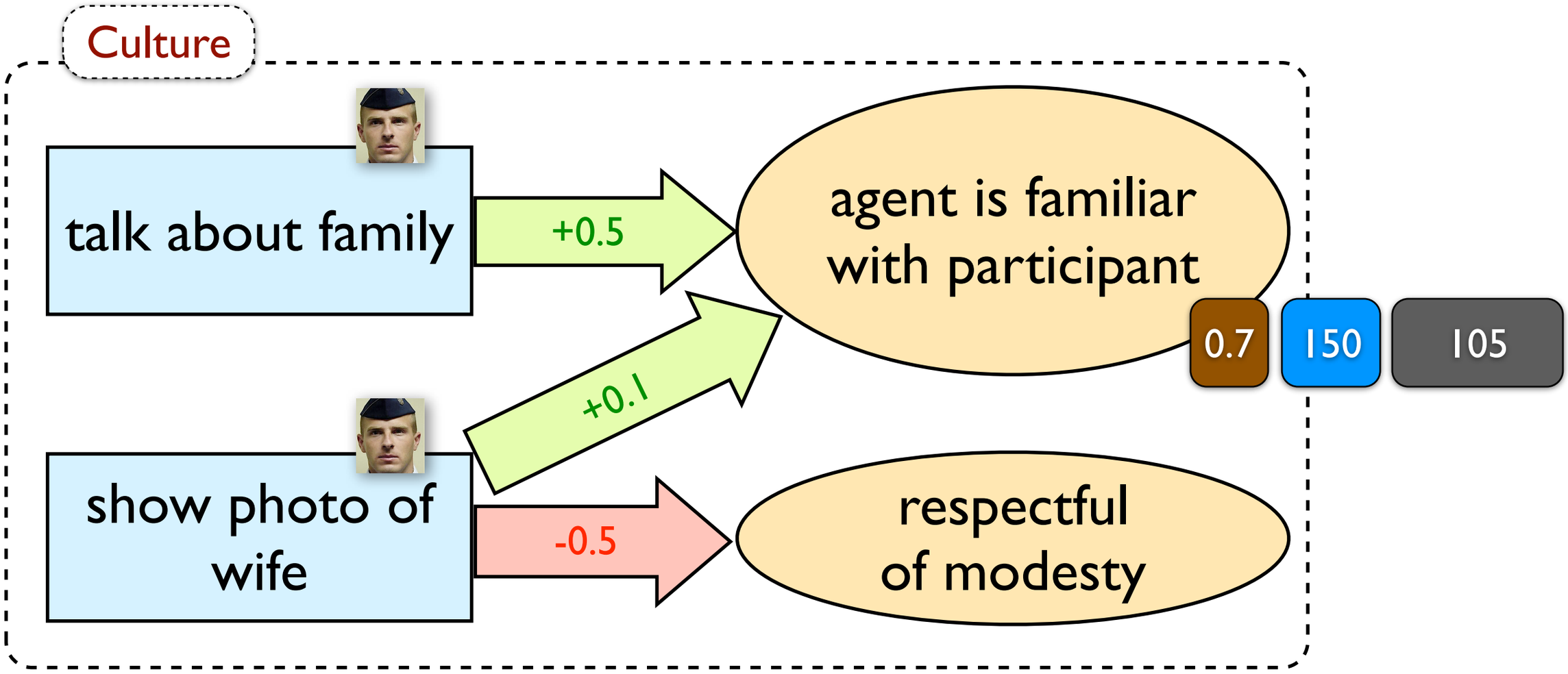


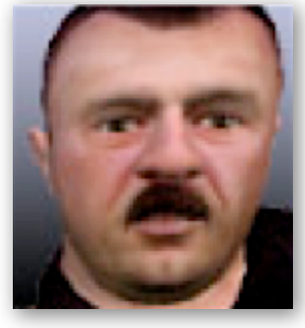
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
+0.1
show photo of wife
-0.5
respectful of modesty

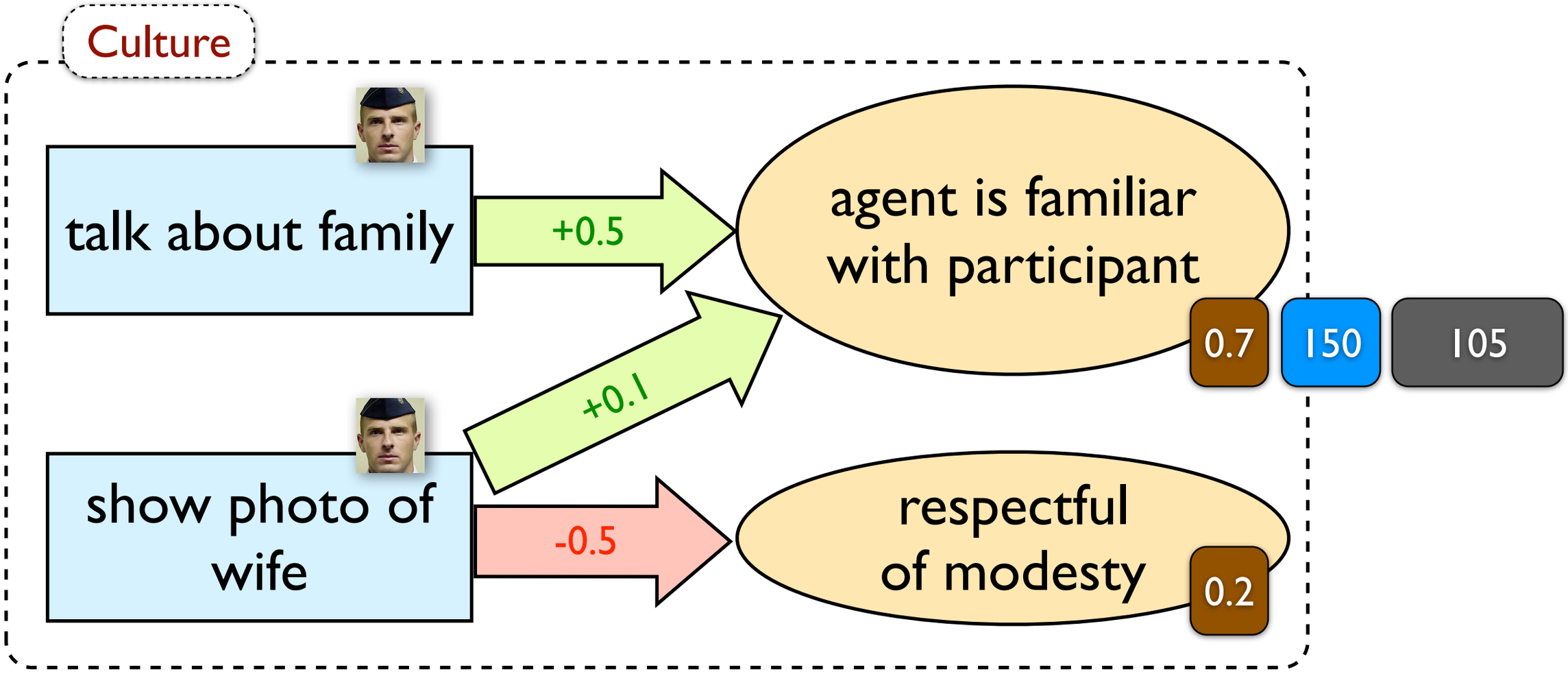


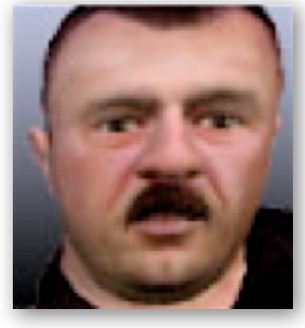
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty

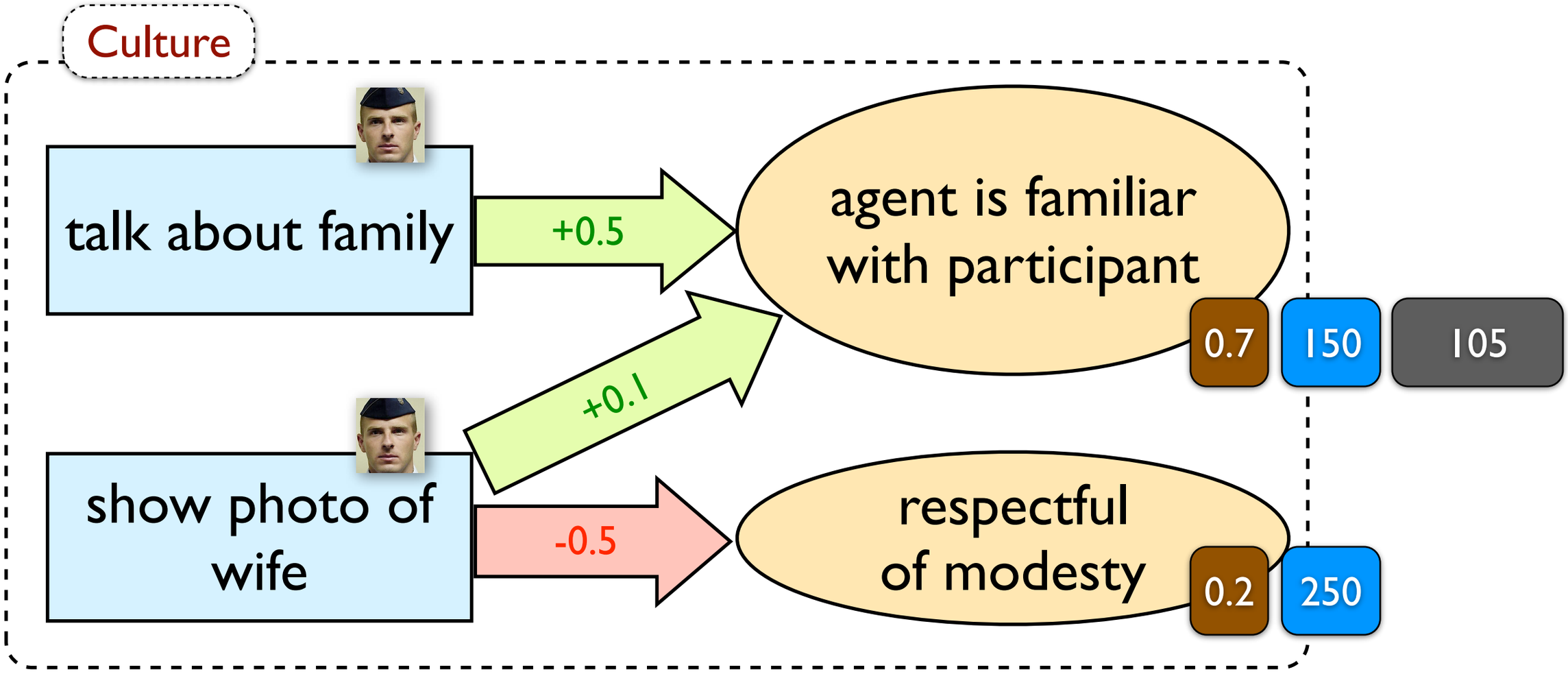


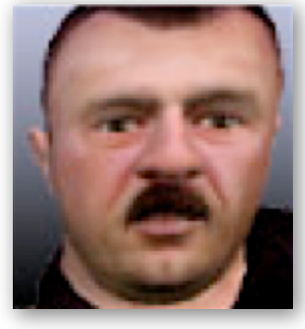
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
0.2

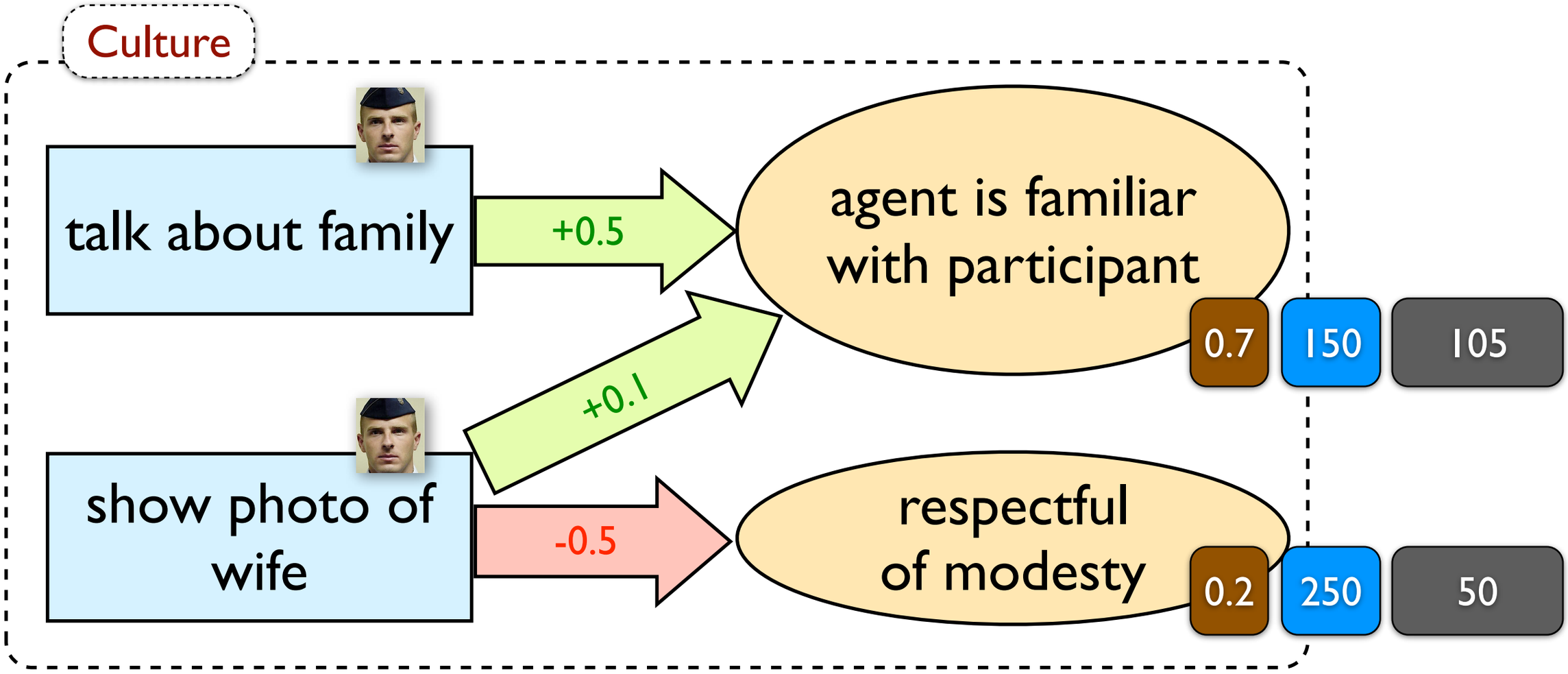


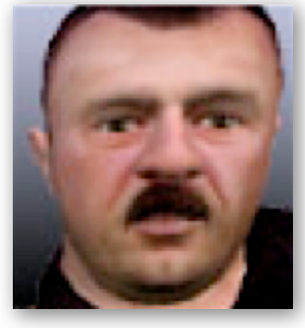
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
0.2
250

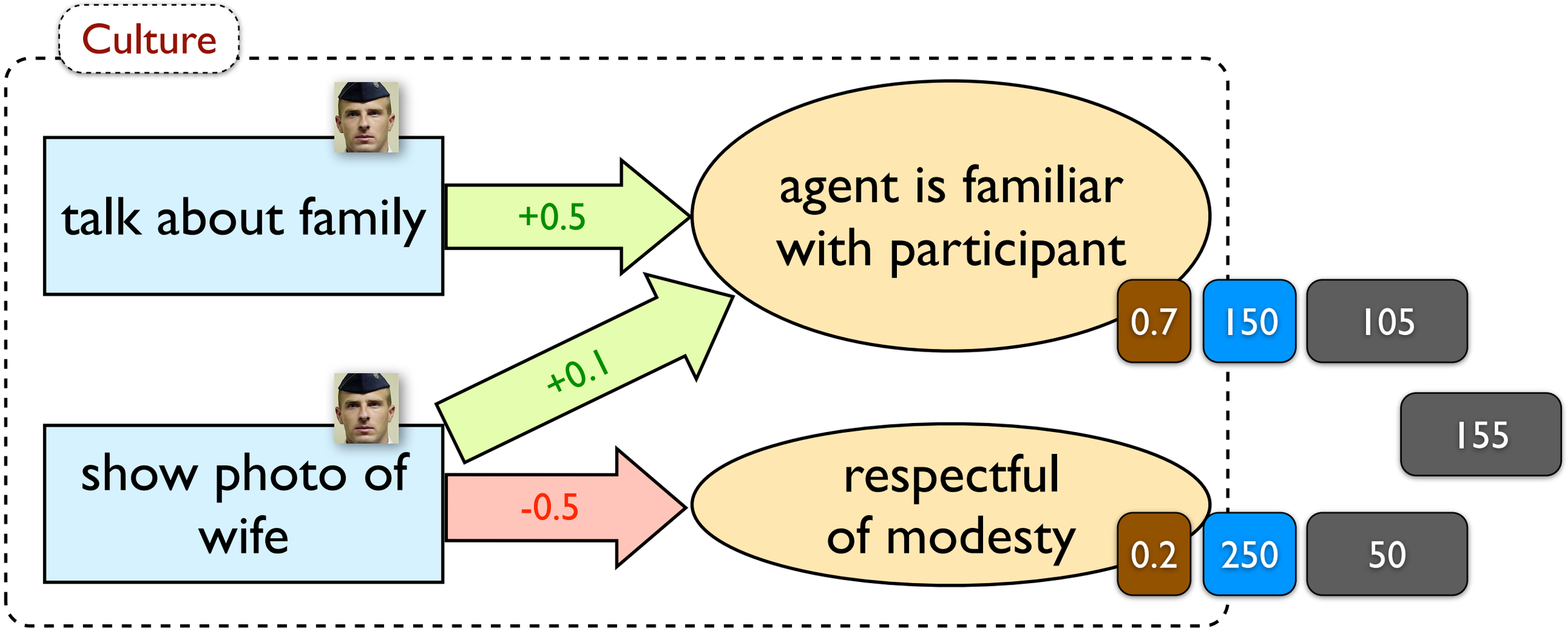


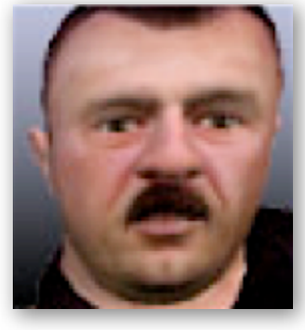
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
0.2
250
50

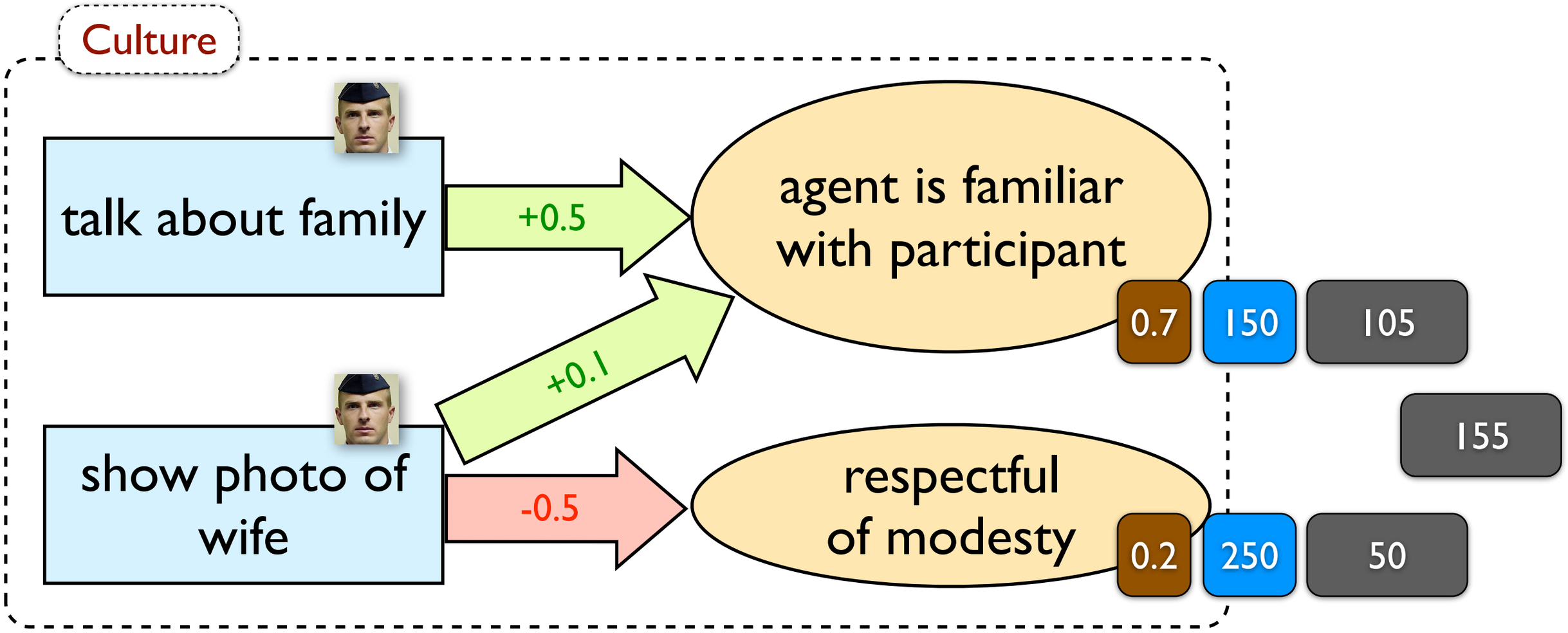


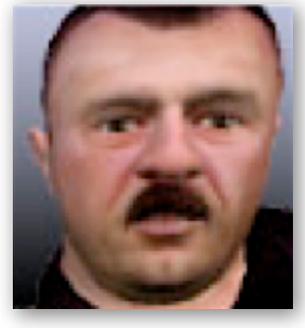
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
155
0.2
250
50

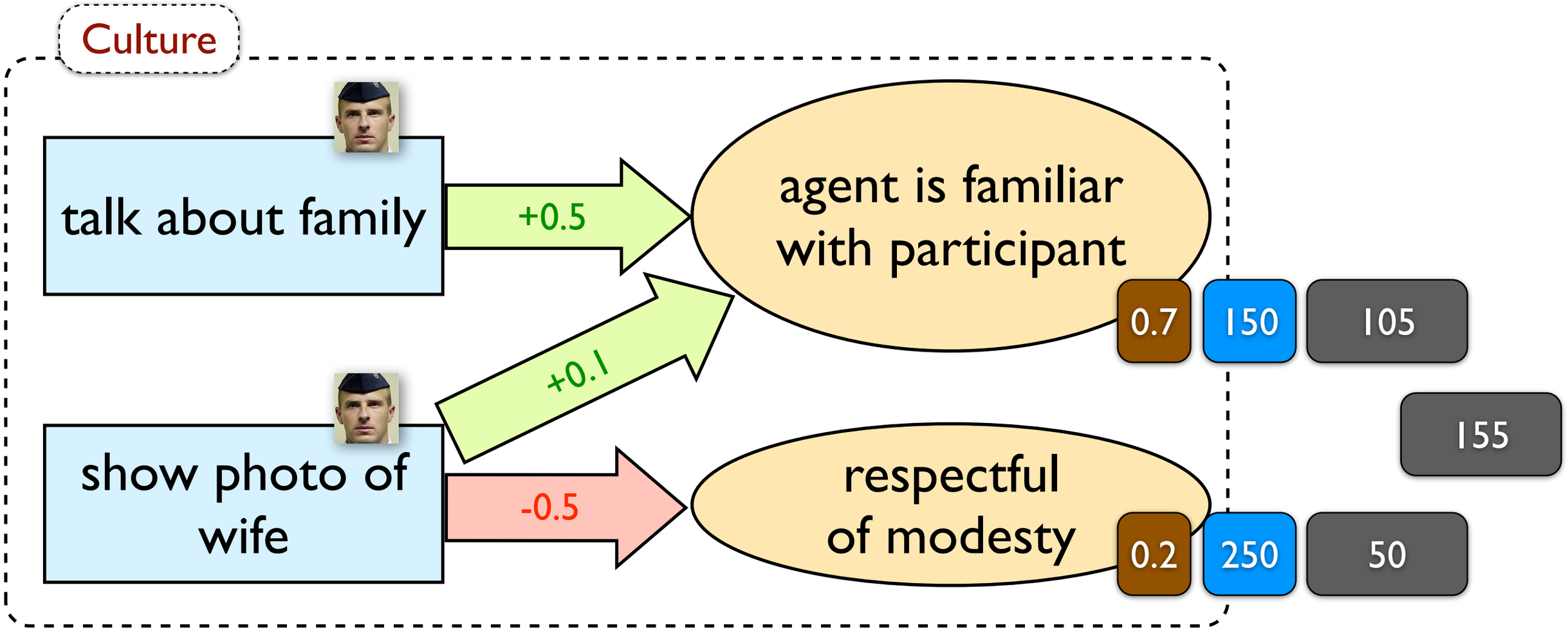


CAB: Example

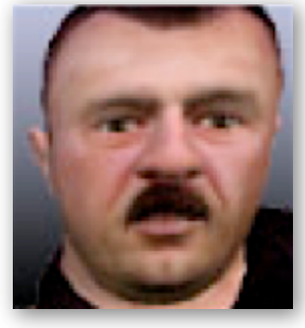

Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
155
0.2
250
50



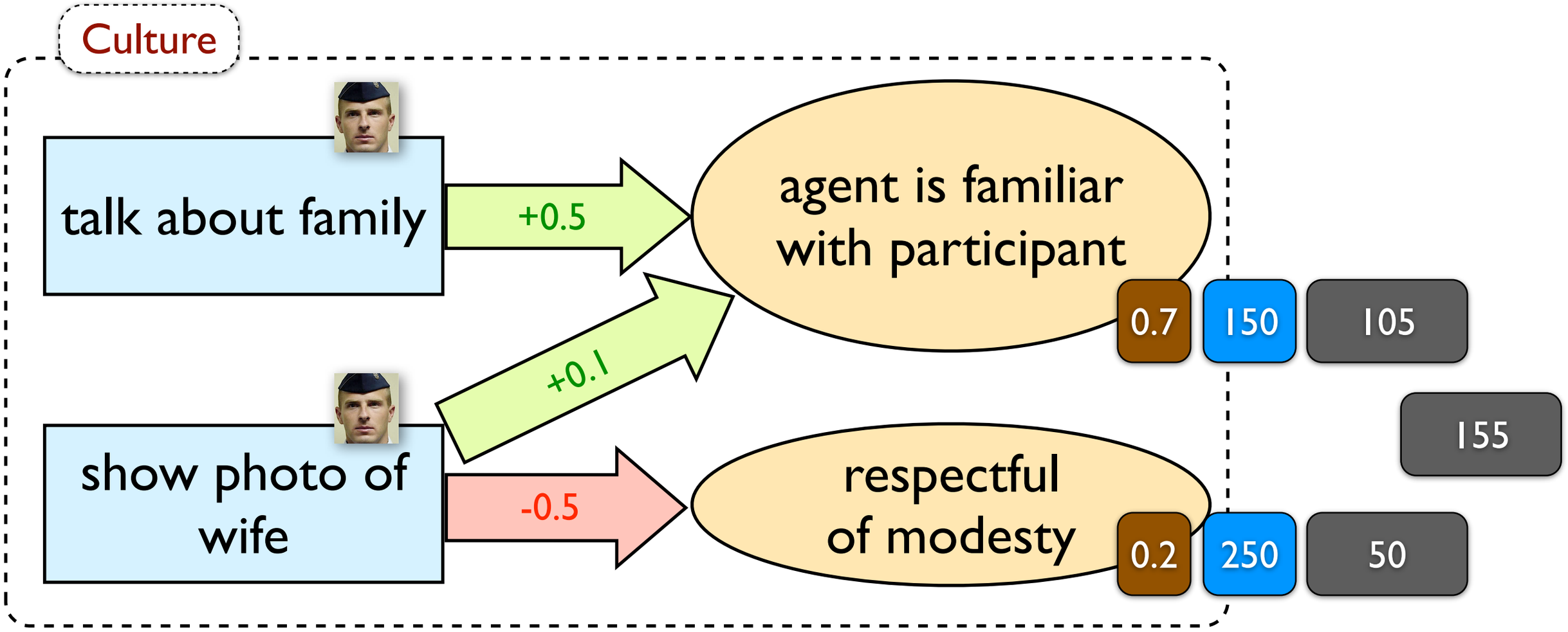
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
155
0.2
250
50

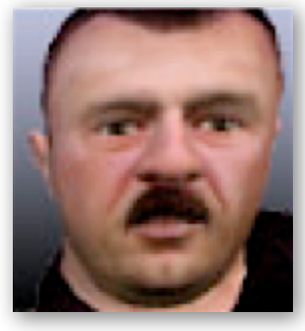

-150



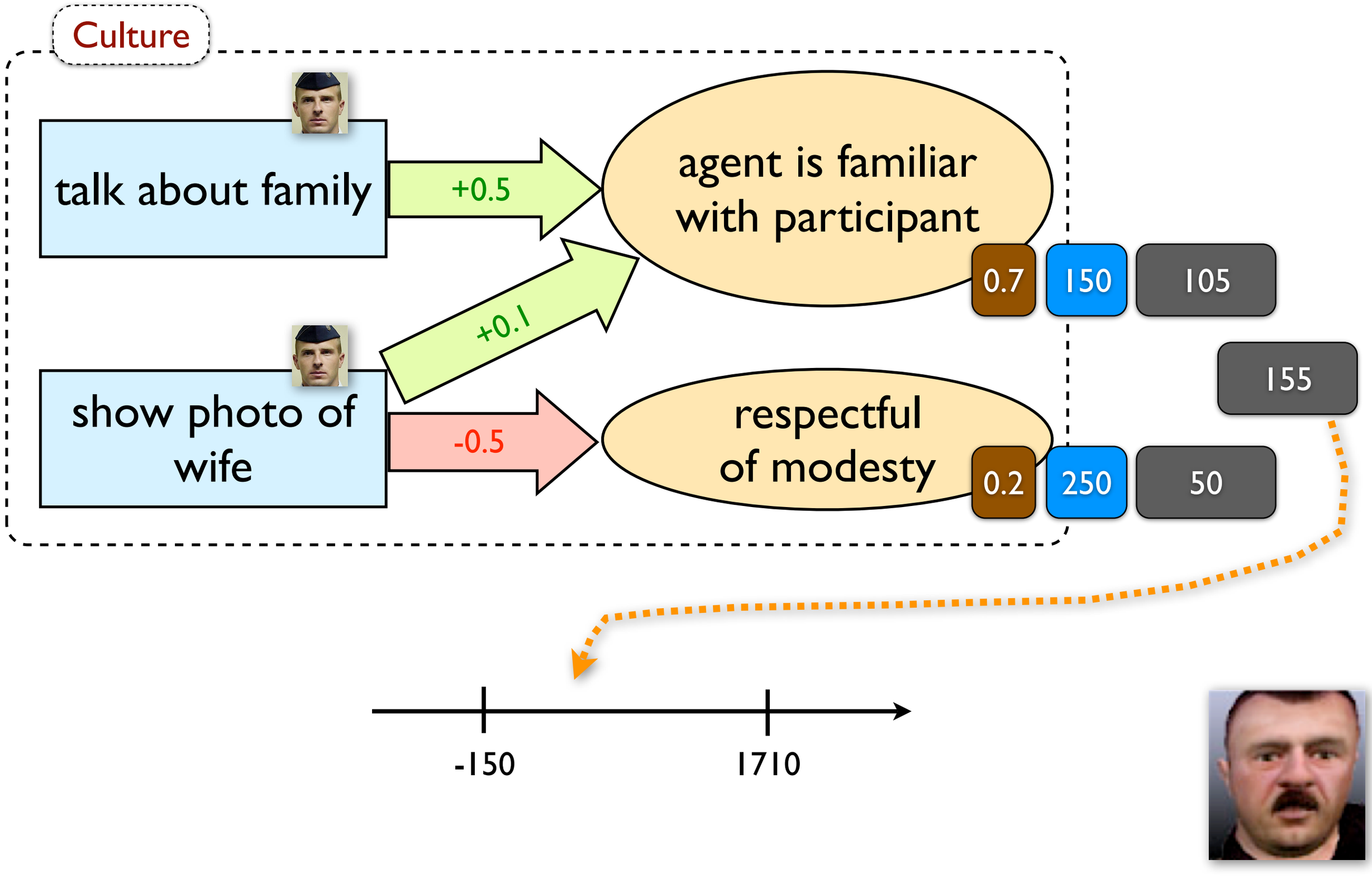
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
155
0.2
250
50

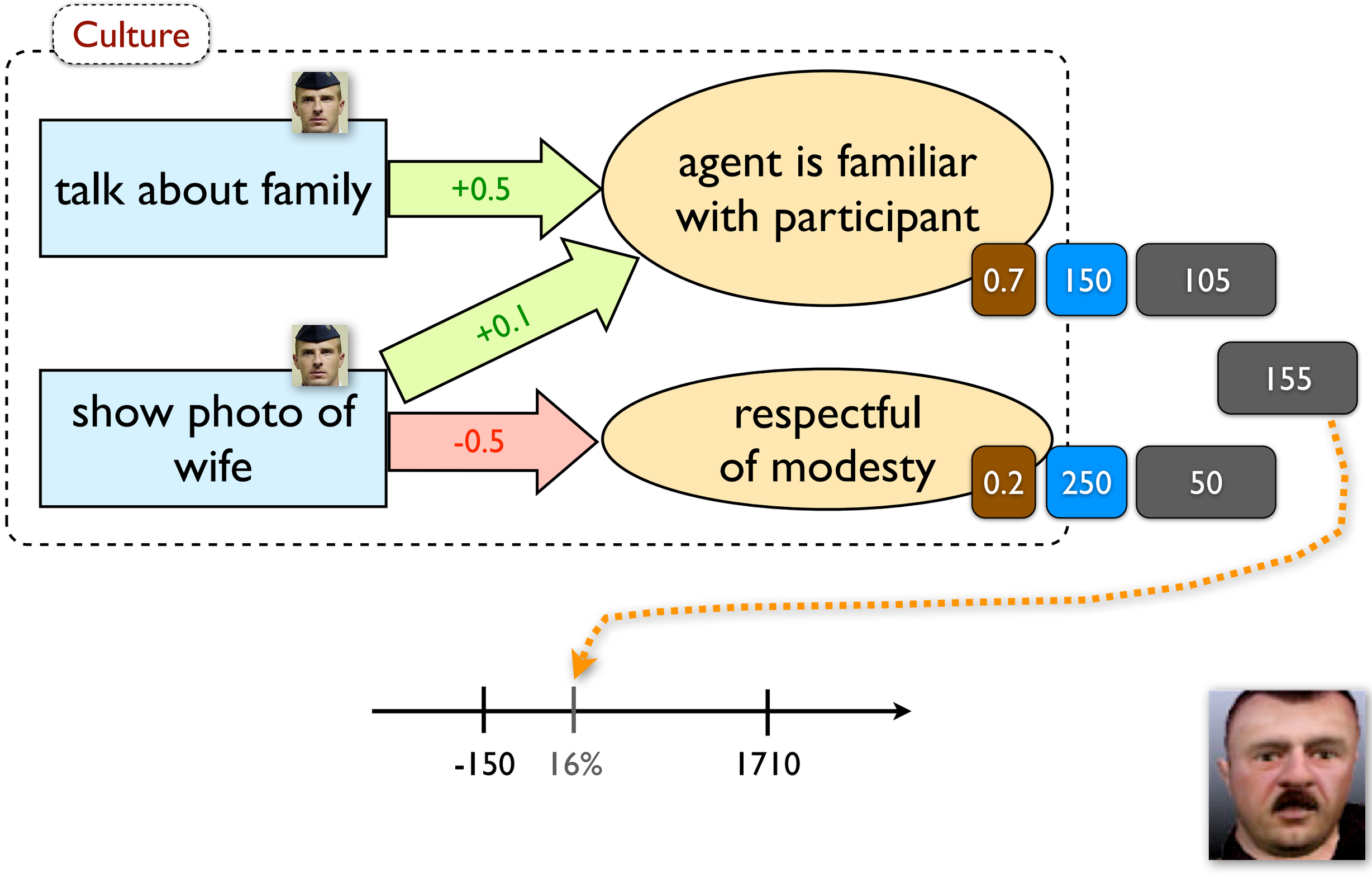

-150
1710



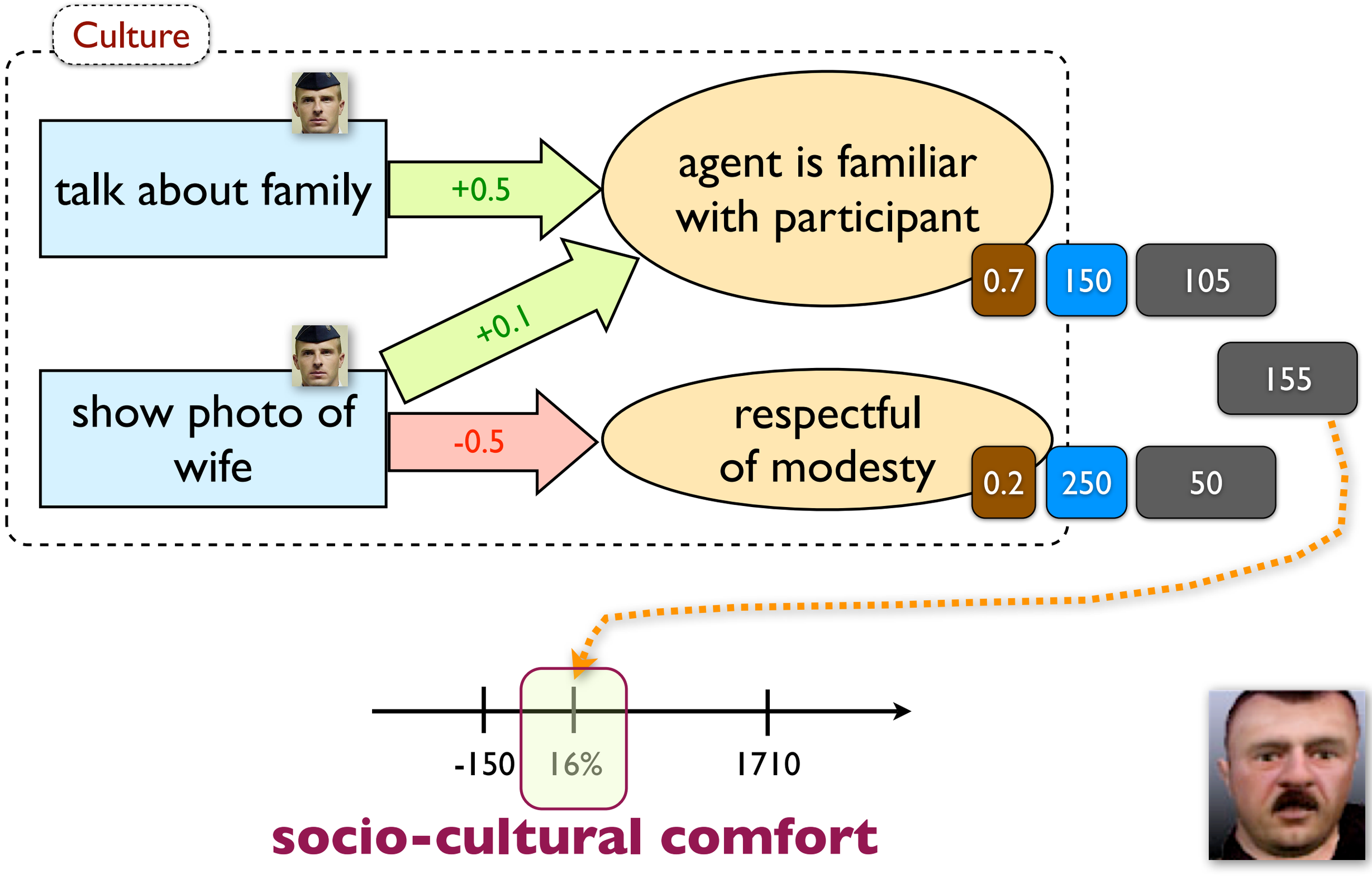
CAB: Example


Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
155
0.2
250
50
-150
1710

CAB: Example

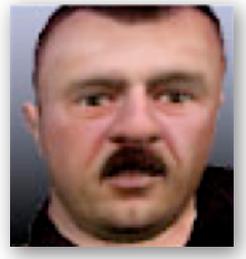

Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
155
0.2
250
50
-150
16%
1710

CAB: Example

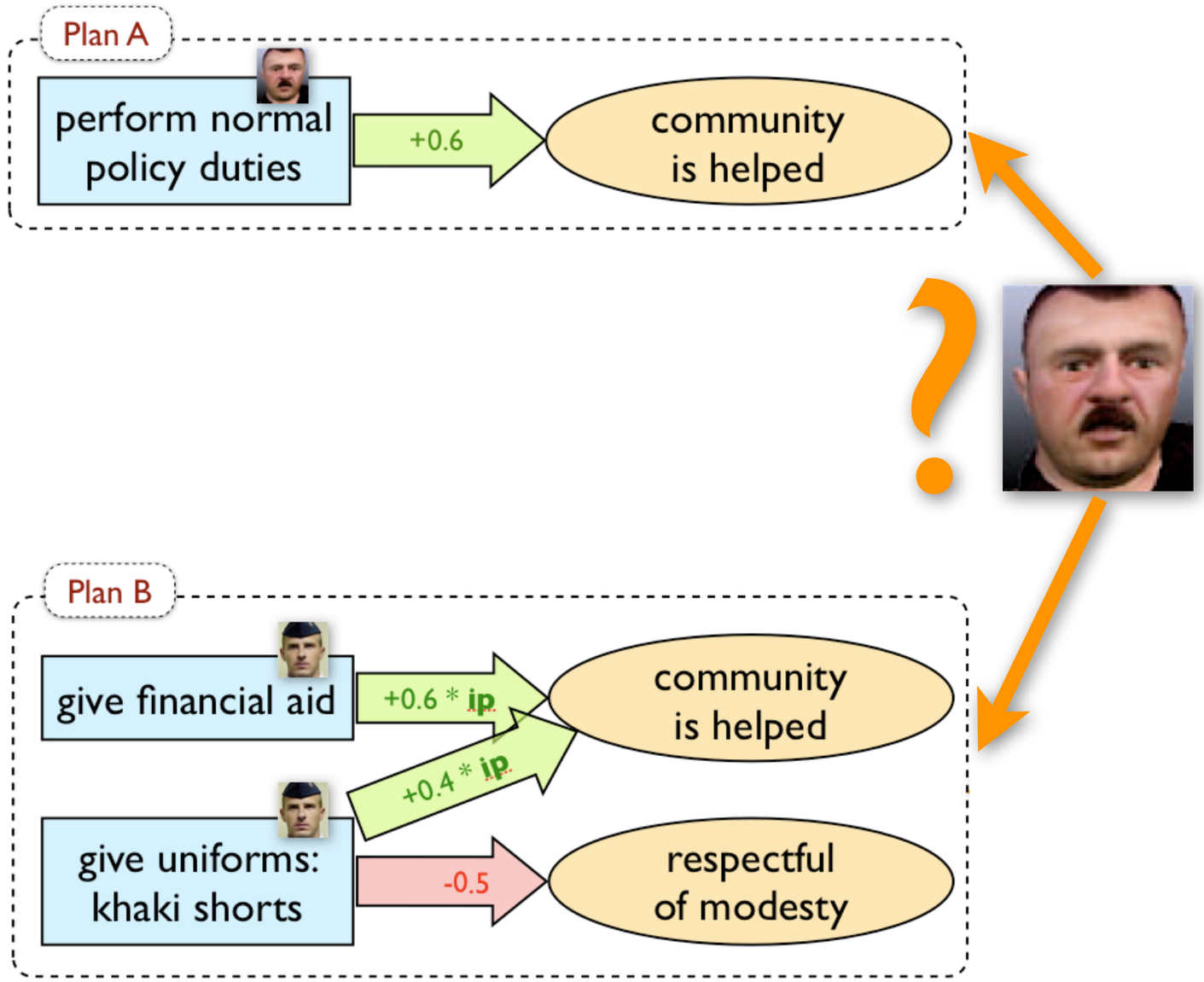

Culture
talk about family
+0.5
agent is familiar with participant
0.7
150
105
+0.1
show photo of wife
-0.5
respectful of modesty
155
0.2
250
50
-150
16%
1710
socio-cultural comfort

CAB: Summary

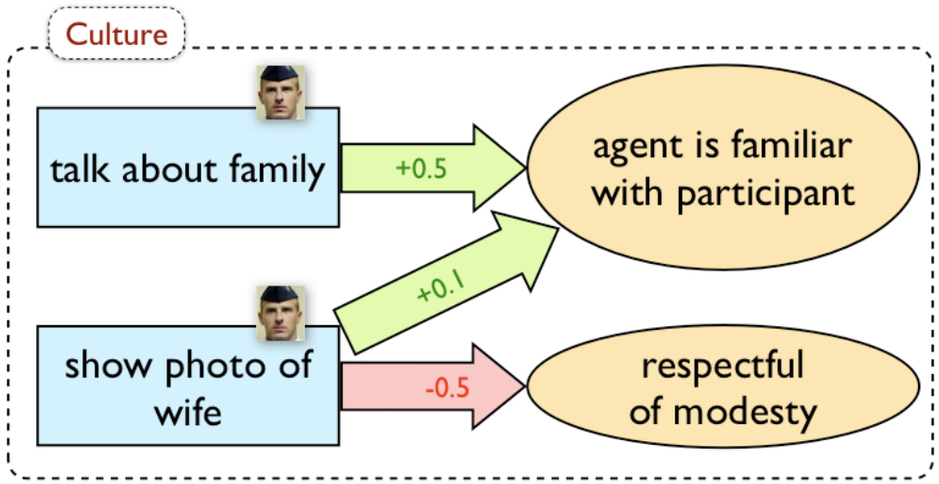
CAB: Summary

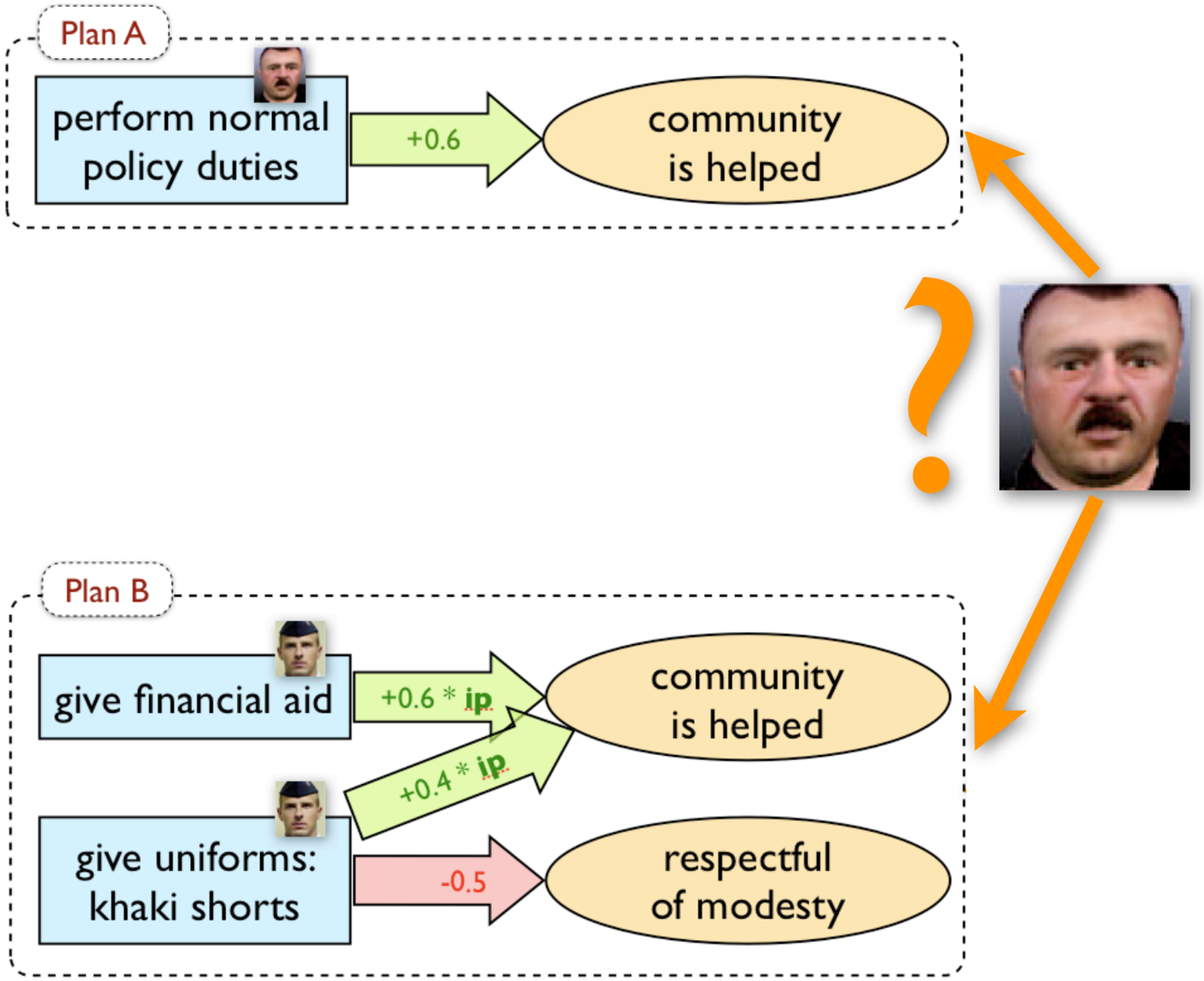


CAB: Summary

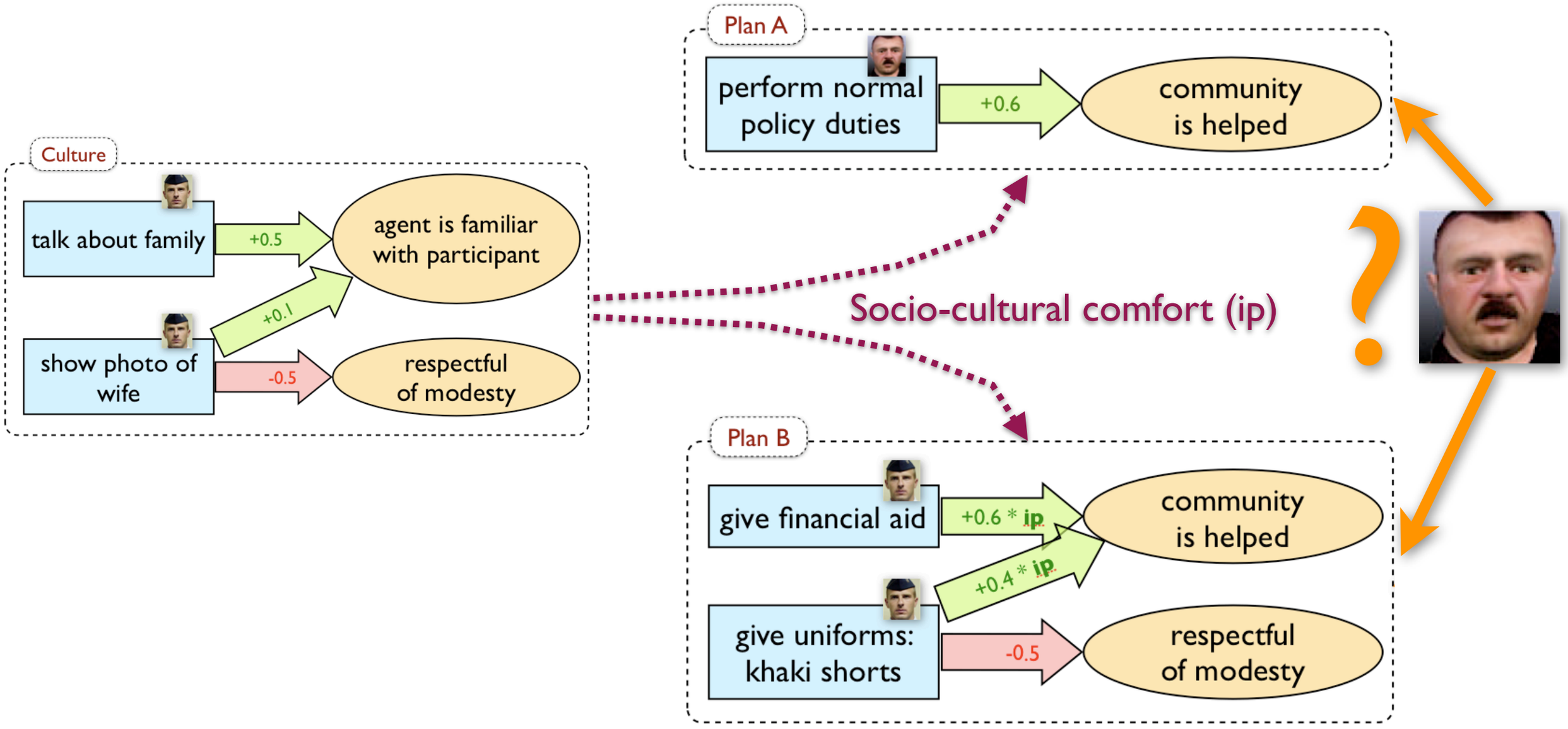

Plan A
perform normal policy duties
+0.6
community is helped
Plan B
give financial aid
+0.6 * ip
community is helped
+0.4 * ip
give uniforms: khaki shorts
-0.5
respectful of modesty

CAB: Summary


Culture
talk about family
+0.5
agent is familiar with participant
+0.1
show photo of wife
-0.5
respectful of modesty


Plan A
perform normal policy duties
+0.6
community is helped
Plan B
give financial aid
+0.6 * ip
community is helped
+0.4 * ip
give uniforms: khaki shorts
-0.5
respectful of modesty

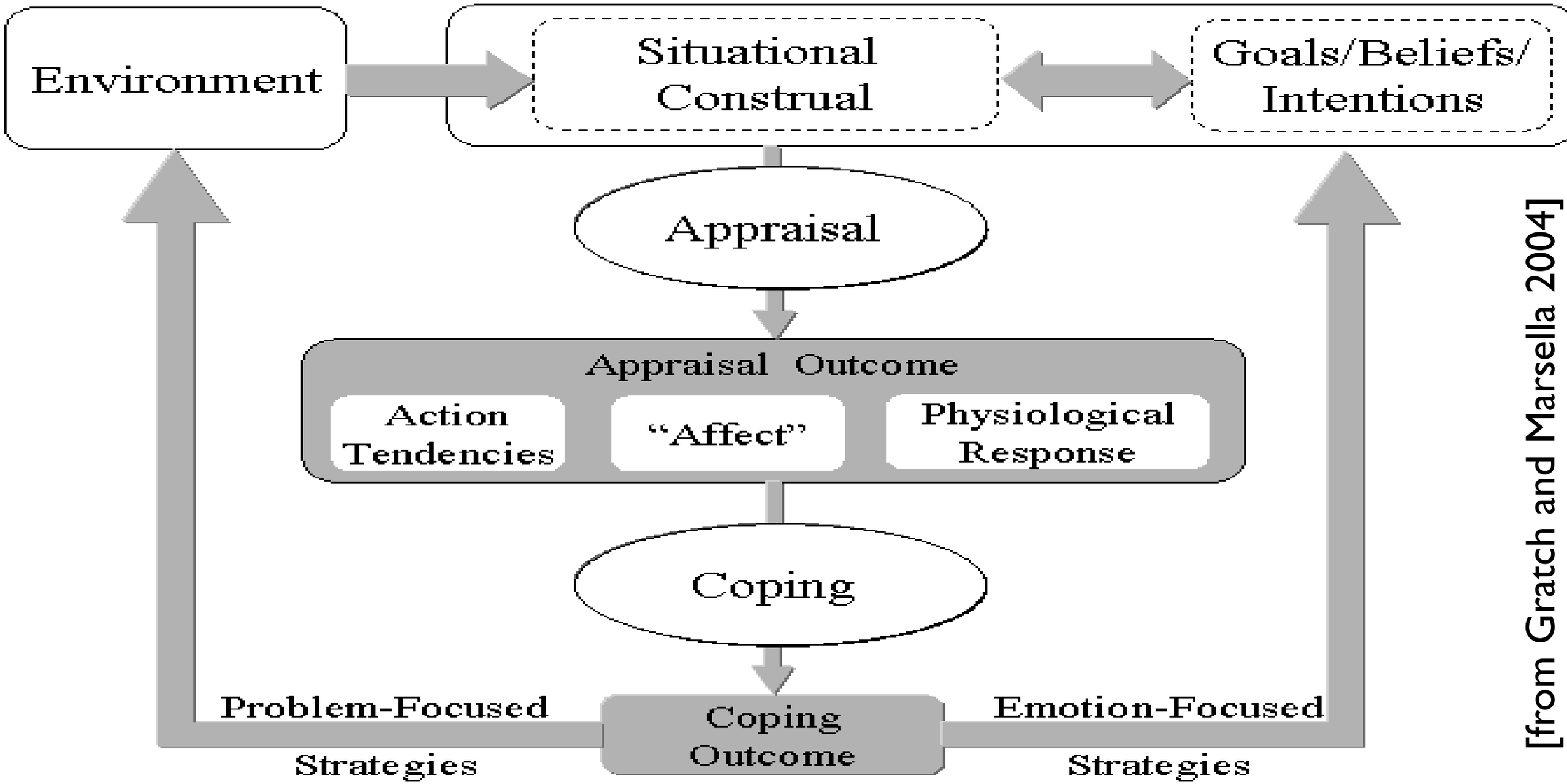
CAB: Summary


Plan A
perform normal policy duties
+0.6
community is helped
Culture
talk about family
+0.5
agent is familiar with participant
+0.1
show photo of wife
-0.5
respectful of modesty
Socio-cultural comfort (ip)
Plan B
give financial aid
+0.6 * ip
community is helped
+0.4 * ip
give uniforms: khaki shorts
-0.5
respectful of modesty

Outline

- Bilateral negotiations (BiLAT)
- Culturally Affected Behavior (CAB)
- EMotion and Adaptation (EMA)
- CEMA = CAB + EMA
- Future work

Psychological Underpinnings



[from Gratch and Marsella 2004]

Figure 1: The cognitive-motivational-emotive system. Adapted from Smith and Lazarus' (1990)

Appraisals

Table 1: Appraisal Variables		
Relevance		Does the event require attention or adaptive reaction
Desirability		Does the event facilitate or thwart what the person wants
Causal attribution	Agency	What causal agent was responsible for an event
	Blame and Credit	Does the causal agent deserve blame or credit
Likelihood		How likely was the event; how likely is an outcome
Unexpectedness		Was the event predicted from past knowledge
Urgency		Will delaying a response make matters worse
Ego Involvement		To what extent does the event impact a person's sense of self (social esteem, moral values, cherished beliefs, etc.)
Coping potential	Controllability	The extent to which an event can be influenced
	Changeability	The extent to which an event will change of its own accord
	Power	The power of a particular agent to directly or indirectly control an event
	Adaptability	Can the person live with the consequences of the event

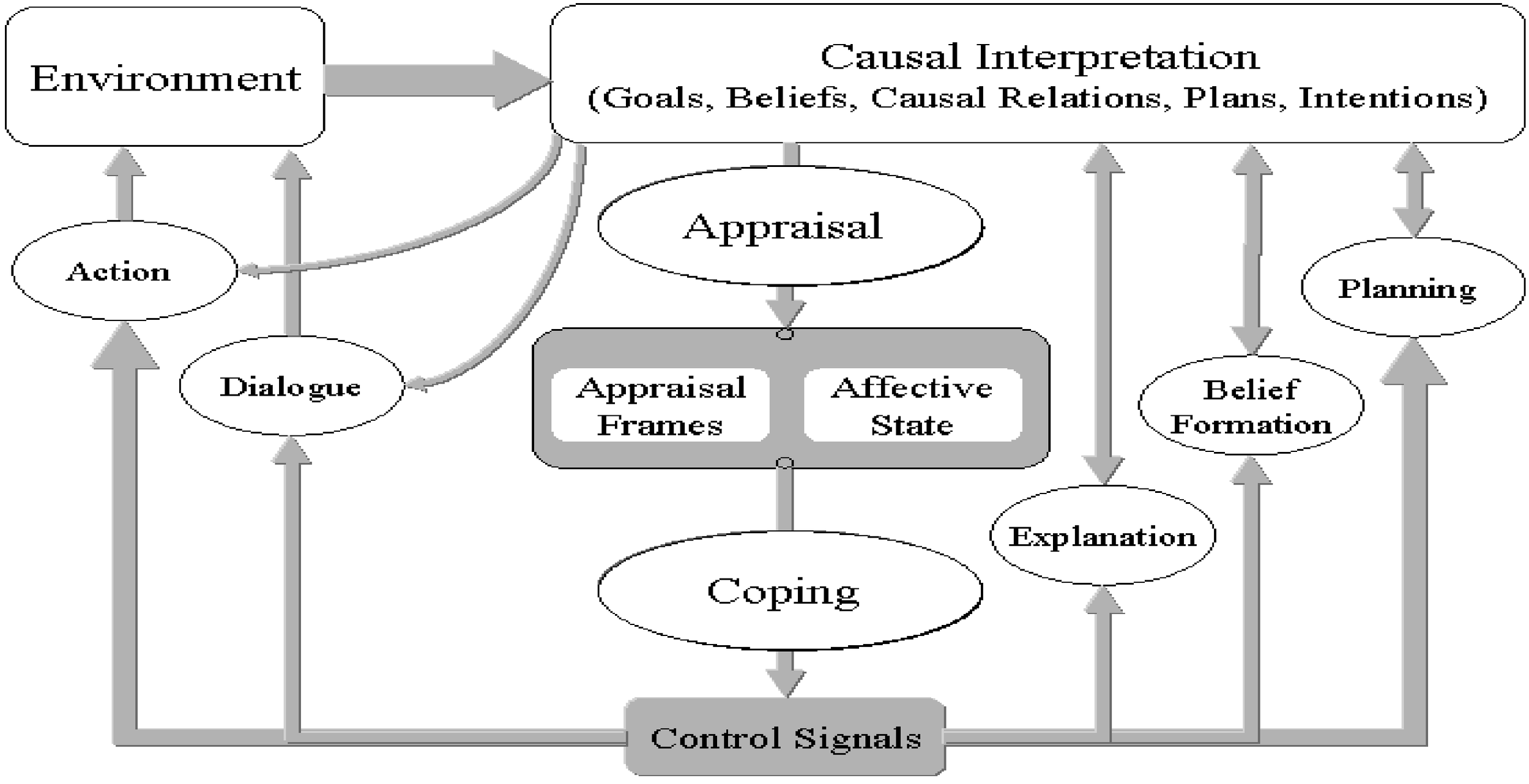
[from Gratch and Marsella 2004]

Emotions

Table 3: Emotion categorization and intensity rules		
Appraisal Configuration	**Emotion**	**Intensity**
Desirability(p) > 0, Likelihood(p) < 1.0	Hope	Desirability(p)×Likelihood(p)
Desirability(p) > 0, Likelihood(p) = 1.0	Joy	Desirability(p)×Likelihood(p)
Desirability(p) < 0, Likelihood(p) < 1.0	Fear	|Desirability(p)×Likelihood(p)|
Desirability(p) < 0, Likelihood(p) = 1.0	Distress	|Desirability(p)×Likelihood(p)|
Desirability(p) < 0, causal attribution(q)=blameworthy	Anger	|Desirability(p)×Likelihood(p)|
Desirability(q ≠ p) < 0, causal attribution(p)=blameworthy, causal agent = p	Guilt	|Desirability(q)×Likelihood(p)|

[from Gratch and Marsella 2004]

EMotion & Adaptation



[from Gratch and Marsella 2004]

"Macro-EMA"

- In the following, we are not covering
  - mood
  - some emotions
  - causal attributions
  - coping

EMA in Virtual Humans

- Agent is selecting among alternative courses of action (i.e., plans)
- The plan with the highest utility wins
- Utility of a plan is cumulative weighted utility of emotions elicited by appraisals of the plan

EMA: Example

Plan A

perform normal police duties

+0.6

community is helped

Plan B

give financial aid

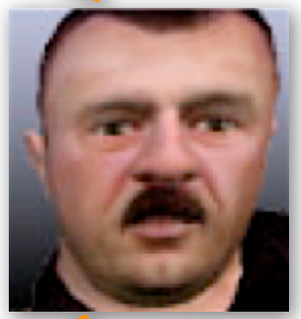
+0.6

community is helped

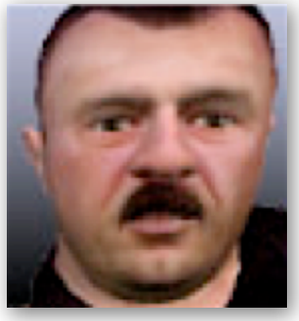
demand clear market

+0.2

agent is threatened



EMA: Example



Plan A

perform normal police duties

+0.6

community is helped

Plan B

give financial aid

+0.6

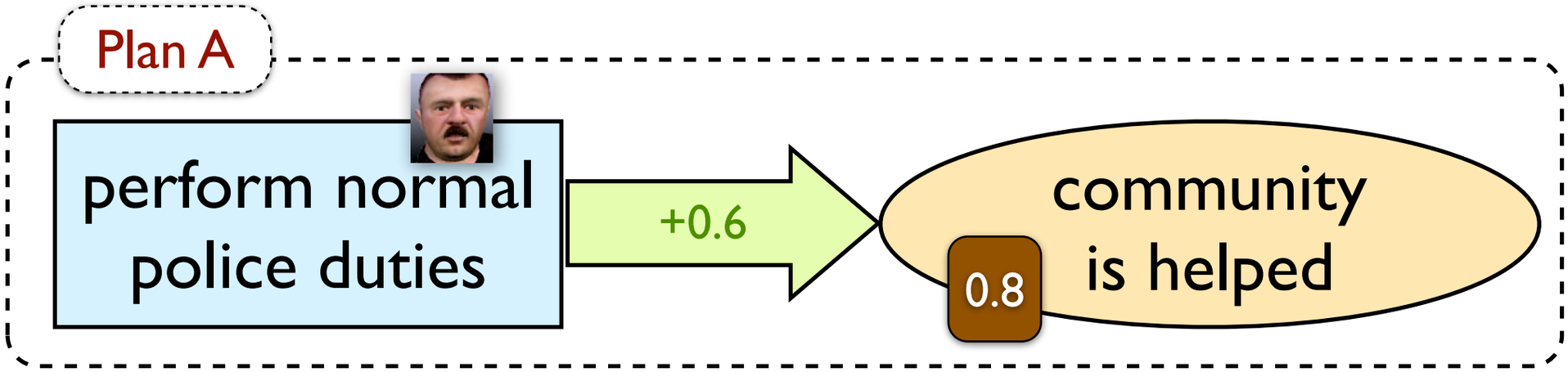
community is helped

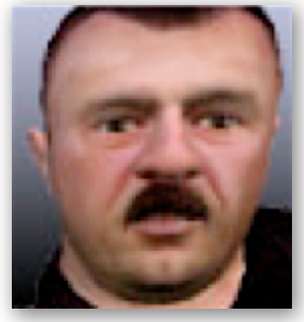
demand clear market

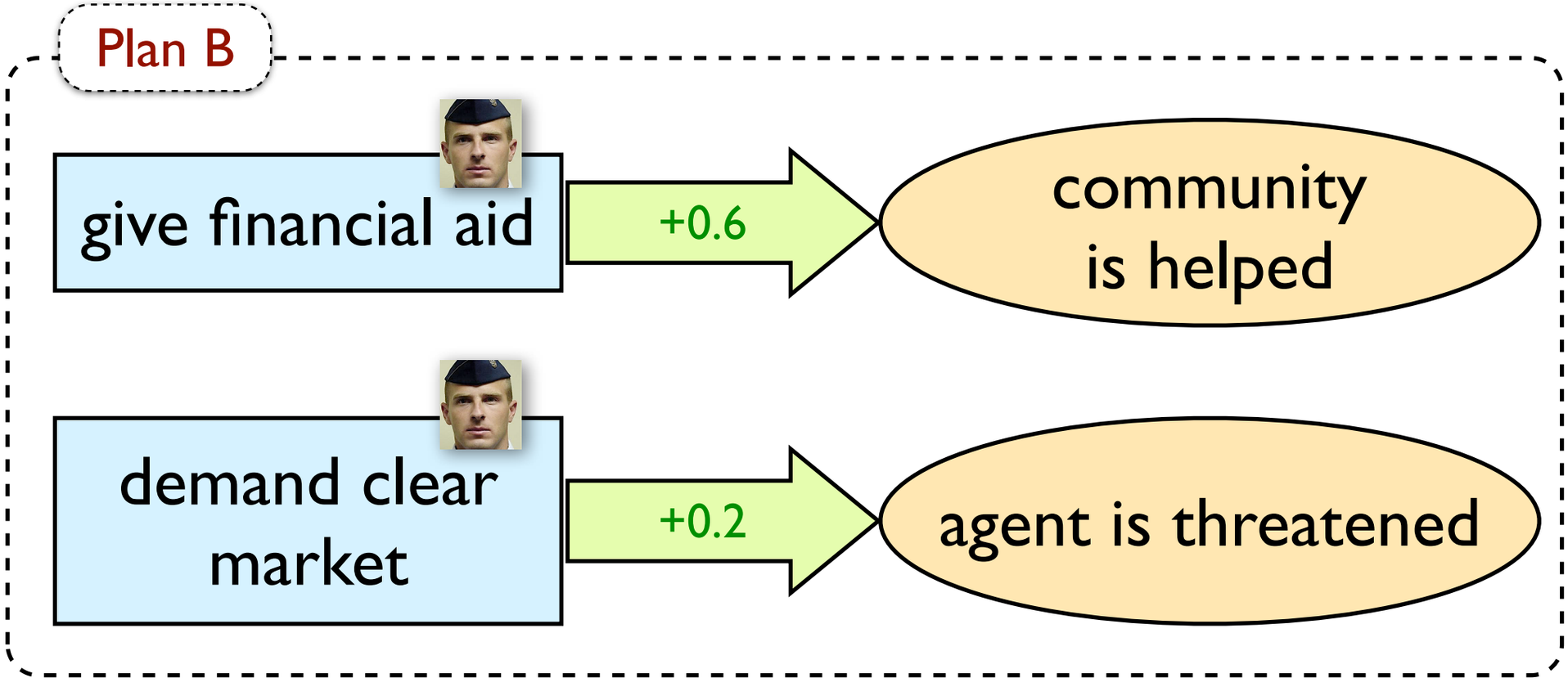
+0.2

agent is threatened

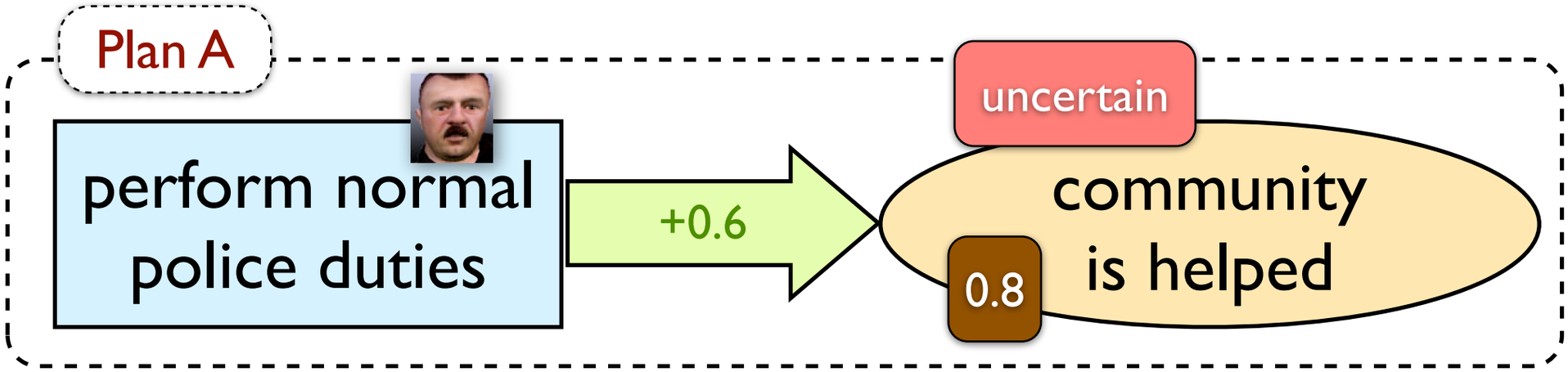
EMA: Example

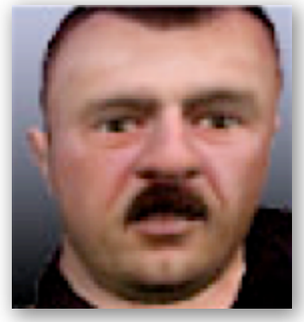

Plan A
perform normal police duties
+0.6
community is helped
0.8

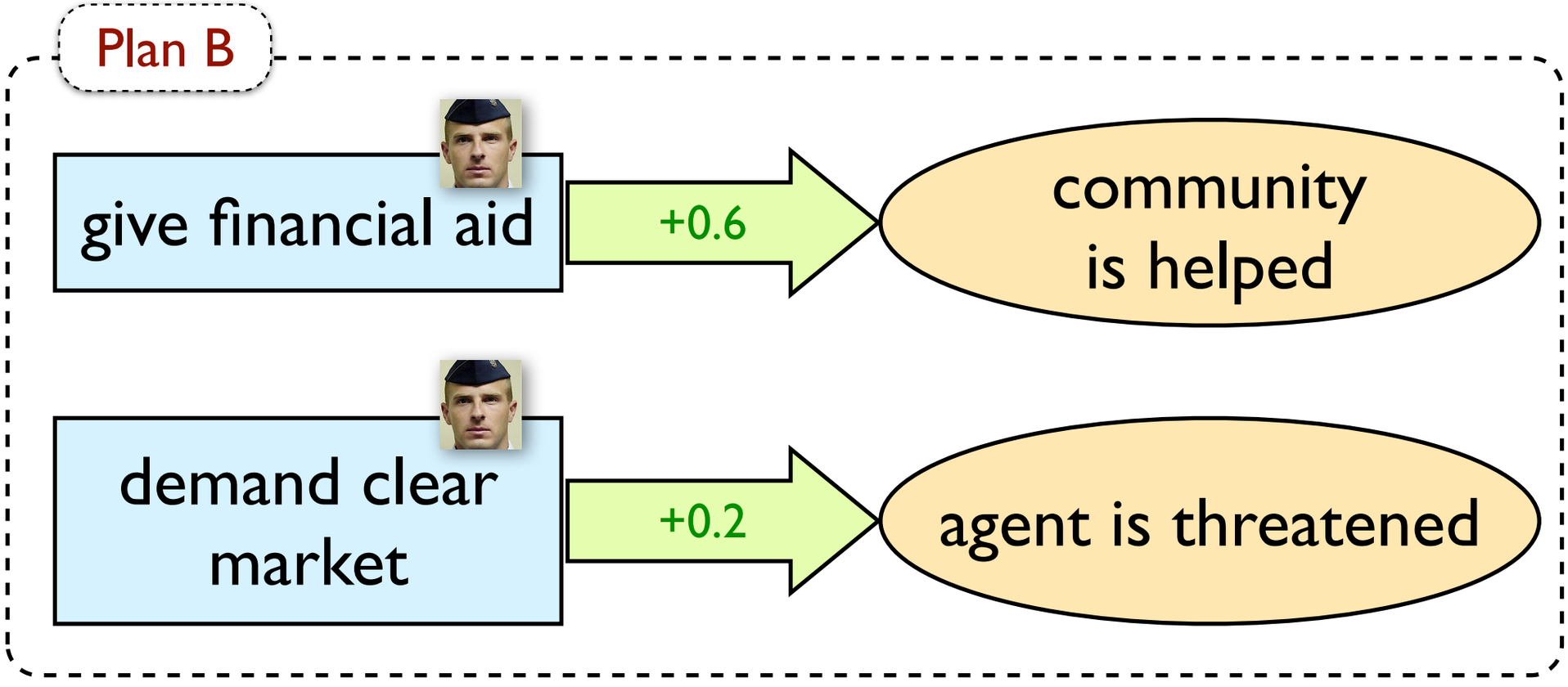



Plan B
give financial aid
+0.6
community is helped
demand clear market
+0.2
agent is threatened

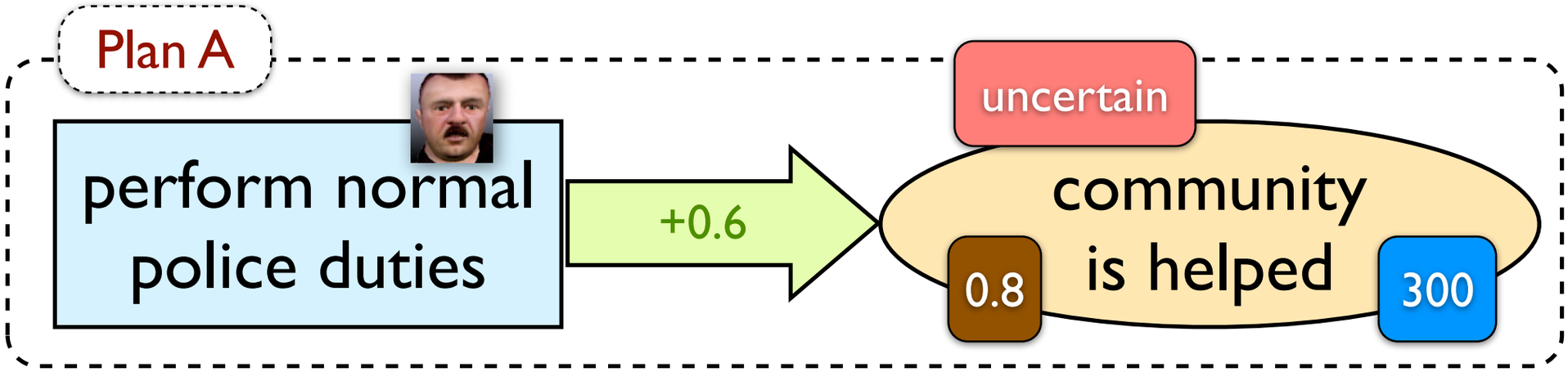
EMA: Example

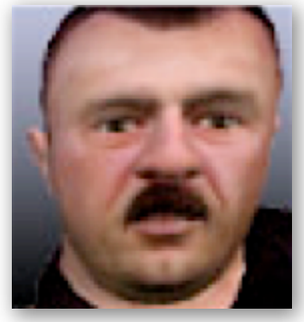

Plan A
perform normal police duties
+0.6
uncertain
community is helped
0.8

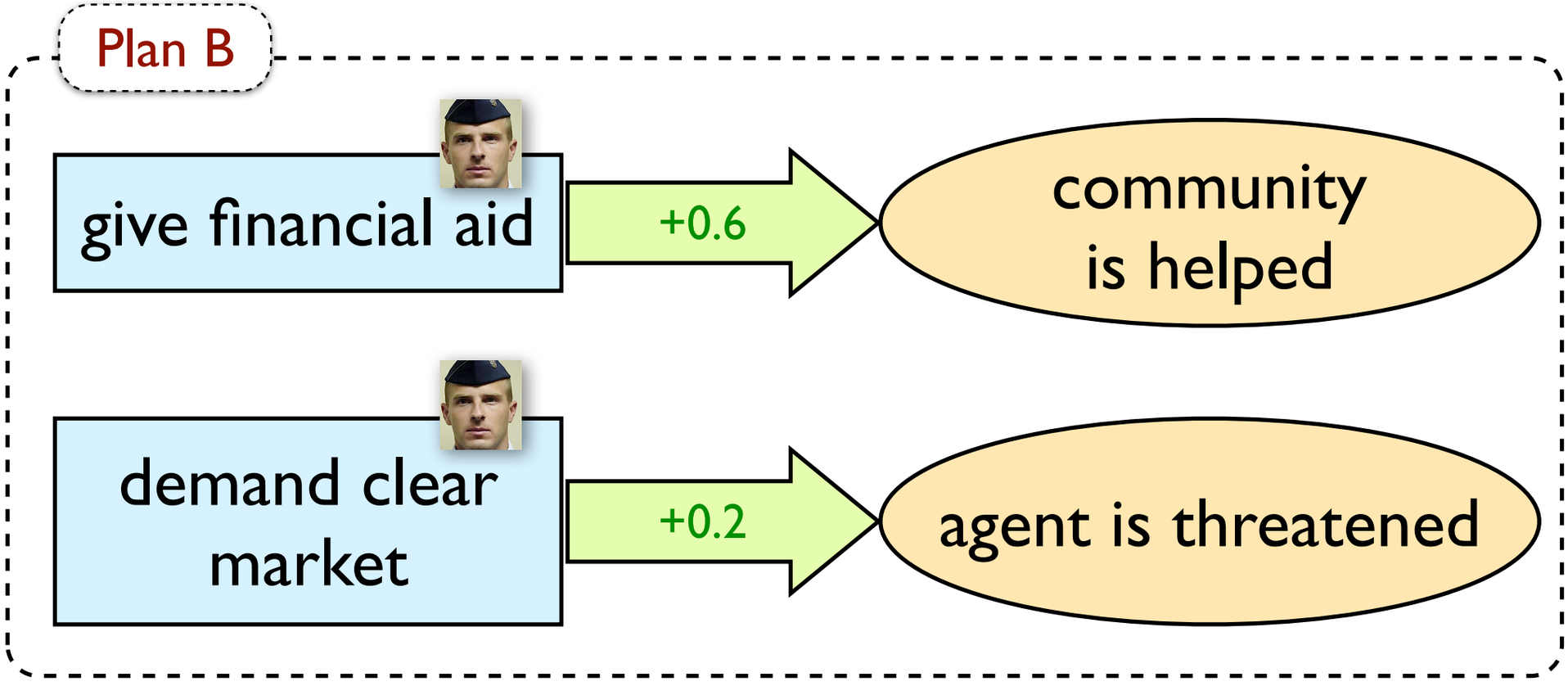



Plan B
give financial aid
+0.6
community is helped
demand clear market
+0.2
agent is threatened

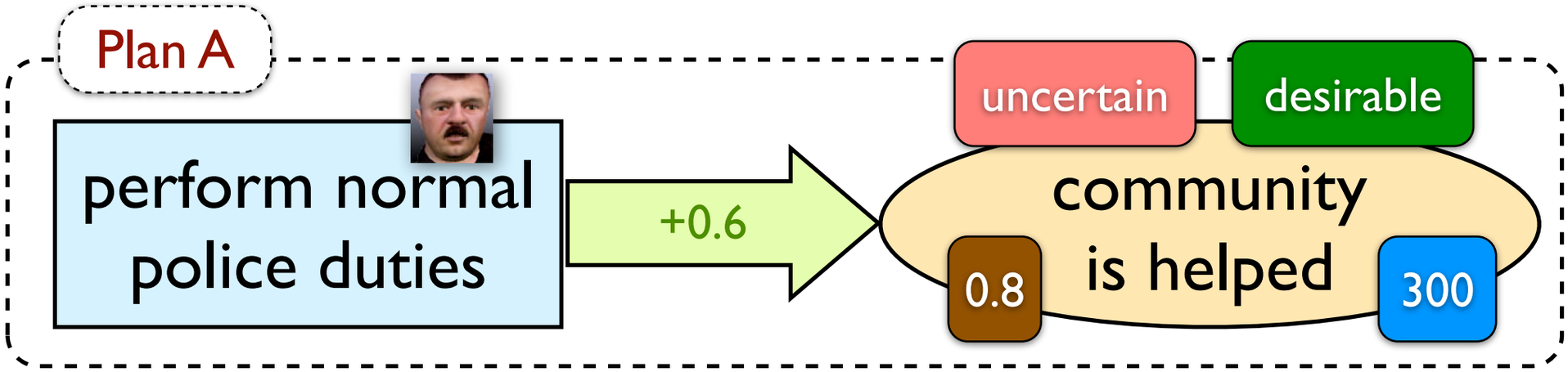
EMA: Example

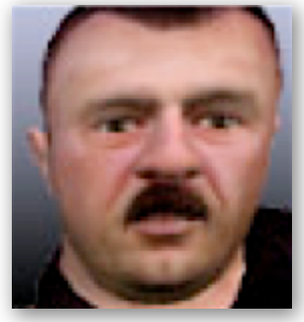

Plan A
perform normal police duties
+0.6
uncertain
community is helped
0.8
300

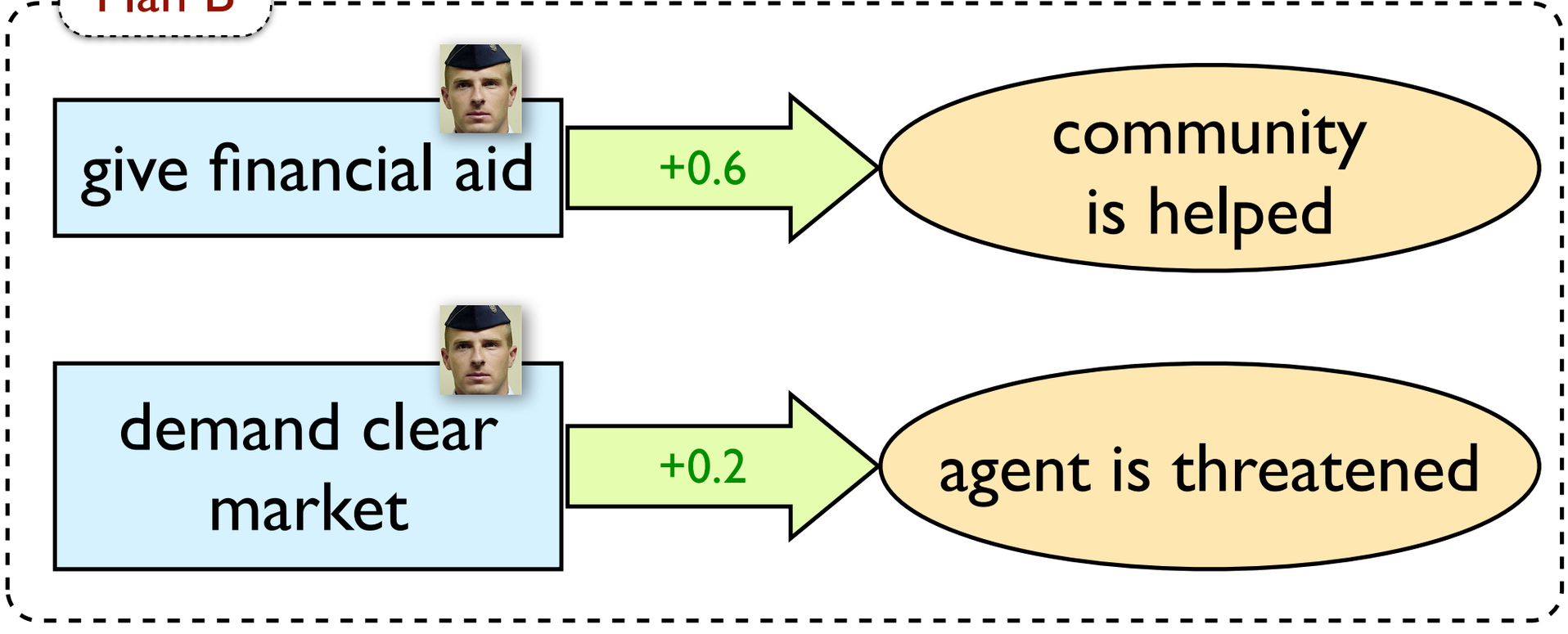



Plan B
give financial aid
+0.6
community is helped
demand clear market
+0.2
agent is threatened

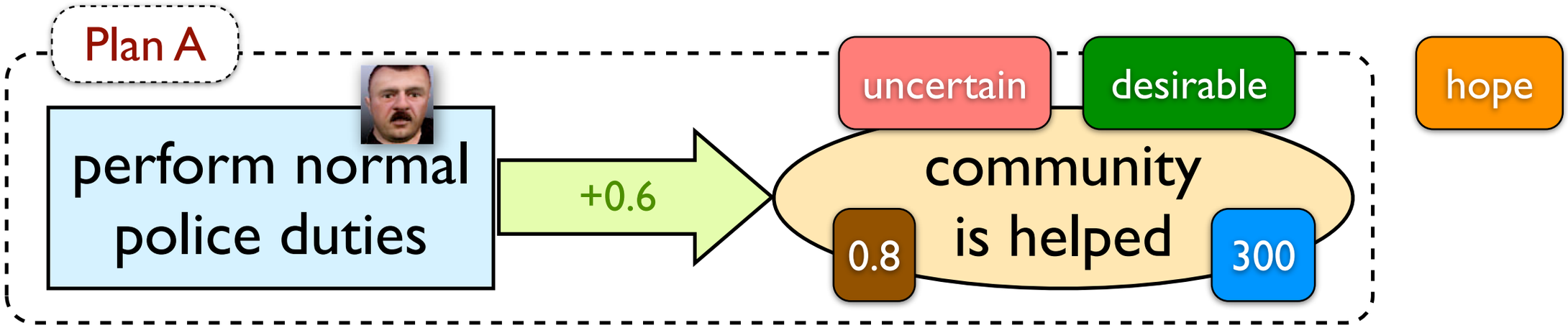
EMA: Example

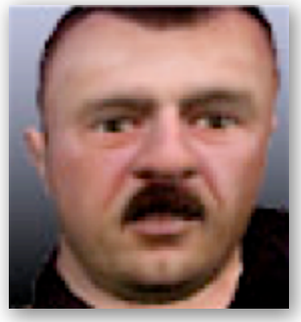

Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300



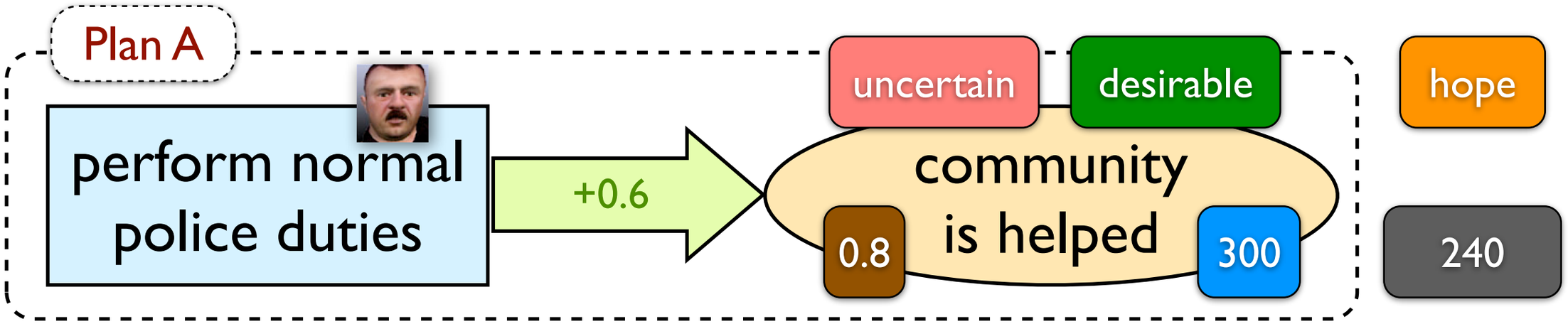

Plan B
give financial aid
+0.6
community is helped
demand clear market
+0.2
agent is threatened

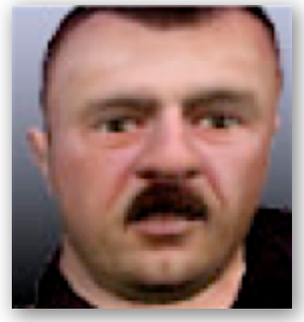
EMA: Example

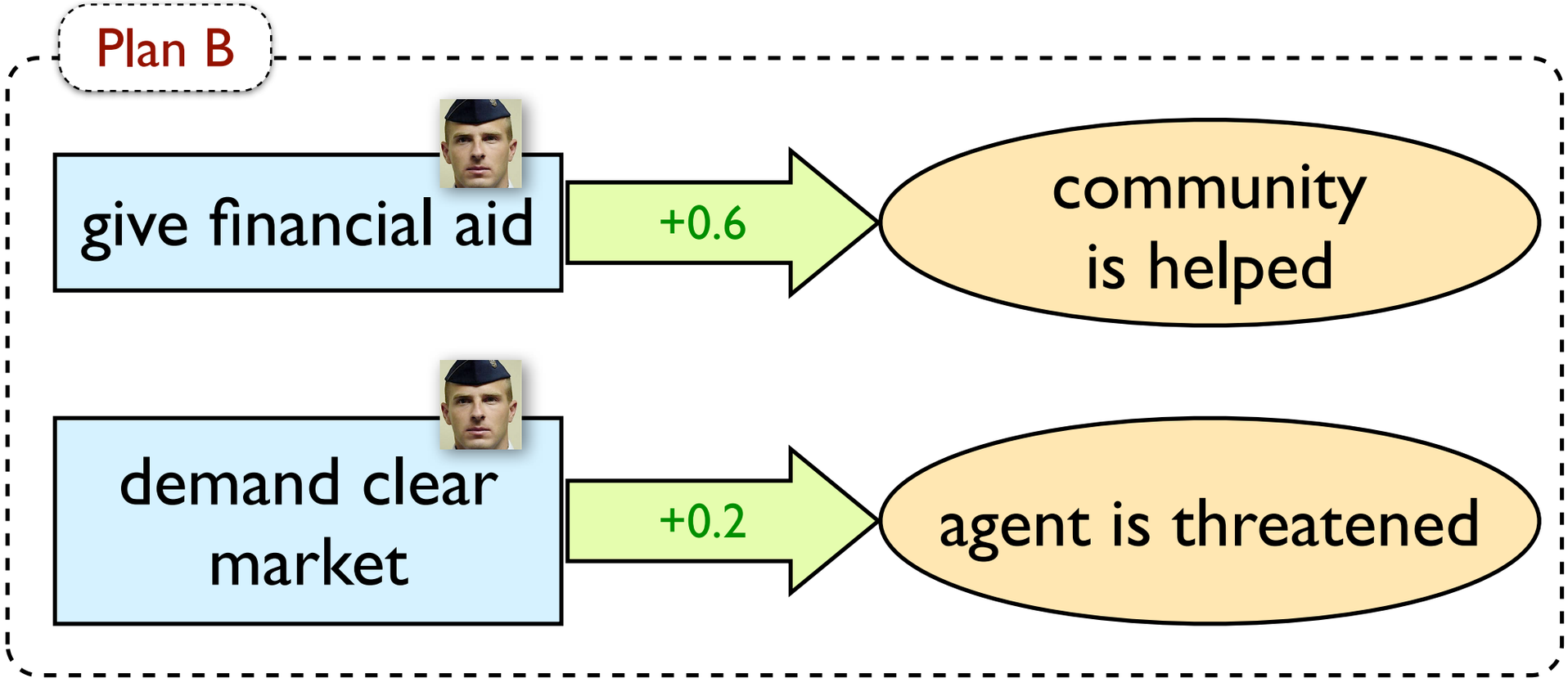

Plan A
perform normal police duties
+0.6
uncertain
desirable
hope
community is helped
0.8
300
Plan B
give financial aid
+0.6
community is helped
demand clear market
+0.2
agent is threatened



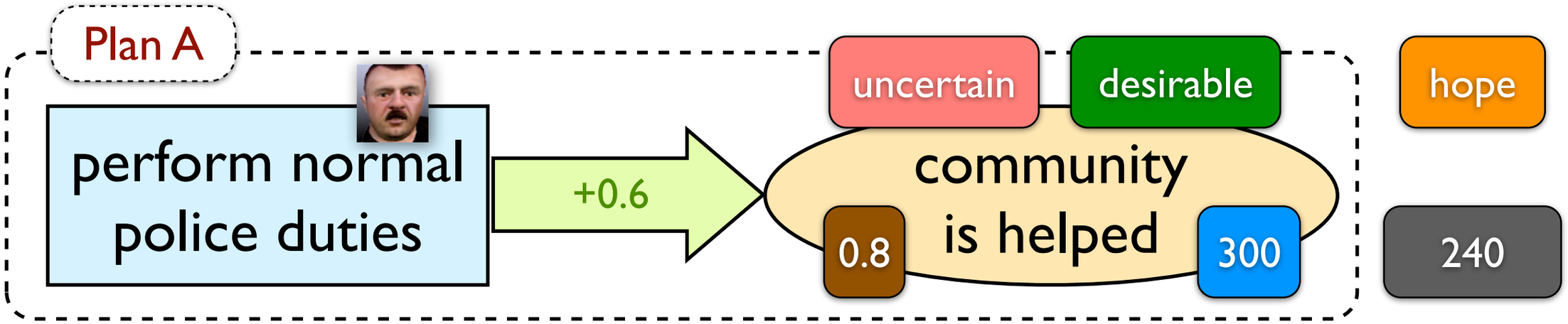
EMA: Example

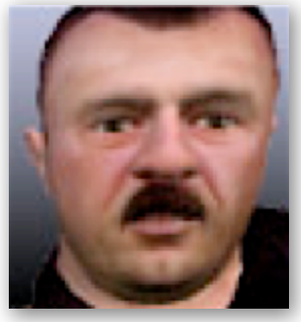

Plan A
perform normal police duties
+0.6
uncertain
desirable
hope
community is helped
0.8
300
240



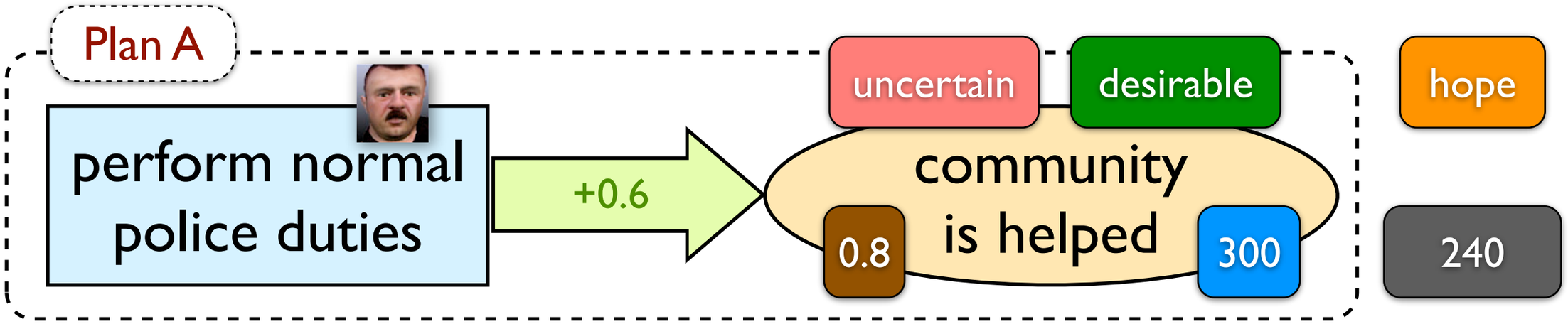

Plan B
give financial aid
+0.6
community is helped
demand clear market
+0.2
agent is threatened

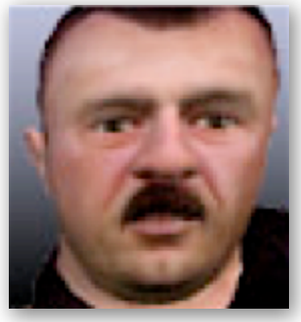
EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
hope
community is helped
0.8
300
240
Plan B
give financial aid
+0.6
community is helped
0.7
demand clear market
+0.2
agent is threatened

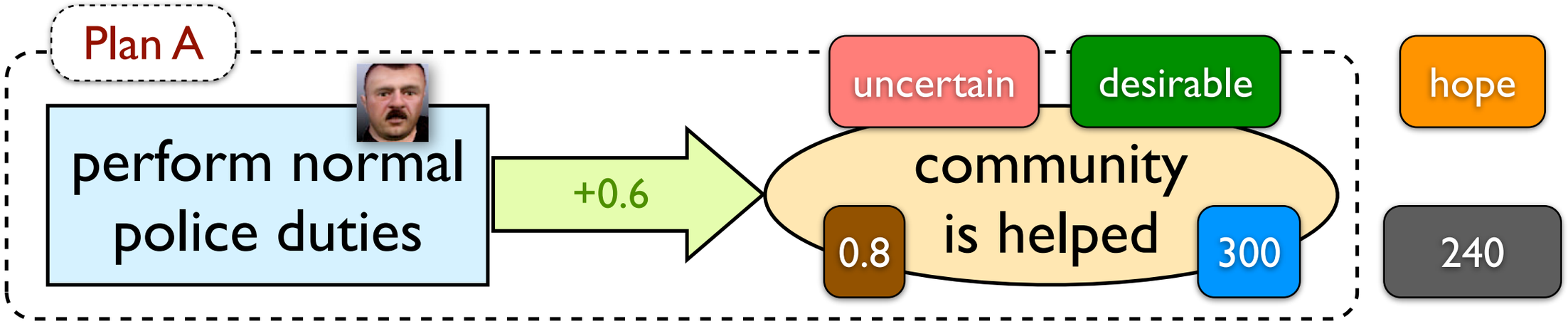


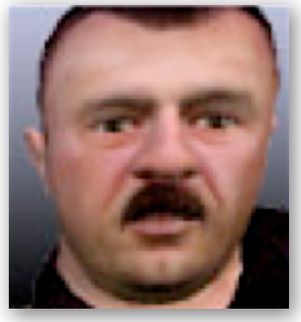
EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
hope
community is helped
0.8
300
240
Plan B
give financial aid
+0.6
uncertain
community is helped
0.7
demand clear market
+0.2
agent is threatened

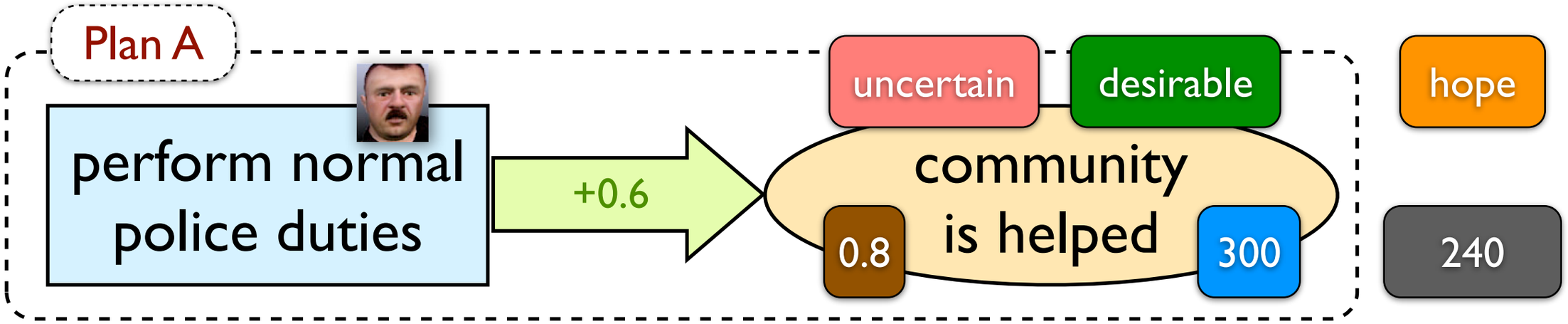


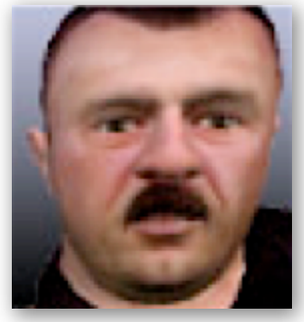
EMA: Example

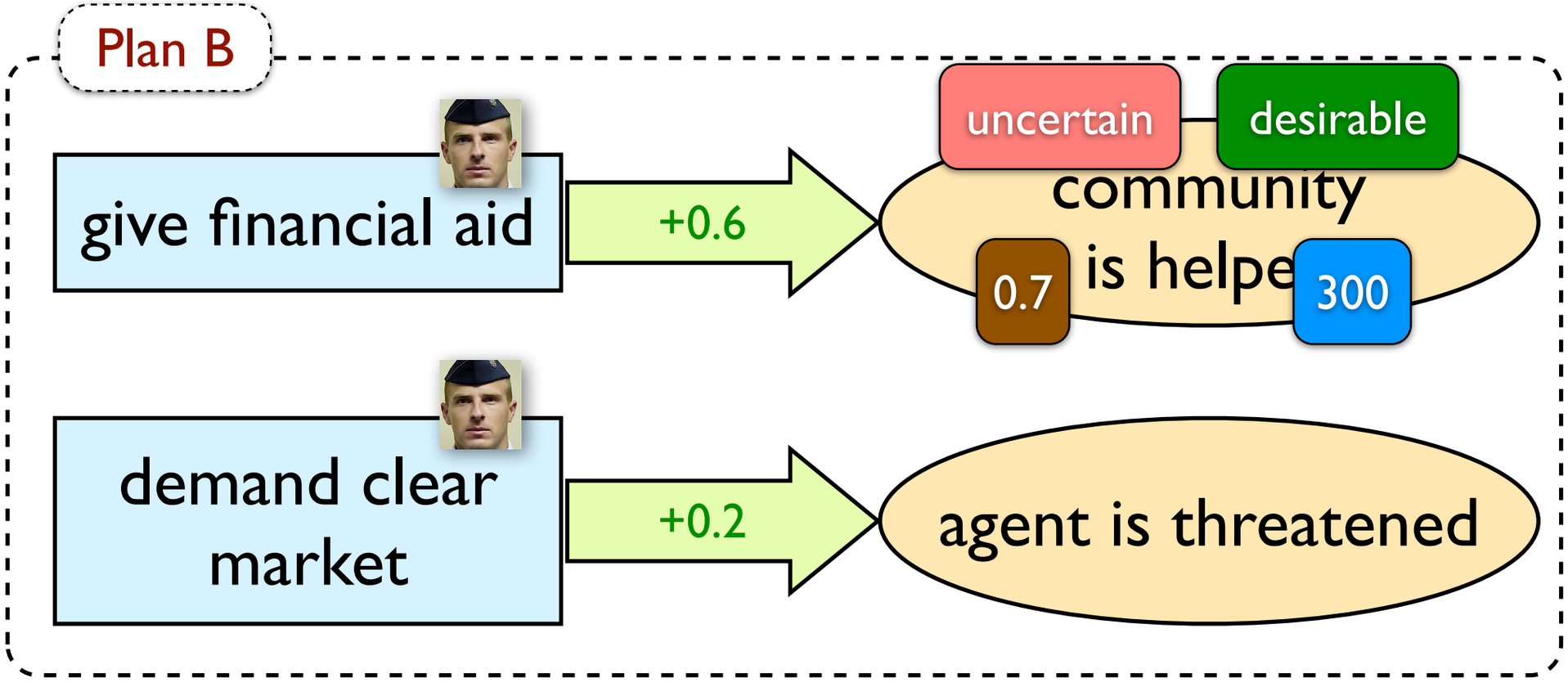

Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240
Plan B
give financial aid
+0.6
uncertain
community is helpe
0.7
300
demand clear market
+0.2
agent is threatened



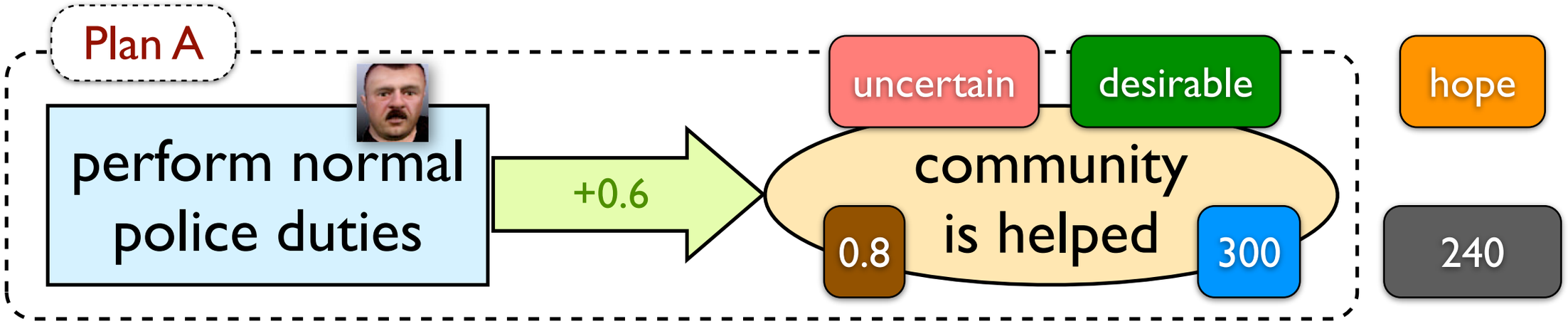
EMA: Example

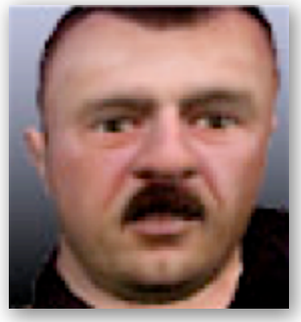

Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240



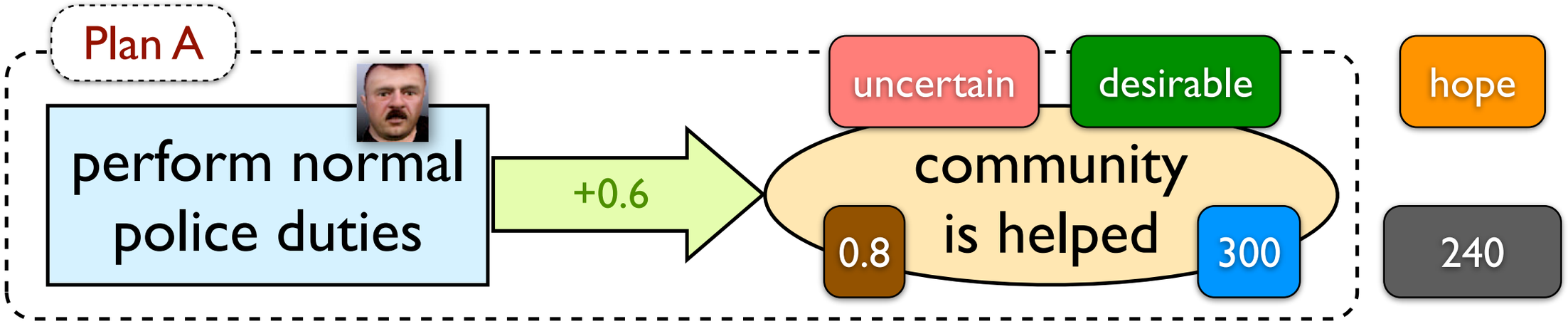

Plan B
give financial aid
+0.6
uncertain
desirable
community is helpe
0.7
300
demand clear market
+0.2
agent is threatened

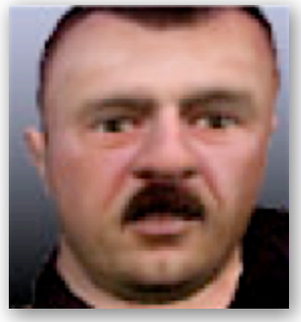
EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240
Plan B
give financial aid
+0.6
uncertain
desirable
community is helpe
0.7
300
hope
demand clear market
+0.2
agent is threatened

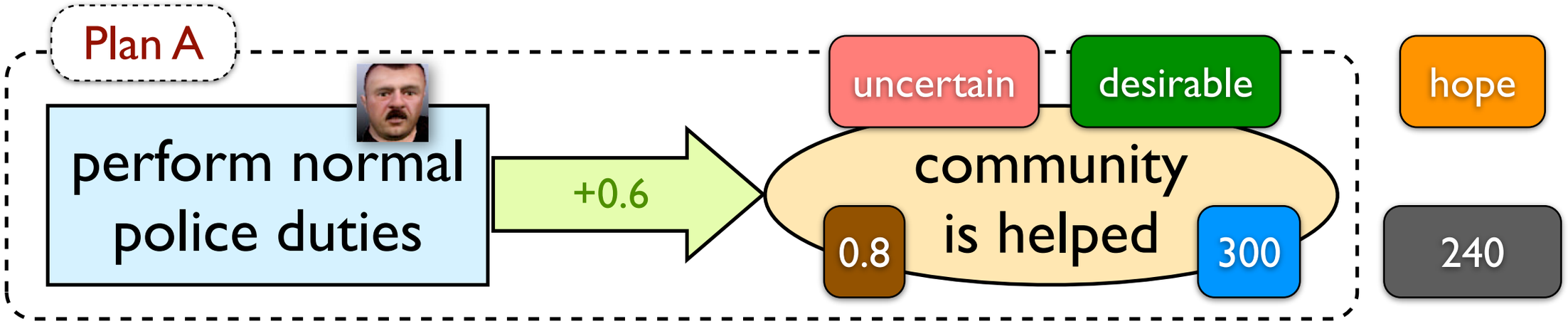


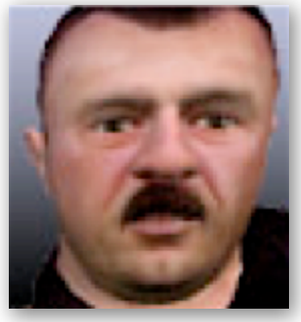
EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240
Plan B
give financial aid
+0.6
uncertain
desirable
community is helpe
0.7
300
hope
210
demand clear market
+0.2
agent is threatened

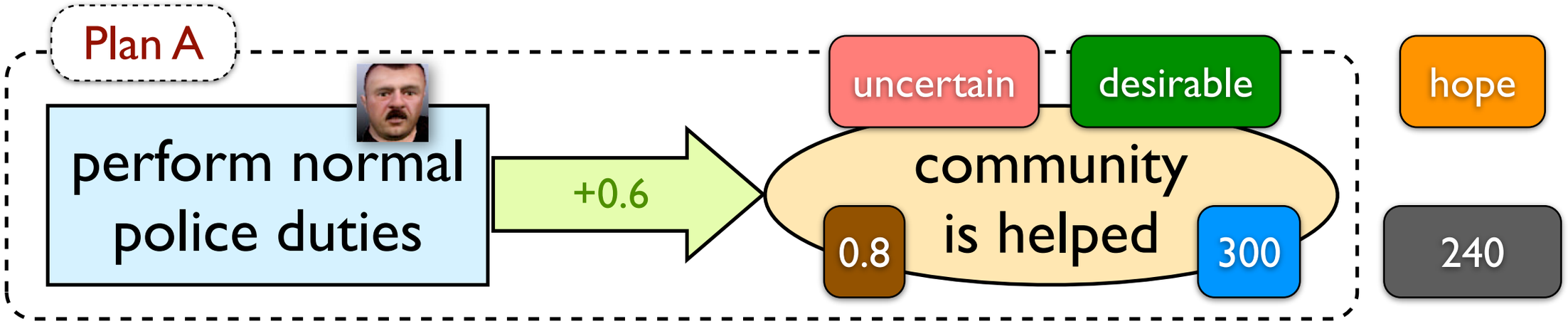


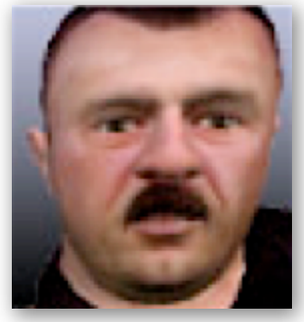
EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240
Plan B
give financial aid
+0.6
uncertain
desirable
community is helpe
0.7
300
hope
210
demand clear market
+0.2
agent is threatened
0.2

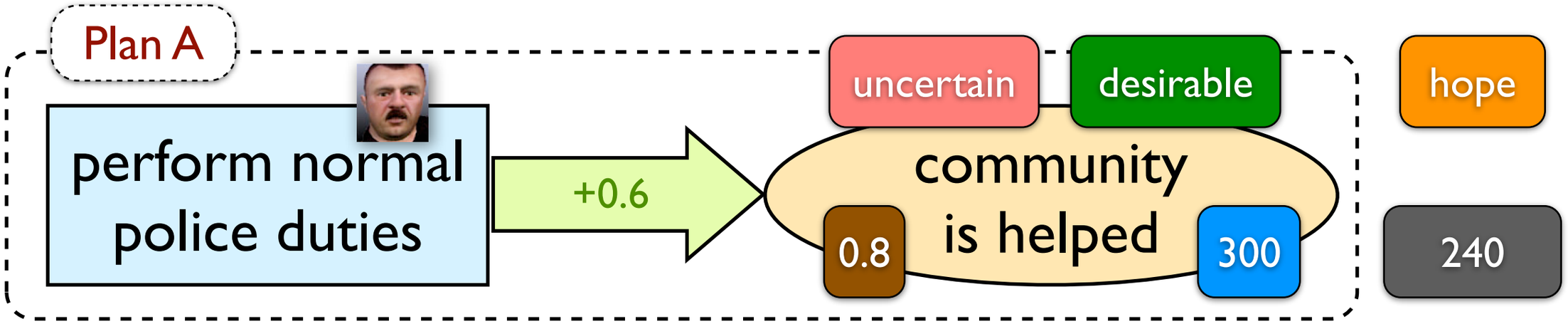


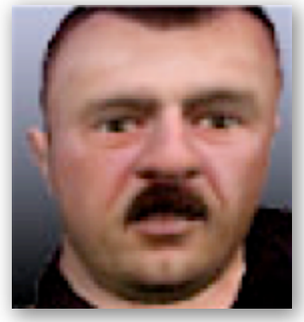
EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240
Plan B
give financial aid
+0.6
uncertain
desirable
community is helpe
0.7
300
hope
210
demand clear market
+0.2
uncertain
agent is threatened
0.2

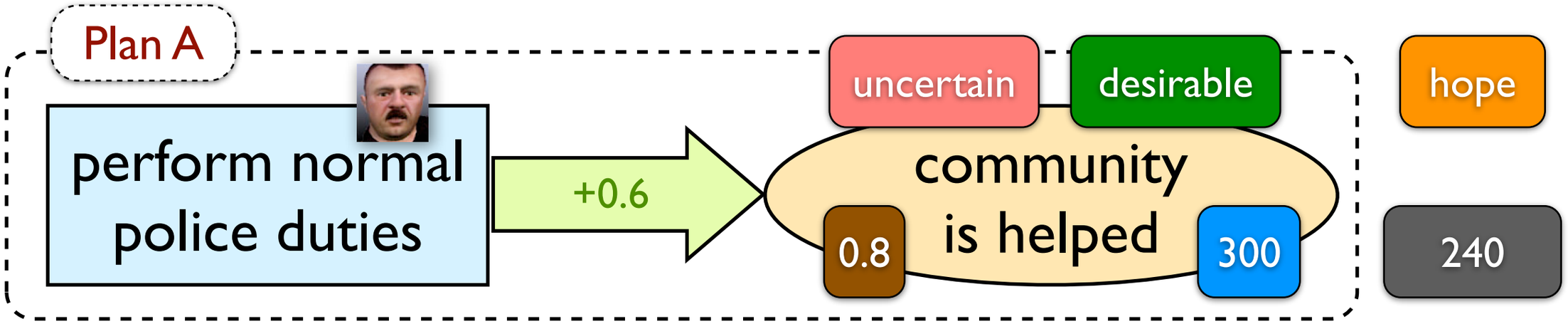


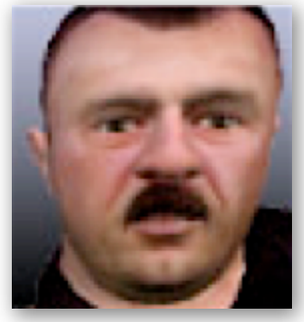
EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240
Plan B
give financial aid
+0.6
uncertain
desirable
community is helpe
0.7
300
hope
210
demand clear market
+0.2
uncertain
agent is threatened
0.2
-100

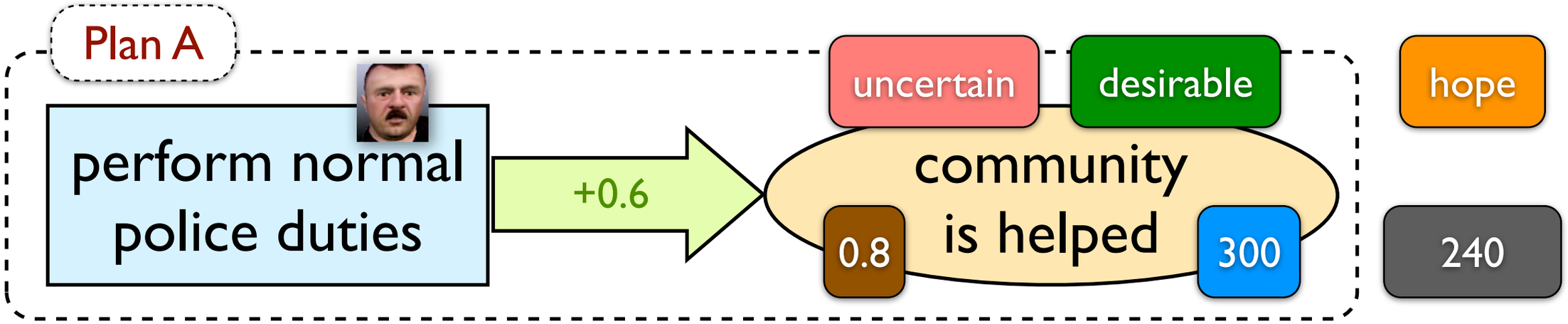


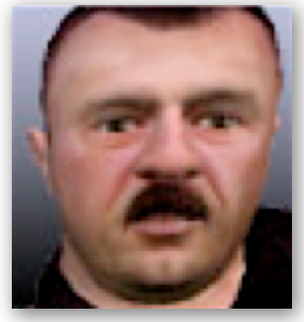
EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240
Plan B
give financial aid
+0.6
uncertain
desirable
community is helpe
0.7
300
hope
210
demand clear market
+0.2
uncertain
undesirable
agent is threatened
0.2
-100

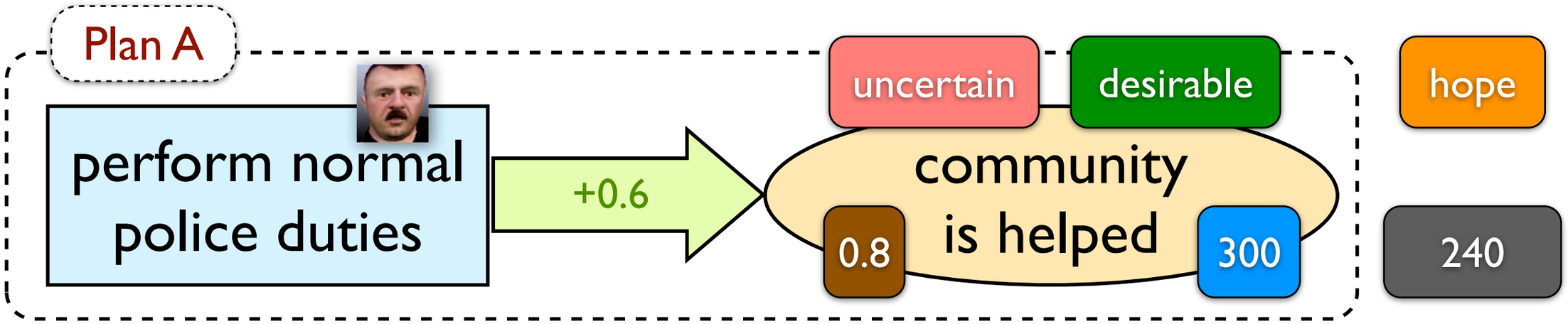


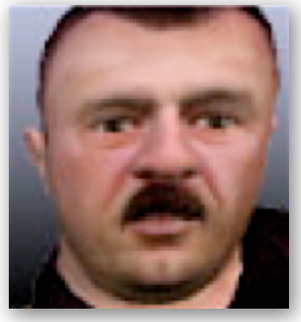
EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240
Plan B
give financial aid
+0.6
uncertain
desirable
community is helpe
0.7
300
hope
210
demand clear market
+0.2
uncertain
undesirable
agent is threatened
0.2
-100
fear



EMA: Example


Plan A
perform normal police duties
+0.6
uncertain
desirable
community is helped
0.8
300
hope
240
Plan B
give financial aid
+0.6
uncertain
desirable
community is helpe
0.7
300
hope
210
demand clear market
+0.2
uncertain
undesirable
agent is threatened
0.2
-100
fear
20

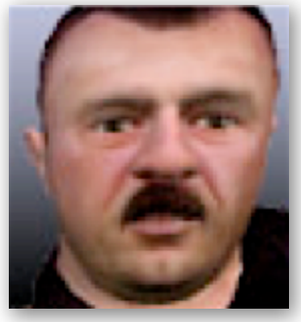


EMA: Example

Plan A

hope

240



Plan B

hope

210

fear

20

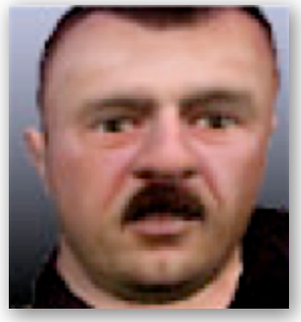
EMA: Example

Plan A

(Hope 240, Joy 0, Fear 0, Distress 0)

hope

240



Plan B

hope

210

fear

20

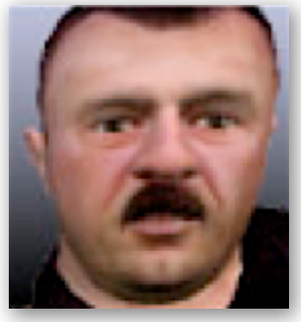
EMA: Example

Plan A

(Hope 240, Joy 0, Fear 0, Distress 0)

hope

240



Plan B

hope

210

fear

20

(Hope 210, Joy 0, Fear 20, Distress 0)

EMA: Example

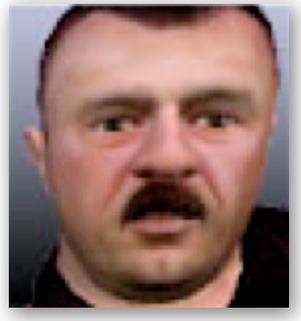
Plan A

(Hope 240, Joy 0, Fear 0, Distress 0)

(Hope +1, Joy +1, Fear -1, Distress -1)

hope

240



Plan B

(Hope +1, Joy +1, Fear -1, Distress -1)

(Hope 210, Joy 0, Fear 20, Distress 0)

hope

210

fear

20

EMA: Example

Plan A

(Hope 240, Joy 0, Fear 0, Distress 0)

(Hope +1, Joy +1, Fear -1, Distress -1)

240

hope

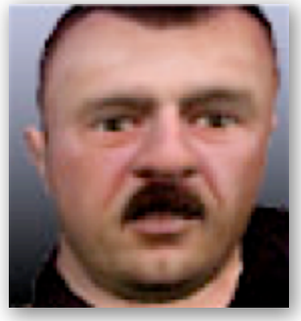
240

240

Plan B

(Hope +1, Joy +1, Fear -1, Distress -1)

(Hope 210, Joy 0, Fear 20, Distress 0)



hope

210

fear

20

EMA: Example

Plan A

(Hope 240, Joy 0, Fear 0, Distress 0)

(Hope +1, Joy +1, Fear -1, Distress -1)

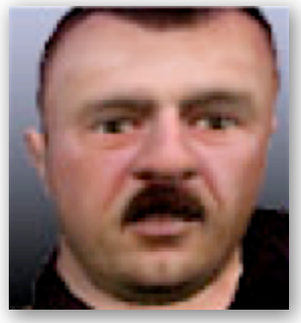
240

hope

240

240

Plan B



hope

190

210

(Hope +1, Joy +1, Fear -1, Distress -1)

fear

(Hope 210, Joy 0, Fear 20, Distress 0)

20

EMA: Example

Plan A

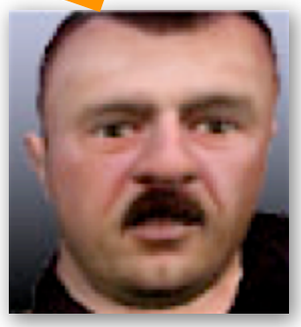
(Hope 240, Joy 0, Fear 0, Distress 0)

(Hope +1, Joy +1, Fear -1, Distress -1)

240

hope

240



Plan B

190

(Hope +1, Joy +1, Fear -1, Distress -1)

(Hope 210, Joy 0, Fear 20, Distress 0)

hope

210

fear

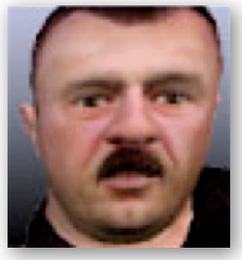
20

Outline

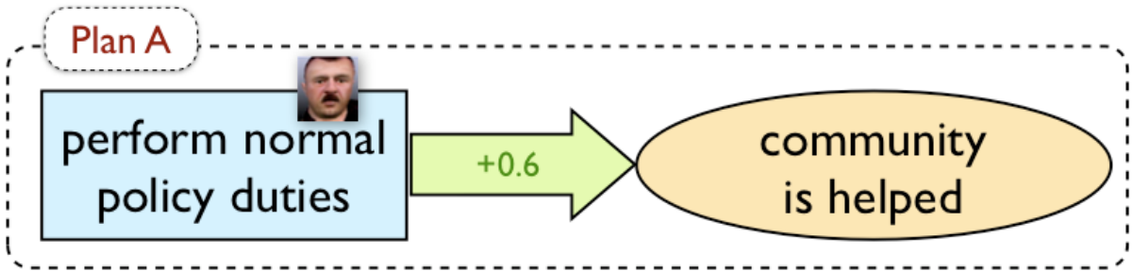
- Bilateral negotiations (BiLAT)
- Culturally Affected Behavior (CAB)
- EMotion and Adaptation (EMA)
- CEMA = CAB + EMA
- Future work

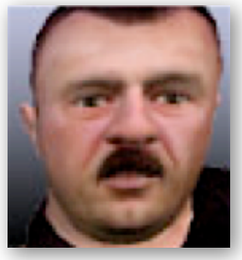
CEMA: combining CAB & EMA

CEMA: combining CAB & EMA

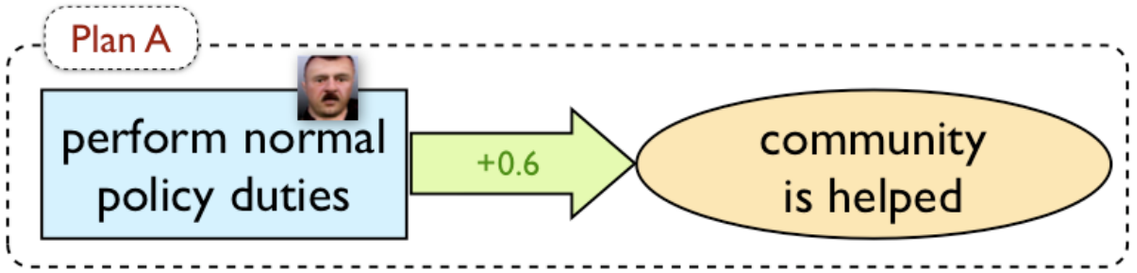


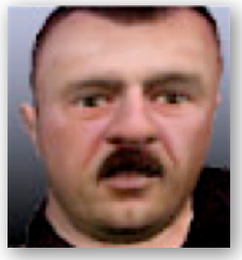
CEMA: combining CAB & EMA

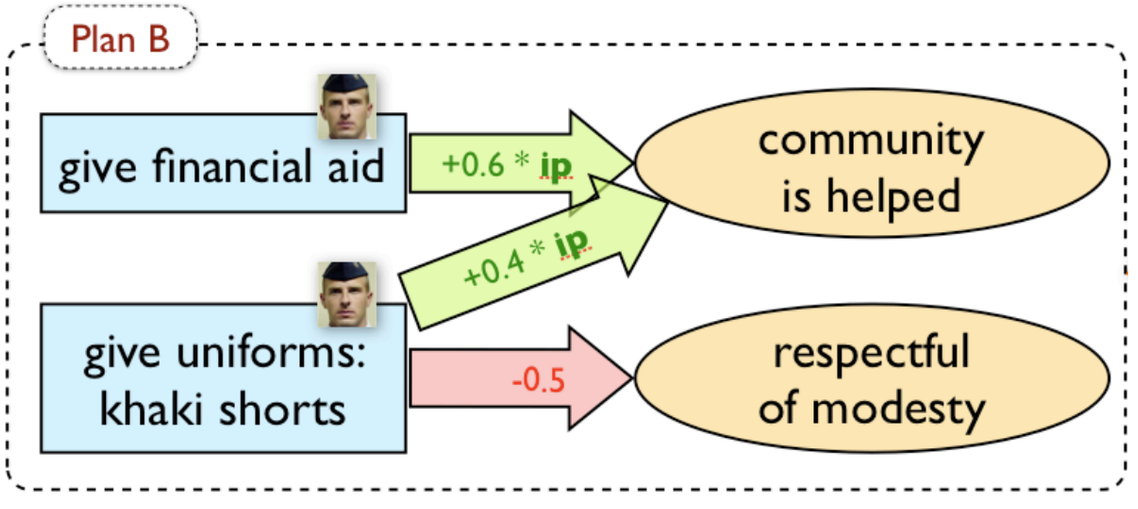




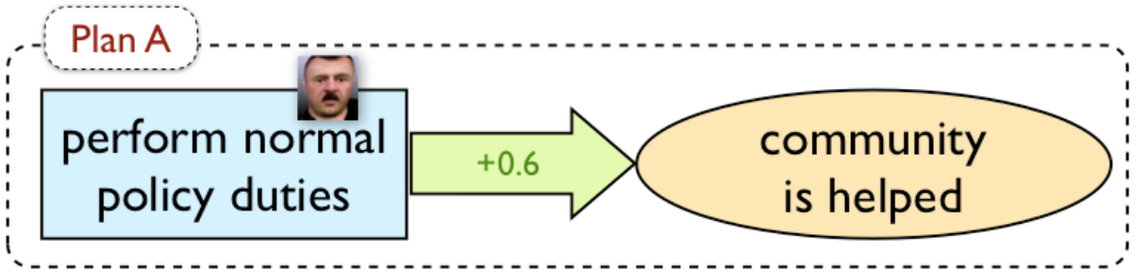
CEMA: combining CAB & EMA

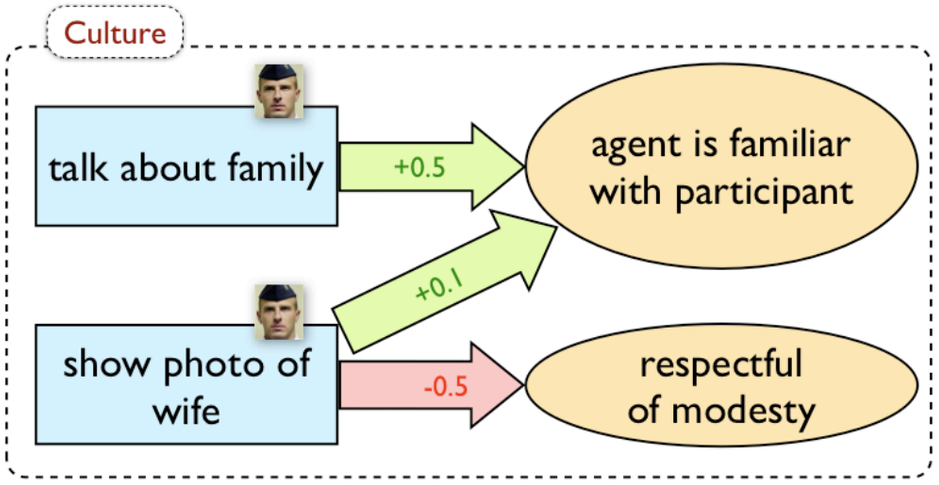


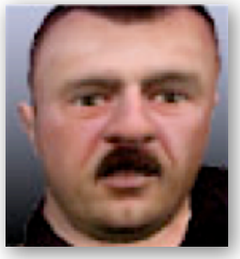


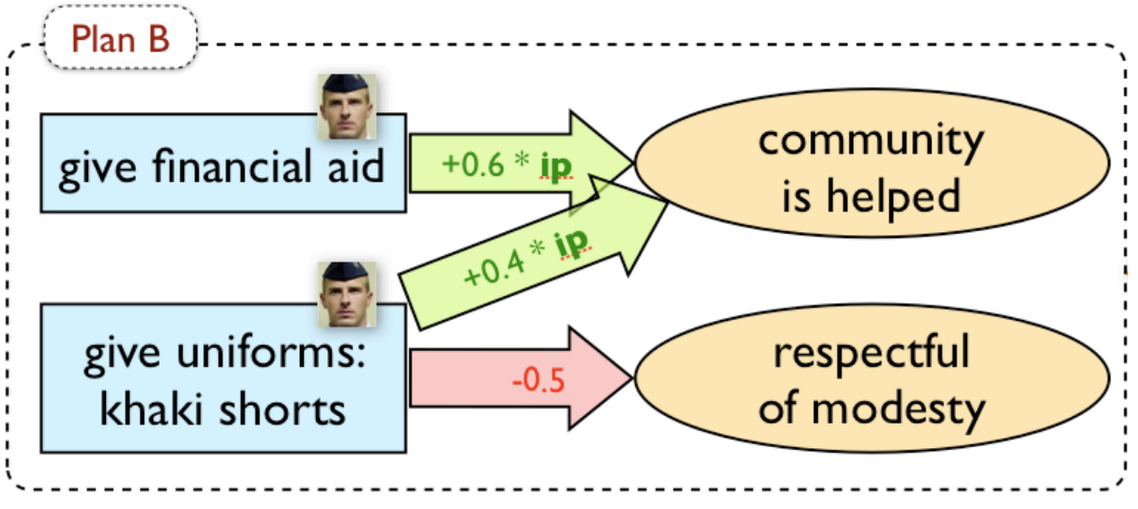


CEMA: combining CAB & EMA

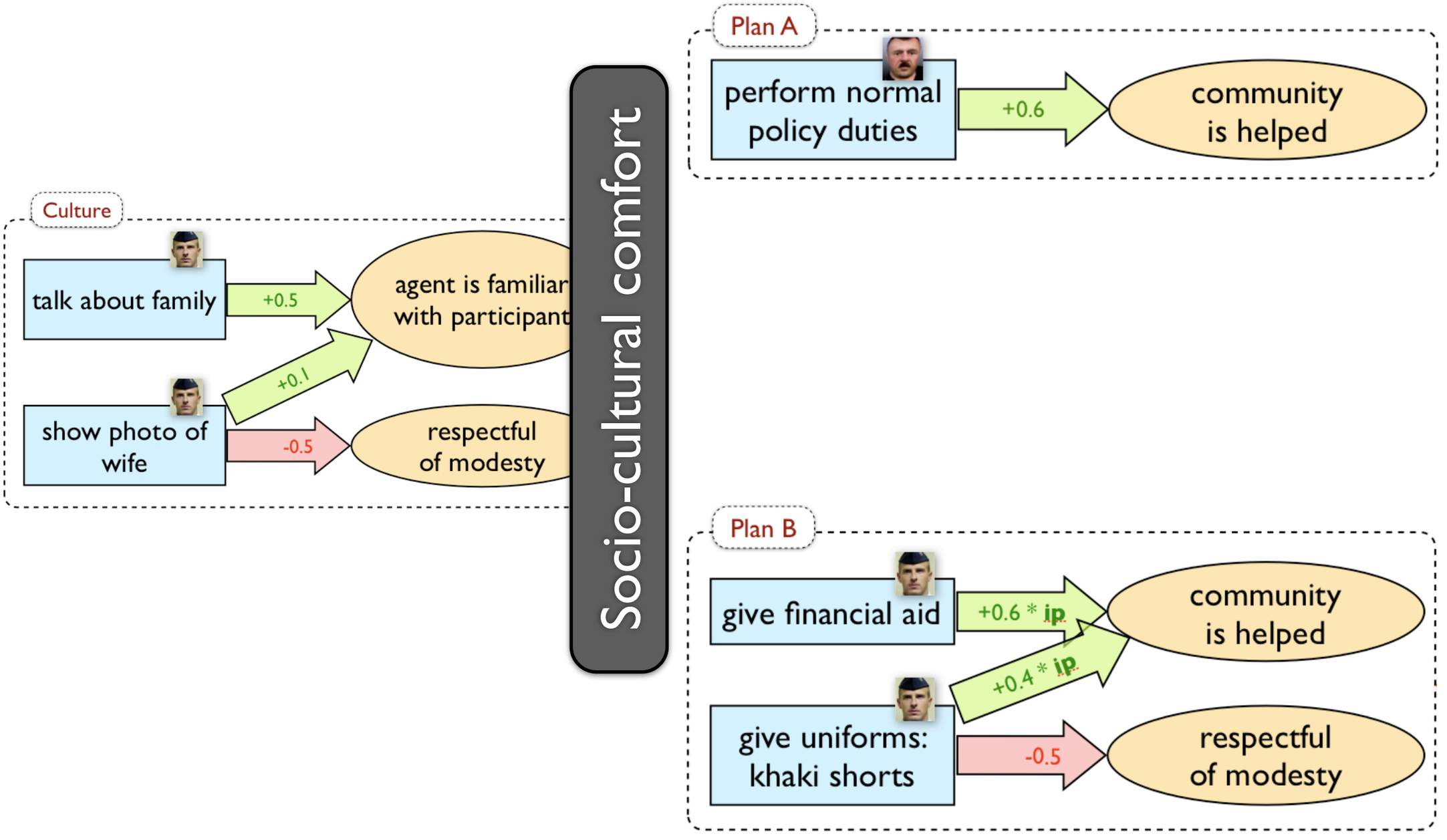


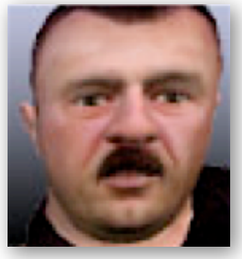




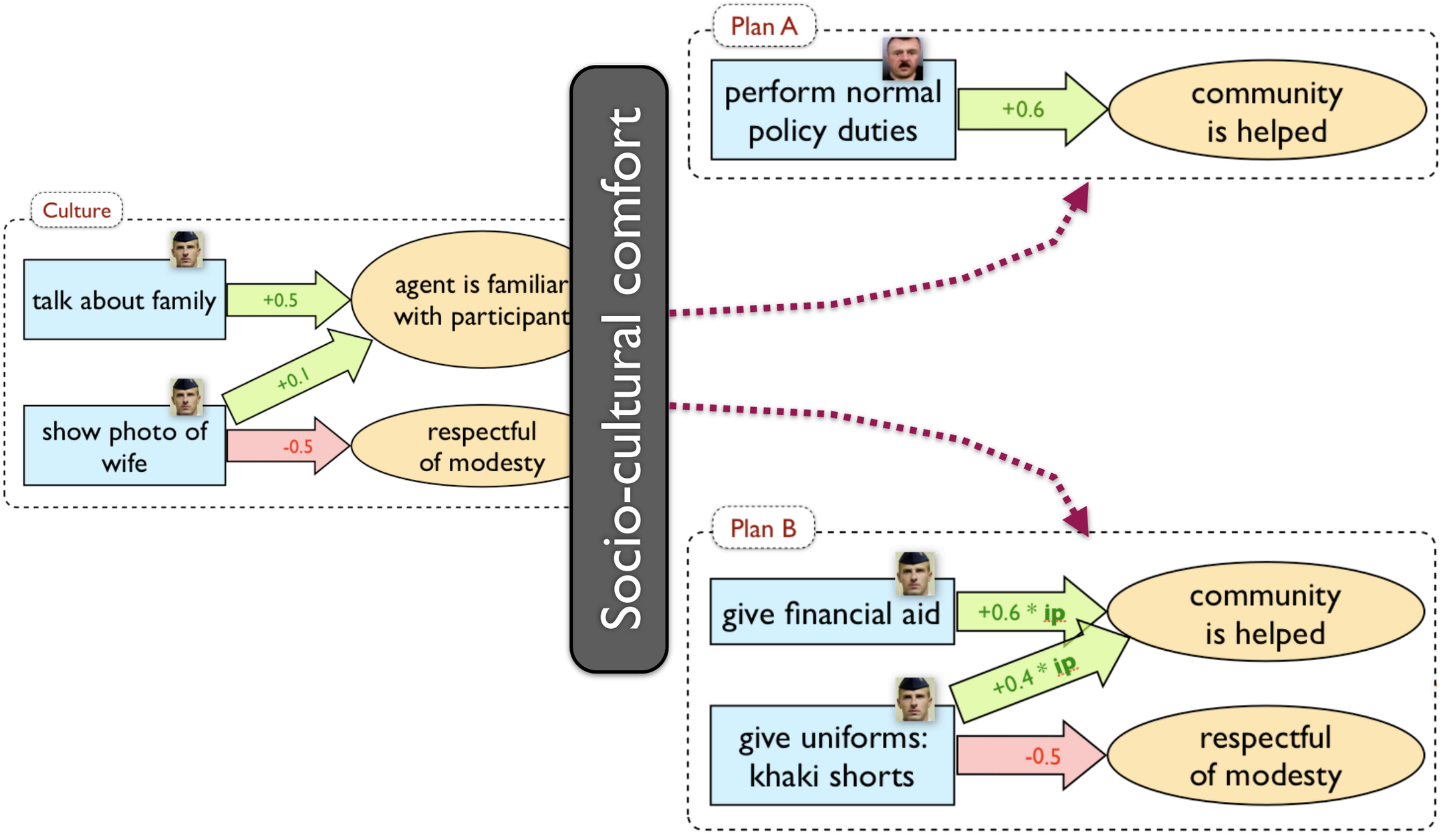


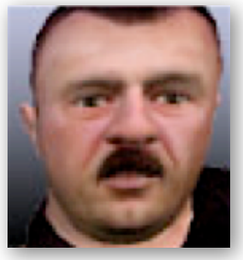
CEMA: combining CAB & EMA



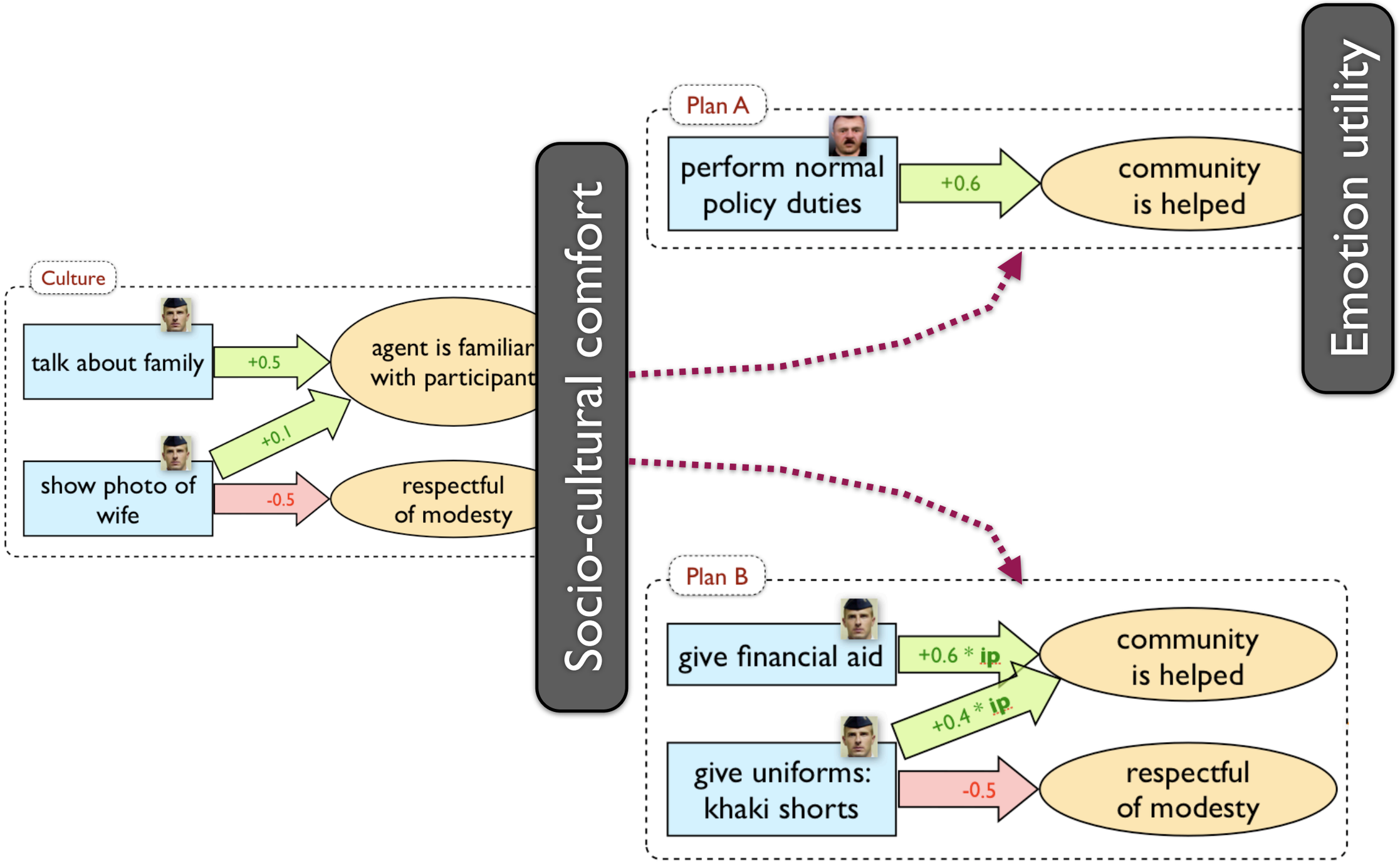


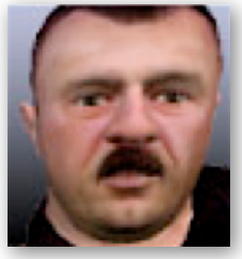
CEMA: combining CAB & EMA



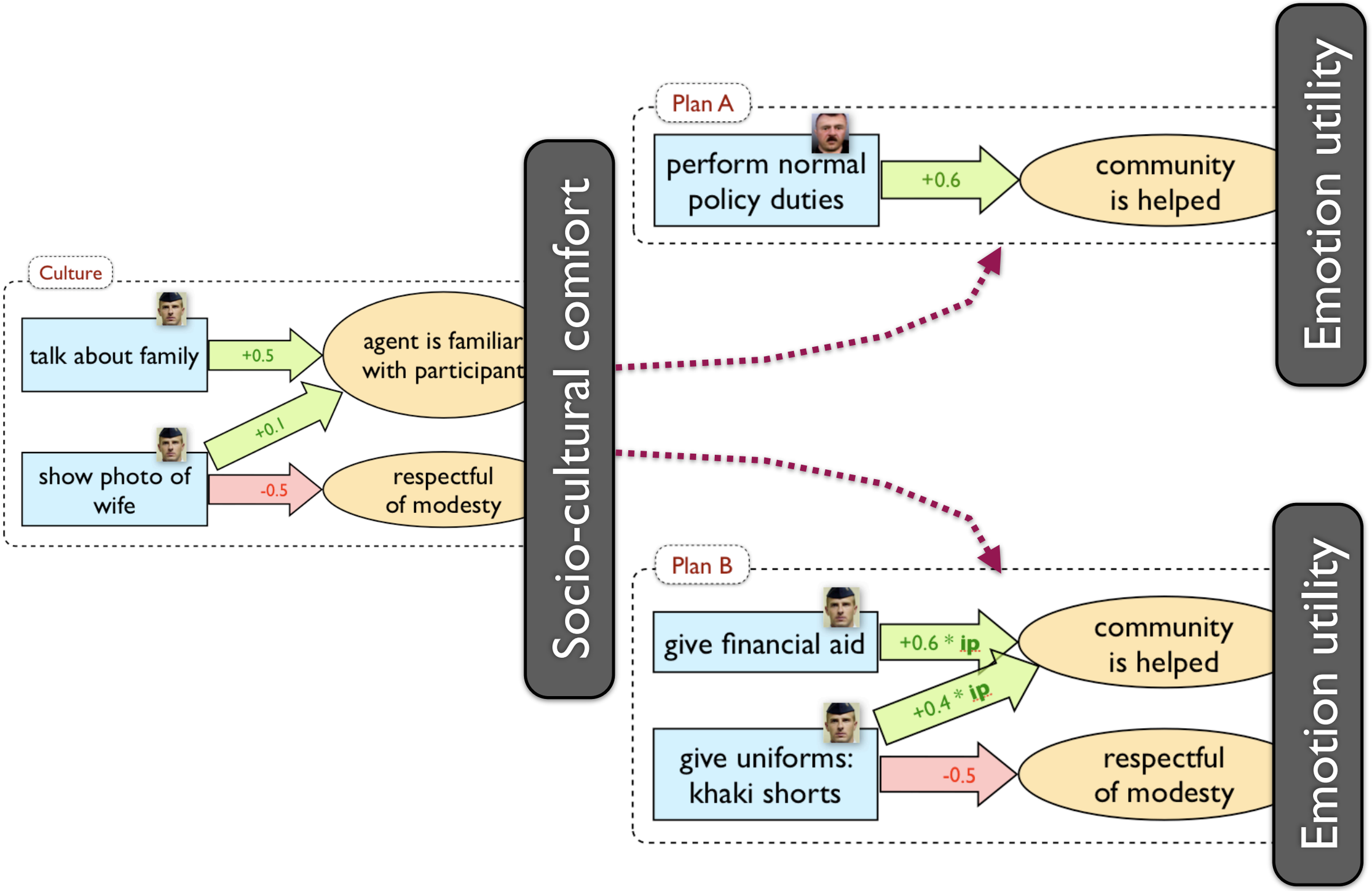


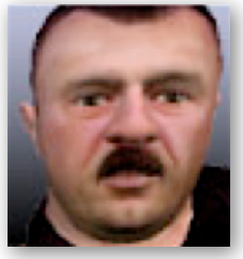
CEMA: combining CAB & EMA





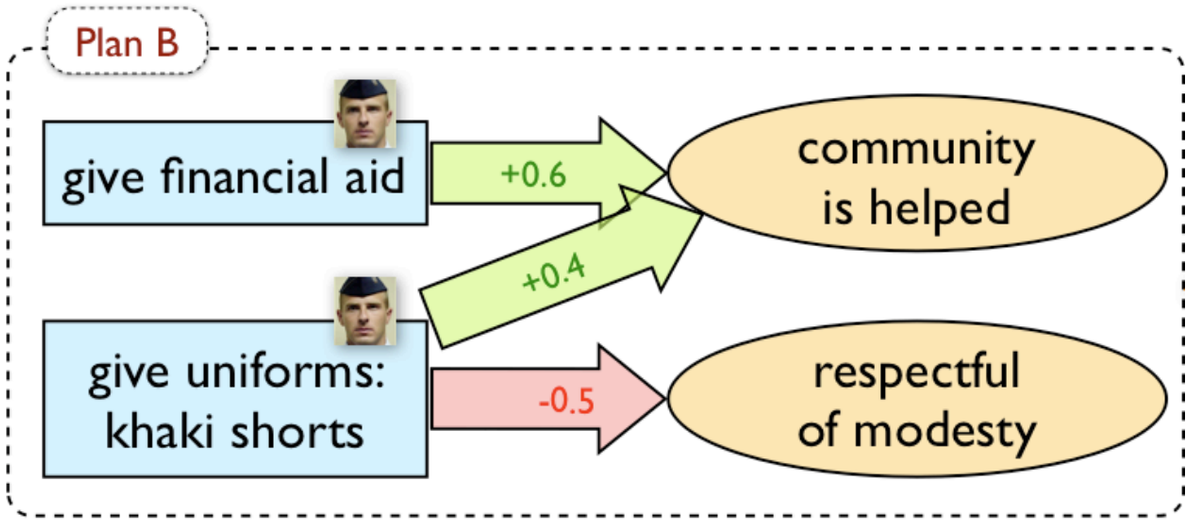
CEMA: combining CAB & EMA





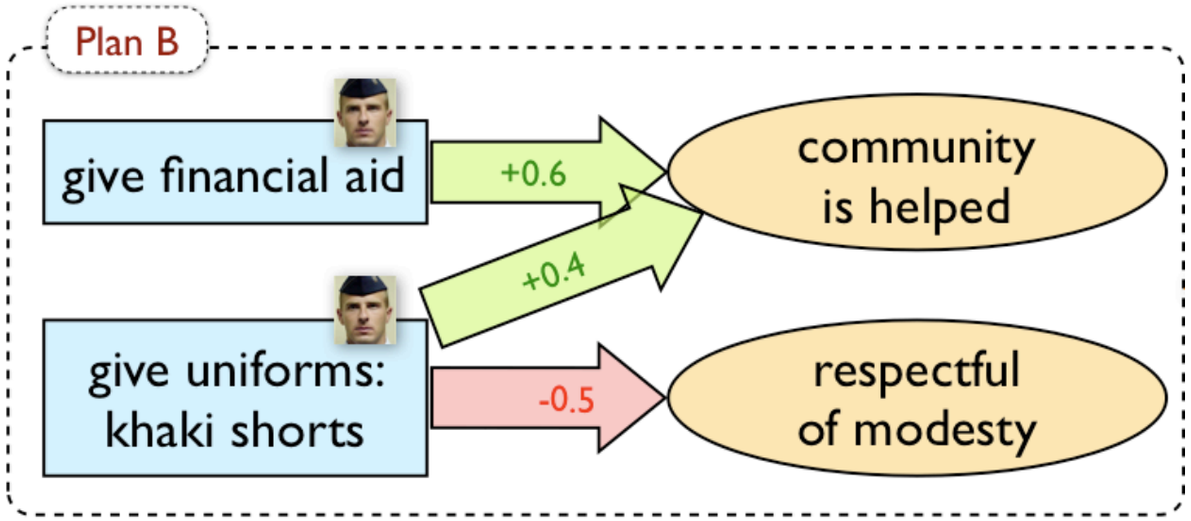
Matrix CEMA

- It turns out that CEMA can be encoded in matrix algebra



Matrix CEMA

- It turns out that CEMA can be encoded in matrix algebra



	give financial aid	give uniforms : shorts
community is helped	+0.6	+0.4
respectful of modesty	0.0	-0.5

Matrix CEMA

- First, compute action effects

	give financial aid	give uniforms : shorts
community is helped	+0.6	+0.4
respectful of modesty	0.0	-0.5

Matrix CEMA

- First, compute action effects

	give financial aid	give uniforms : shorts
community is helped	+0.6	+0.4
respectful of modesty	0.0	-0.5

x

Matrix CEMA

- First, compute action effects

	give financial aid	give uniforms : shorts
community is helped	+0.6	+0.4
respectful of modesty	0.0	-0.5

x

selector

give financial aid	0
give uniforms: shorts	1

Matrix CEMA

- First, compute action effects

	give financial aid	give uniforms : shorts
community is helped	+0.6	+0.4
respectful of modesty	0.0	-0.5

x

selector

give financial aid	0
give uniforms: shorts	1

=

Matrix CEMA

- First, compute action effects

	give financial aid	give uniforms : shorts
community is helped	+0.6	+0.4
respectful of modesty	0.0	-0.5

x

selector

give financial aid	0
give uniforms: shorts	1

Δ

=

community is helped	0.4
respectful of modesty	-0.5

Matrix CEMA

- Second, update beliefs:

△

community is helped	0.4
respectful of modesty	-0.5

Matrix CEMA

- Second, update beliefs:

community is helped	0.4
respectful of modesty	-0.5

+

Matrix CEMA

- Second, update beliefs:

Δ current beliefs

community is helped	0.4
respectful of modesty	-0.5

+

community is helped	0.2
respectful of modesty	0.9

Matrix CEMA

- Second, update beliefs:

Δ current beliefs

community is helped	0.4
respectful of modesty	-0.5

+

community is helped	0.2
respectful of modesty	0.9

=

Matrix CEMA

- Second, update beliefs:

Δ current beliefs new beliefs

community is helped	0.4
respectful of modesty	-0.5

+

community is helped	0.2
respectful of modesty	0.9

=

community is helped	0.6
respectful of modesty	0.4

Matrix CEMA

- Third, compute plan utility

new beliefs

community is helped	0.6
respectful of modesty	0.4

Matrix CEMA

- Third, compute plan utility

new beliefs

x

community is helped	0.6
respectful of modesty	0.4

Matrix CEMA

- Third, compute plan utility

state utilities

community is helped	300
respectful of modesty	250

x

new beliefs

community is helped	0.6
respectful of modesty	0.4

Matrix CEMA

- Third, compute plan utility

state utilities

community is helped	300
respectful of modesty	250

x

new beliefs

community is helped	0.6
respectful of modesty	0.4

=

Matrix CEMA

- Third, compute plan utility

state utilities

community is helped	300
respectful of modesty	250

x

new beliefs

community is helped	0.6
respectful of modesty	0.4

=

plan utility

utility	280

Matrix CEMA

- Intention probability
- Agent's actions conditional on state degrees
- Appraisals
- Emotion elicitation
- ...
- *Can all be encoded in the matrix form*

Appraisal + Elicitation: Hope

- `hopeMask = (degrees < 1.0) .* (utilities > 0);`
- `intensity = abs(degrees .* utilities);`
- `hopeInstances = hopeMask .* intensity;`
- `hope = sum(hopeInstances);`

- Actual 4 lines of code in MATLAB

Matrix Advantages

- code becomes a series of one-liners
  - transparent and easy to follow
- complete separation of data and code
  - cultures and personalities are just matrices
- machine learning of culture and personality parameters

Outline

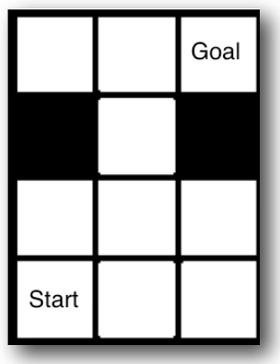
- Bilateral negotiations (BiLAT)
- Culturally Affected Behavior (CAB)
- EMotion and Adaptation (EMA)
- CEMA = CAB + EMA
- Future work

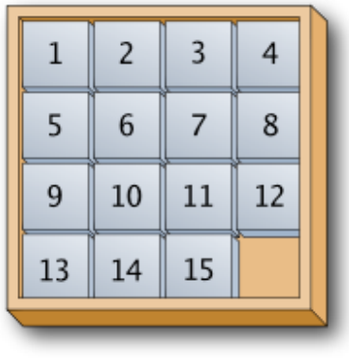
Future Work: Machine Learning

- Both CAB and EMA have a large number of parameters:
  - action add/delete effects
  - concern values
  - intention probability function
- Where do they come from?
- Machine learning using historic data?

Future Work: Learning Heuristic Search

- Lots of (recent) work in learning in heuristic search:
  - Korf, Ishida, Russell, Wefald, Shue, Zamani, Barto, Shimbo, Koenig, Furcy, Shang, Bulitko, Hernandez, Meseguer, Sigmundarson, Bjornsson, Likhachev, Rayner, Lu, Anderson, Lustrek, et al.
- Powerful methods
- Search does not have to happen in gridworlds or 15-puzzles
  - Can be in negotiation space in BiLAT
  - *Links to both culture and emotions*





Future Work: Emotions from Culture

- Can there be situations where culture or emotions by themselves do not model the right behavior?
- Example:
  - agent's cultural norms are threatened or jeopardized → causes fear or distress
    - agent is fearful of being viewed as unobservant of Islam
  - i.e., appraising and eliciting emotions over a socio-cultural network

Contributions

- Simultaneous modeling of emotions and culture
  - provisions for modeling emotions from cultural states
- Formal re-write of CAB and EMA in matrix form
  - computationally effective
  - transparent/simple representation/implementation
  - easy ways to add personality and religion
  - provisions for easier machine learning
  - provisions for learning real-time heuristic search