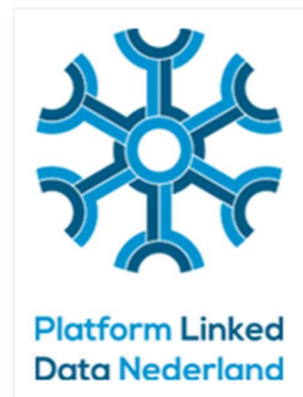


Open **Linked Data**

meets

Open **Linked Interaction**



December 2nd 2016
Waternet, Amsterdam

Peter de Laat

GoUnitive

peter@gounitive.com

**So why isn't there
massive usage?**

subject	predicate	object
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	For centuries China stood as a leading civilization, outpacin
https://www.cia.gov/cia/publications/factbook/geos/ch.html	http://www4.wiwiss.fu-berlin.de/factbook/	http://www4.wiwiss.fu-berlin.de/factbook/resource/China
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	mostly mountains, high plateaus, deserts in west; plains, d
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	23 provinces (sheng, singular and plural), 5 autonomous re
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	UTC 8 (13 hours ahead of Washington, DC during Standard
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	extremely diverse; tropical in south to subarctic in north
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	14500
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	calendar year
https://www.cia.gov/library/publications/the-world-factbook	http://www4.wiwiss.fu-berlin.de/factbook/	http://www4.wiwiss.fu-berlin.de/factbook/resource/China
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	232780
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	2
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	777900000000
http://www4.wiwiss.fu-berlin.de/factbook/	http://www.gounitive.com/uri/a/data_sour	http://www4.wiwiss.fu-berlin.de/factbook/resource/China
http://dbpedia.org/resource/China	http://www.gounitive.com/uri/a/same_as_	http://www4.wiwiss.fu-berlin.de/factbook/resource/China
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	24.47
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	20.01
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	22.12
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	1.5
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	.cn
https://www.cia.gov/library/publications/the-world-factbook	http://www.gounitive.com/uri/a/depiction_	http://www4.wiwiss.fu-berlin.de/factbook/resource/China
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	3
http://www4.wiwiss.fu-berlin.de/factbook/resource/China	http://www4.wiwiss.fu-berlin.de/factbook/	123000000

**Should we all just keep sharing
more and more data?**

**Or should we also build interaction
to actually support usage of all that data?**

The Linked Data User Interaction Problem

Interaction with Linked Data

“Numerous challenges *remain in understanding appropriate user interaction paradigms for applications built on data assembled dynamically”*

Christian Bizer / Tom Heath / Tim Berners Lee

in: Linked Data - The Story So Far - 2009

Interaction with Linked Data

User Interaction *is one of the
most important things
on the to do List
for Linked Data*

Prof. Frank van Harmelen

at: The Linked Data Symposium Eindhoven - 2016

**So what is the
problem?**

Interaction with Linked Data



Why **fundamentally** different?

Where we come from

← Fixed Domain of Properties →

Name	Price	Size	Resolution	Display Technology	Refresh Rate
Philips 32PFK5300	€269	32 inch	1080 p	LED-LCD	50 HZ
Philips 40PFK5300	€379	40 inch	1080 p	LED-LCD	50 HZ
Philips 40PFK4100	€329	40 inch	1080 p	LED-LCD	50 HZ
Philips 48PUS7600	€799	48 inch	4K	LED-LCD	100 HZ
Philips 50PFK5300	€549	50 inch	1080 p	LED-LCD	50 HZ
Philips 32PFK5500	€319	32 inch	1080 p	LED-LCD	50 HZ
LG 42LF580V	€347	42 inch	1080 p	LED-LCD	50 HZ



Open ended in 1 dimension

Name	Price	Size	Resolution	Display Technology	Refresh Rate
Philips 40PFK4100	€329	40 inch	1080 p	LED-LCD	50 HZ
Philips 48PUS7600	€799	48 inch	4K	LED-LCD	100 HZ
Philips 50PFK5300	€549	50 inch	1080 p	LED-LCD	50 HZ
Philips 32PFK5500	€319	32 inch	1080 p	LED-LCD	50 HZ
LG 42LF580V	€347	42 inch	1080 p	LED-LCD	50 HZ

PHILIPS 32PFK5500 €319

★★★★☆ 13 reviews



Display Technology	LED-LCD
Size	32 inch
Resolution	1080 p
Wifi	✓
Refresh Rate	50 HZ
Weight	5,2 kg
Color	Black

[More details](#)

Linked Data is very dynamic

Subject	Predicate	Object
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#name	Philips 32PFK5300
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#hasCurrencyValue	269
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#hasCurrency	Euro
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#SizeValue	32
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#SizeUnitOfMeasurement	inch
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#ProductDimensions	28.9 x 3.9 x 17.6
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#DimensionsUnitOfMeas	inch
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#DateFirstAvailable	March 22, 2014
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#ShippingWeight	13,5
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#ShippingWeightUnitOf	pound
http://gounitive.com/productsample/16354821	http://purl.org/goodrelations/v1#BestSellersRank	561
http://gounitive.com/productsample/16354822	http://purl.org/goodrelations/v1#name	Philips 40PFK5300
http://gounitive.com/productsample/16354822	http://purl.org/goodrelations/v1#hasCurrencyValue	379
http://gounitive.com/productsample/16354822	http://purl.org/goodrelations/v1#hasCurrency	Euro
http://gounitive.com/productsample/16354822	http://purl.org/goodrelations/v1#SizeUnitOfMeasurement	inch
http://gounitive.com/productsample/16354822	http://purl.org/goodrelations/v1#SizeValue	40
http://gounitive.com/productsample/16354823	http://purl.org/goodrelations/v1#name	Philips 40PFK4100
http://gounitive.com/productsample/16354823	http://purl.org/goodrelations/v1#hasCurrencyValue	329
http://gounitive.com/productsample/16354823	http://purl.org/goodrelations/v1#hasCurrency	Euro



Properties can be added at will

.. and can be different for each and every instance

Linked Data is open ended in multiple dimensions

Sources

Source	Property	Instance	Value
Source 1	Property 1	Instance 1	Value 1
Source 1	Property 2	Instance 2	Value 2
Source 2	Property 1	Instance 3	Value 3
Source 2	Property 2	Instance 4	Value 4
Source 3	Property 1	Instance 5	Value 5
Source 3	Property 2	Instance 6	Value 6
Source 4	Property 1	Instance 7	Value 7
Source 4	Property 2	Instance 8	Value 8
Source 5	Property 1	Instance 9	Value 9
Source 5	Property 2	Instance 10	Value 10

Properties

Instances

Linked Data is **open ended** in **multiple dimensions**

Sources



Properties

Instances

That is different

**Our current
user interaction paradigm
works with a fixed view on data**

**It cannot handle
the dynamic nature of linked data**

The Linked Data Interaction Problem

“Numerous challenges remain in understanding appropriate user interaction paradigms for applications built on data assembled dynamically”

Christian Bizer / Tom Heath / Tim Berners Lee

in: Linked Data - The Story So Far - 2009

Interaction with Linked Data– Current Solutions 1



Make user interaction generic

Iterate through predicates

Pro

- Supports open ended nature of linked data

Con

- Not intuitive enough
- Doesn't scale
- Unattractive
- **Unorganized**

http://www.w3.org/People/Berners-Lee/card#i

Open

Tim Berners-Lee


<http://www.w3.org/1999/02/22-rdf-syntax-ns#type>

Person 
<http://www.w3.org/2000/10/swap/pim/contact#Male> 

label

Tim Berners-Lee 

sameAs

[Tim Berners-Lee \(also at www4.wiwiw.fu-berlin.de\)](#) 

image





Weblinks

<http://www.w3.org/People/Berners-Lee/> 


name

Tim Berners-Lee 
Timothy Berners-Lee 
Tim Berners Lee 


Given name

Timothy 

family name

Berners-Lee 

sha1sum of a personal mailbox URI name

985c47c5a70db7407210cef8e4e6f5374a525c5c 

workplace homepage

<http://www.w3.org/> 

nickname

TimBL 



niokname

TimBL 
timbl 



personal mailbox

<mailto:timbl@w3.org> 

seeAlso

[Tim Berners-Lee's FOAF file](#) 
[Tim Berners-Lee's FOAF file](#) 

is seeAlso of

Tim Berners-Lee 
Tim Berners-Lee 

openid

<http://www.w3.org/People/Berners-Lee/> 

is primary topic of

http://en.wikipedia.org/wiki/Tim_Berners-Lee 

knows

Coralie Mercier 

Interaction with Linked Data– Current Solutions 2



Keep user interaction **specific**

Interaction with Linked Data– Current Solutions 2

Use **just a part**
of the data

PHILIPS 32PFK5500 €**319**
★★★★☆ 13 reviews



Display Technology	LED-LCD
Size	32 inch
Resolution	1080 p
Wifi	✓
Refresh Rate	50 HZ
Weight	5,2 kg
Color	Black

[More details](#)

Keep user interaction **specific**

Interaction with Linked Data– Current Solutions 2

- The **specific data** required for this design **doesn't have to be available**
 - Therefor mainly used by parties who control the data themselves.
 - Outside parties applying this technique need trust that data supplied does not change
- **Very limiting for the user**
 - There can be a wealth of data available which the user cannot access
- **Abnegation of the dynamic nature of Linked Data**



PHILIPS 32PFK5500 €319

★ ★ ★ ★ ☆ 13 reviews

32" 81cm

PHILIPS

Display Technology	LED-LCD
Size	32 inch
Resolution	1080 p
Wifi	✓
Refresh Rate	50 HZ
Weight	5,2 kg
Color	Black

[More details](#)

Keep user interaction **specific**

Use **just a part** of the data

**We need an answer to
a crucial question**

What kind of user interaction paradigm

can support the full flexibility of linked data

AND

can offer a well designed and organized user interface?

AND ..



can support **different use cases**



We need **personalization**

AND ..



allows sharing and reuse of interaction

User Interaction Paradigm Requirements

- Can give user **full access** to Linked Data
- Can offer a **well designed** and **organized** user interface
- Supports **personalization**
- Allows **sharing / reuse**

User Interaction Paradigm Requirements

- ☑ Can give user **full access** to Linked Data
- ☑ Can offer a **well designed** and **organized** user interface
- ☑ Supports **personalization**
- ☑ Allows **sharing / reuse**

**Our solution is surprisingly simple
but does offer this all**

So what is our solution?

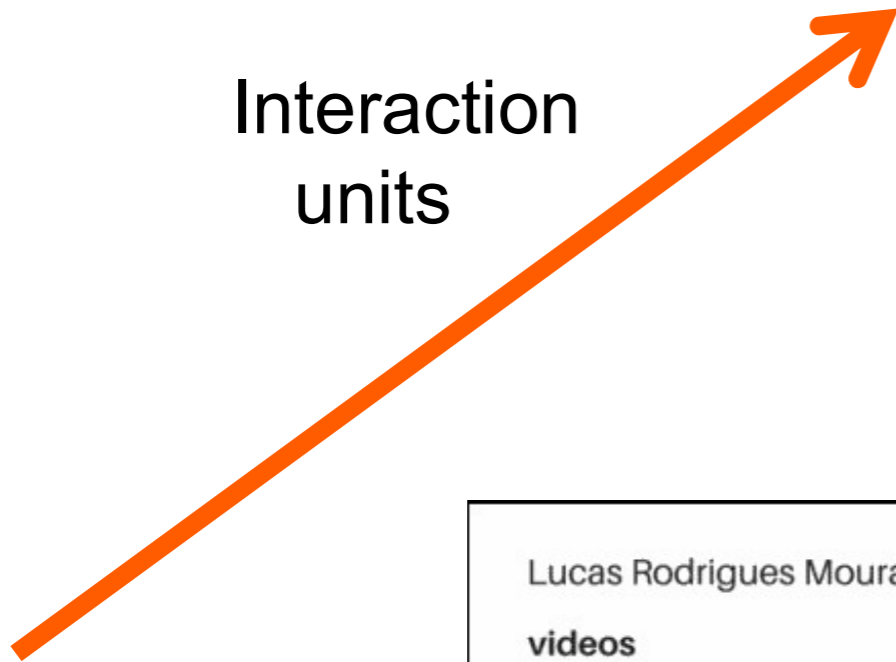


Our solution: **Open Linked Interaction**

- **Make which interaction unit can be used open ended as well**
- Use optimizer to determine which unit is used
- Allow user to use a different unit
- Use feedback loop to improve optimizer

Make **which interaction unit** can be used **open ended** as well

Interaction units



Lucas Rodrigues Moura da Silva

Transfer news

Sky Sports News HQ
BREAKING: Sky Sources: Leicester close to signing Winger Lucas Mouro from Paris Saint-Germain. #SSNHQ
11:46 PM · 13 Aug 2015

Sport Witness



Lucas Rodrigues Moura da Silva

videos

Lucas Moura vs Chelsea FC (25/07/15) HD 720p by Yan
van LucasMoura7x
2 weken geleden · 9.902 weergaven
International Champions Cup 2015 PSG 5-6 Chelsea FC (25.07.15) Song: Zac Samuel
- Set Out Your Loving Download Link: ...

Lucas Moura • Amazing Skills Show • 2014/15 [HD]
van FootballTV



Lucas Rodrigues Moura da Silva



Right winger

Through balls	■	Likes to dribble
Key passes	■	Likes to play short passes
Dribling	■	Likes to do layoffs
Taking set-pieces	■	Gets fouled often
Passing	■	
Crossing	■	
Holding on to the ball	■	
Finishing	■	

PARIS SAINT-GERMAIN

balltv776 ...

Brazil ~ 22yrs ~ 1.72m ~ right footed ~ £22,40m (est.)




These can be **specific** or **generic**

Make **which interaction unit** can be used **open ended** as well



Lucas Rodrigues Moura da Silva

Transfer news

 Sky Sports News HQ

BREAKING: Sky Sources: Leicester close to signing Winger Lucas Mouro from Paris Saint-Germain. #SSNHQ

11:46 PM - 13 Aug 2015

 Sport Witness

Marca say Lucas to Arsenal would be a 'tragedy' for Paris Saint-Germain and the idea has 'caused an earthquake' at the France club.

8:16 AM - 14 Aug 2015



Instead of browsing through different data,
users can browse through different interaction units

**Specify for each unit the
class/property requirements
a unit can be used**

Like a data contract



George Walton Lucas Jr.



Biggest Successes

Star Wars Episode I: The Phantom Menace	Star Wars Episode III: Revenge of the Sith	Indiana Jones and the Last Crusade
Director Writer	Director Writer	Writer



Lucas Rodrigues Moura da Silva



Right winger

- Through balls ■
- Key passes ■
- Dribbling ■
- Taking set-pieces ■
- Passing ■
- Crossing ■
- Holding on to the ball ■
- Finishing ■
- Likes to dribble ■
- Likes to play short passes ■
- Likes to do layoffs ■
- Gets fouled often ■



- 22yrs - 1.72m - right footed - £22,40m (est.)



Rep. Frank Lucas (R)

Representative from Oklahoma's 3rd District



Elected Positions:

Dates	Title	State / District
2003-2016	Representative	Oklahoma's 3rd District
1993-2002	Representative	Oklahoma's 6th District

Bills Sponsored:

- H.R. 1601: State Regulatory Representation Clarification Act of 2015
- H.R. 1561: Weather Research and Forecasting Innovation Act of 2015
- H.R. 1029: EPA Science Advisory Board Reform Act of 2015



México - Cabo San Lucas

today 16:00 partly cloudy

95°F Precipitation: 0% Wind: 12 mph

Tue	Wed	Thu	Fri	Sat
93	93	94	94	94
81	82	81	82	82

Things to Do





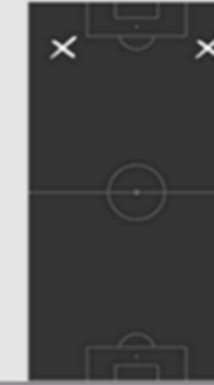
Lucas Rodrigues Moura da Silva



Right winger

- | | | |
|------------------------|---|----------------------------|
| Through balls | ■ | Likes to dribble |
| Key passes | ■ | Likes to play short passes |
| Dribling | ■ | Likes to do layoffs |
| Taking set-pieces | ■ | Gets fouled often |
| Passing | ■ | |
| Crossing | ■ | |
| Holding on to the ball | ■ | |
| Finishing | ■ | |

🇧🇷 ~ 22yrs ~ 1.72m ~ right footed ~ £ 22,40m (est.)



Lucas Rodrigues Moura da Silva

Transfer news



Sky Sports News HQ

BREAKING: Sky Sources: Leicester close to signing Winger Lucas Mouro from Paris Saint-Germain. #SSNHQ

11:46 PM - 13 Aug 2015



Sport Witness

Marca say Lucas to Arsenal would be a 'tragedy' for Paris Saint-Germain and the idea has 'caused an earthquake' at the France club.

8:16 AM - 14 Aug 2015



Lucas Rodrigues Moura da Silva

videos



Lucas Moura vs Chelsea FC (25/07/15) HD 720p by Yan

van LucasMoura7x
2 weken geleden • 9.902 weergaven
International Champions Cup 2015 PSG 5-6 Chelsea FC (25.07.15) Song: Zac Samuel - Set Out Your Loving Download Link: ...

HD



Lucas Moura • Amazing Skills Show • 2014/15 [HD]

van FootballTv



Our solution

- Make which interaction unit can be used open ended as well
- **Use optimizer** to determine which unit is used
- **Allow user to use a different unit**
- **Use feedback loop** to improve optimizer

Optimizer can be fed with

- **Data / Meta data**
- **Actual usage** of a unit
- **Progress made** (for instance in education)
- **Sales numbers**
- **Whether user continues** within some process
- **Combination** of the above

Interaction unit **can be reused**

PARIS SAINT-GERMAIN

NEWS TEAMS ASSOCIATION PSGTV COMMUNITY CLUB TICKETS SHOPPING FOUNDATION

Lucas Rodrigues Moura da Silva

Right winger

- Through balls
- Key passes
- Dribbling
- Taking set-pieces
- Passing
- Crossing
- Holding on to the ball
- Finishing
- Likes to dribble
- Likes to play short passes
- Likes to do layoffs
- Gets fouled often

BR — 22yrs — 1.72m — right footed — € 22.40m (est.)

Skills	11/12	12/13	13/14	14/15
Attacking				
- Goals	5	7	7	8
- Assist	3	5	6	7
Creative				
- Passes per game	30,7	31,2	29,5	32,6
- % Success in passes	81,3	85,7	84,2	86,5
Defensive				
- Tackles per game	0,8	1,4	1,0	1,2
- % Success in tackles	29,2	32,3	35,6	41,3
Physical				
- Sprint speed - km/h	29,1	29,4	29,5	29,9
- Sprints per game	32,3	30,8	33,2	32,6
- Strength	--	--	--	--

Injuries

- 14/15 Hamstring
10 games missed
- Groin strain
7 games missed
- 13/14 Ankle
4 games missed
- 12/13 Adductor
9 games missed

Interaction unit can be reused

The screenshot displays the GoUnitive website interface for searching soccer players. The search results are organized into three distinct interaction units, each for a different player. Each unit contains a player's photo, their name, position, and a list of skills with corresponding progress bars. A filter sidebar is located on the right side of the page.

GoUnitive® search soccer players X

Lucas Rodrigues Moura da Silva
Right winger
Fly Emirates
PARIS
- 22yrs - 1.72m - right footed - £ 22.40m (est.)

Skill	Progress	Preference
Through balls	Full	Likes to dribble
Key passes	Full	Likes to play short passes
Dribbling	Full	Likes to do layoffs
Taking set-pieces	Medium	Gets fouled often
Passing	Medium	
Crossing	Medium	
Holding on to the ball	Medium	
Finishing	Low	

Zlatan Ibrahimovic
Striker
Fly Emirates
PARIS
- 33yrs - 1.95m - right footed - £ 65m (est.)

Skill	Progress	Preference
Passing	Full	Likes to play long balls
Long shots	Full	Likes to do layoffs
Direct free-kicks finishing	Full	Indirect set-piece threat
Through balls	Full	Likes to shoot from distance
Key passes	Medium	Does not dive into tackles
Aerial Duels	Medium	
Offside awareness	Low	

Marco Verratti
Midfielder
Fly Emirates
PARIS
- 22yrs - 1.65m - right footed - £ 40m (est.)

Skill	Progress	Preference
Passing	Full	Gets fouled often
Dribbling	Full	Likes to do layoffs
Through balls	Full	Likes to tackle
Key passes	Medium	Commits fouls often
Blocking the ball	Medium	
Concentration	Low	
Aerial Duels	Low	
Discipline	Low	

Filter

Nation

- Spain
- France
- Brazil
- Germany
- Argentina

League

- Barclays PL
- Liga BBVA
- Bundesliga
- Serie A
- Ligue 1

Position

- All Position
- Attackers
- Midfielders
- Defenders
- Goalkeepers

Club

- PSG
- AS Monaco
- Olympique Lyon
- Marseille
- Toulouse FC

Goals

from to

Assist

from to

Age

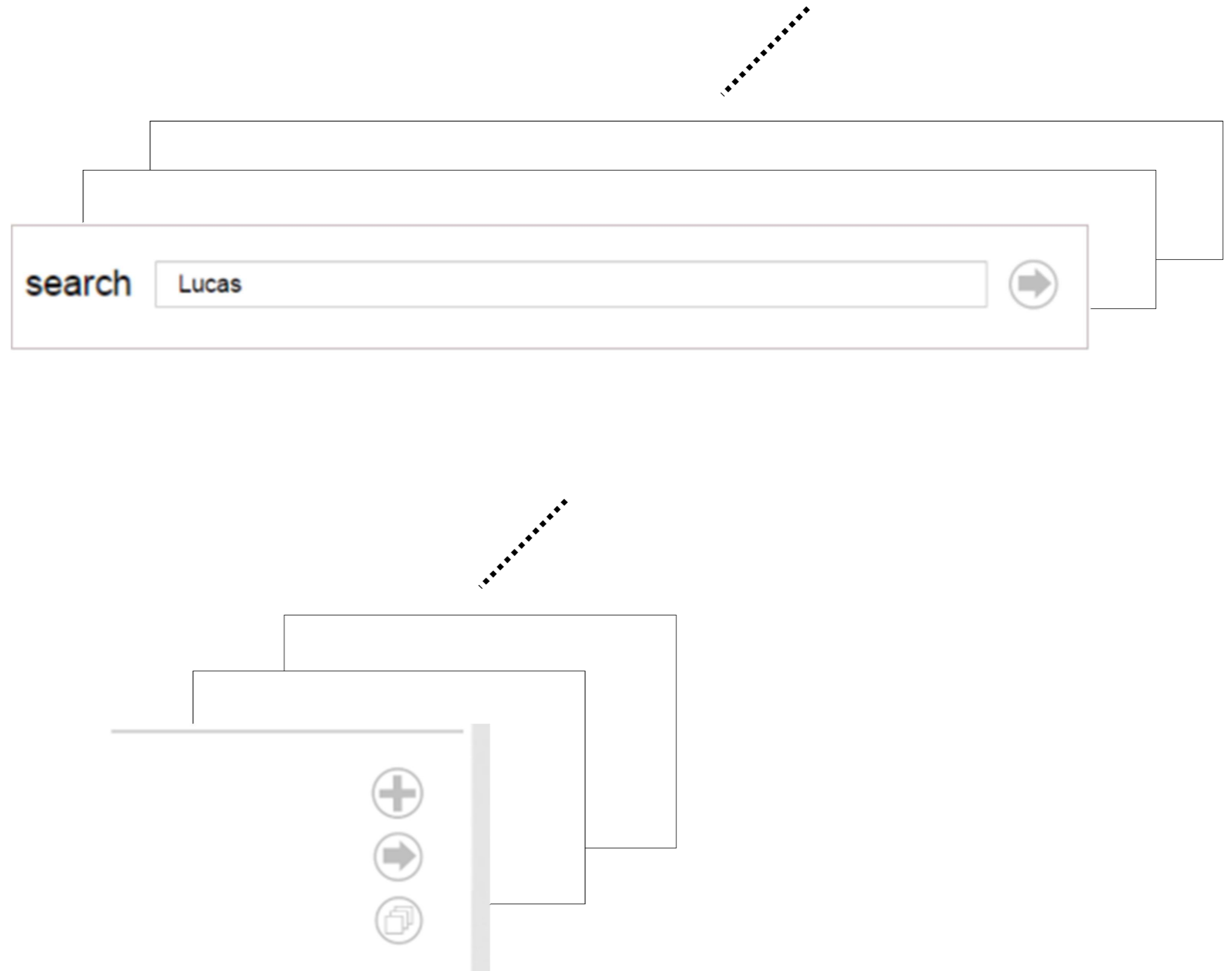
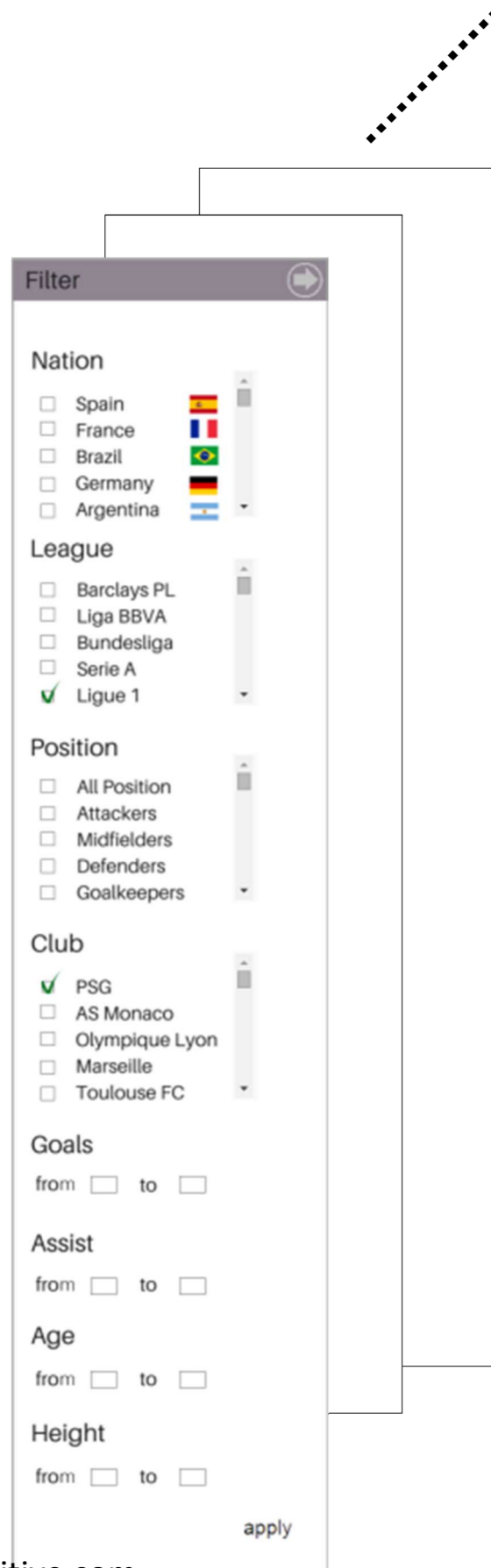
from to

Height

from to

apply

It can be used for any kind of interaction component



Sharing / Reuse Requires

- **A standard way** of describing for which data an interaction unit can be used
 - Linked data – requires vocabulary – a kind of data contract
- **A standard way** a unit can be retrieved
 - http request
- **A standard interface** to the unit once loaded
 - Functions to call
 - What data to supply (Uri's or data object model)
- **A standard way** to write data for optimizer feedback loop
- **Libraries supporting such standard functionalities**

But we need to **experiment first** before we can make great standards

The way of the web
is open solutions based on standards

That is our exactly
what we propose for user interaction

Our Solution: **Open Linked Interaction**

- ☑ Can give user **full access** to Linked Data
- ☑ Can offer a **well designed** and **organized** user interface
- ☑ Supports **personalization**
- ☑ Allows **sharing / reuse**

More information?



Peter de Laat
GoUnitive
peter@gounitive.com

Contact me!