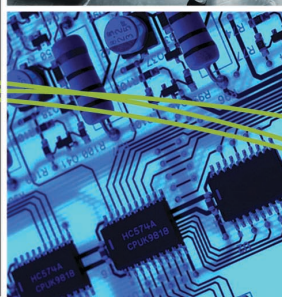
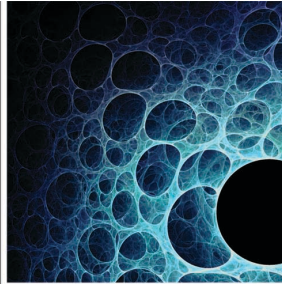




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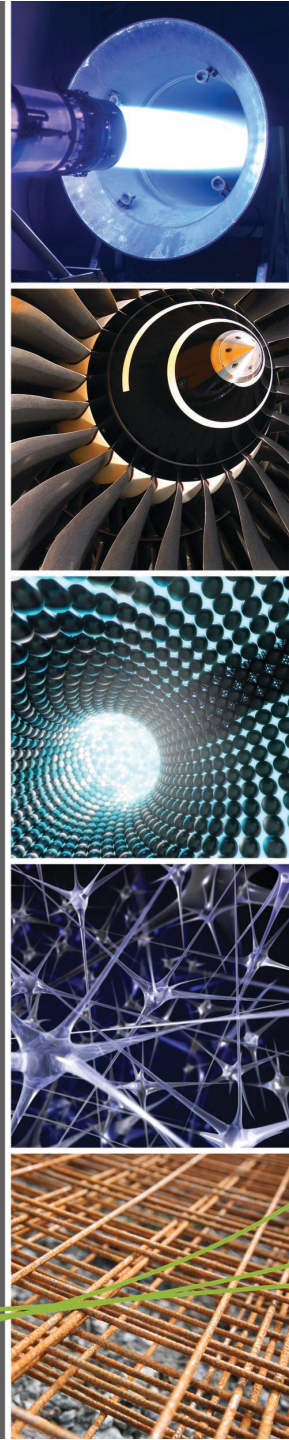




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Interactive Glyph-Based Visualization for Real-Time Sports Performance Analysis

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Swansea University
April 2012



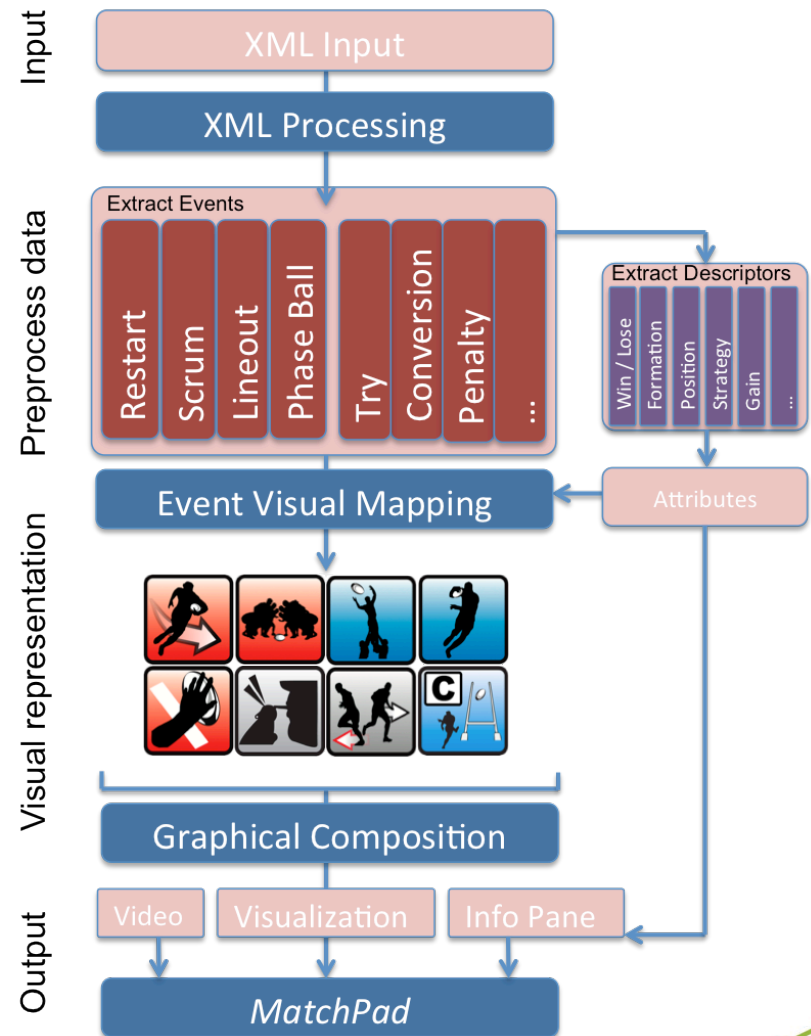
-
- The screenshot displays the SportsCode Elite software interface, which is used for analyzing sports footage. The top section shows a live video feed of a rugby match between Wales and England. Below the video, there's a timeline with various event markers. The bottom section shows a detailed data table with columns for different game events like Delivery, Lineout, Scrum, and Conversion, with numerical data points for each.

Question

- Can Visualization improve sports performance analysis?
- The visualization would need to:
 - Depict most, if not all, annotated events.
 - Link each event to the corresponding video for in-depth review.
 - Facilitate rapid information seeking and in-match decision making.
 - Serve as a visual aid for post-match team and player briefings.
 - Be intuitive, requiring minimal learning and memorization.
 - Operate on portable devices for pitch-side use during matches.

MatchPad Framework

- Four key stages that make up the MatchPad:
 - XML processing.
 - Event Visual Mapping.
 - Graphical Composition.
 - UI Integration.
- Pipeline is constantly repeated to collect real-time match data.



XML Processing

- XML is retrieved from the analyst's workstation at set intervals (e.g., every 15 second).
- The XML contains all recorded match events (up to current play).
- ID, Start / End Time, Event Type, Event Descriptors.
- The pipeline is designed to recognise the semantic textual codes specified in a dictionary for a particular sport or application.

```
<ALL_INSTANCES>
...
<instance>
<ID>29</ID>
<start>86.1200</start>
<end>106.1200</end>
<code>:LINEOUT</code>
<text>ZONE ATTACKING 3RD</text>
<text>L/S/RS WON</text>
<text>From Lineout Full</text>
<text>..CLEAN BALL</text>
<text>.. Delivery Off Top</text>
</instance>
...
<instance>
<ID>46</ID>
<start>163.1500</start>
<end>176.1500</end>
<code>Opposition Scrum</code>
<text>L/S/RS WON</text>
<text>Pen/FK Opposition</text>
<text>ZONE DEFENSIVE 3RD</text>
</instance>
...
</ALL_INSTANCES>
```


Glyph-Based Visual Mapping

- Glyphs are used to depict multivariate data entries.
- Each glyph is composed of a number of visual channels, each of which encodes a specific attribute of the data.
- To fully appreciate the problem, we must first consider the full extent of the data space.



Rugby Data Space (1)

	Match	Team	Player	Outcome	Values	Metaphoric Glyph		Abstract Icon	Shape	Colour
Restart		○		Occurrence						
Drop Kick		○	○	Occurrence						
Scrum		○		Won/Lost						
Lineout		○		Won/Lost						
Ruck		○		Won/Lost						
Maul		○		Won/Lost						
Tackle		○	○	Won/Lost						
Pass		○	○	Won/Lost						

Rugby Data Space (2)

	Match	Team	Player	Outcome	Values	Metaphoric Glyph	Abstract Icon	Shape	Colour
Try	○	○	○	Occurrence		  			
Goal Kick	○	○	○	Score/Miss	C, P, D	  			
Injury	○	○	○	Occurrence		  			
Substitute	○	○	○	Occurrence		  			
Phase Ball	○	○		Occurrence	1 - 10	  			
Territory	○	○		Occurrence	A - D	  			
Referee	○			Occurrence	N, Y, R				
Ball in Play	○			Occurrence					

Design Options

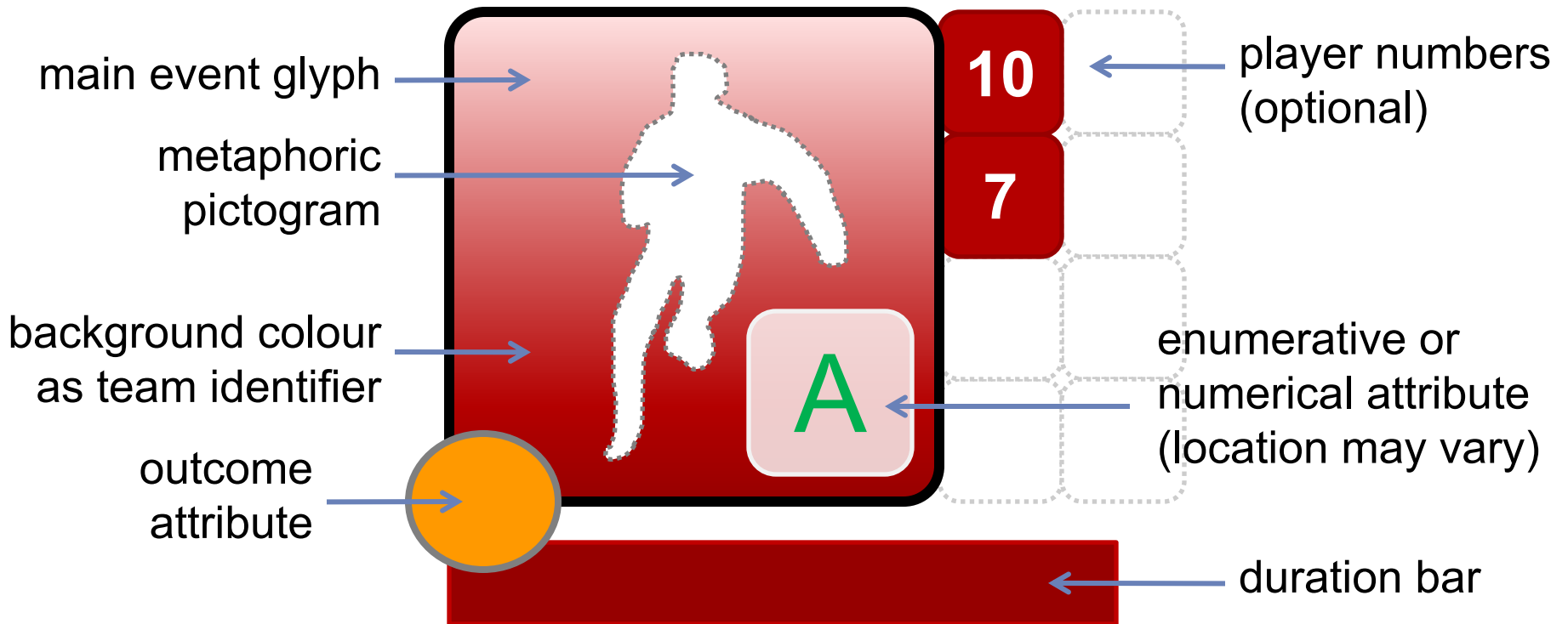
- We consider four design options to represent events:
 - Metaphoric Glyph, Abstract Icon, Shape and Colour.
- Shape and Colour fail due to the large number of events.
- To meet our requirements, event depiction should be easy to learn, memorize and recognize.
- Abstract Icon although better, still requires some learning.
- Metaphoric Glyph is easy to recognize, especially for a domain expert, and requires no learning.

Metaphoric Pictogram

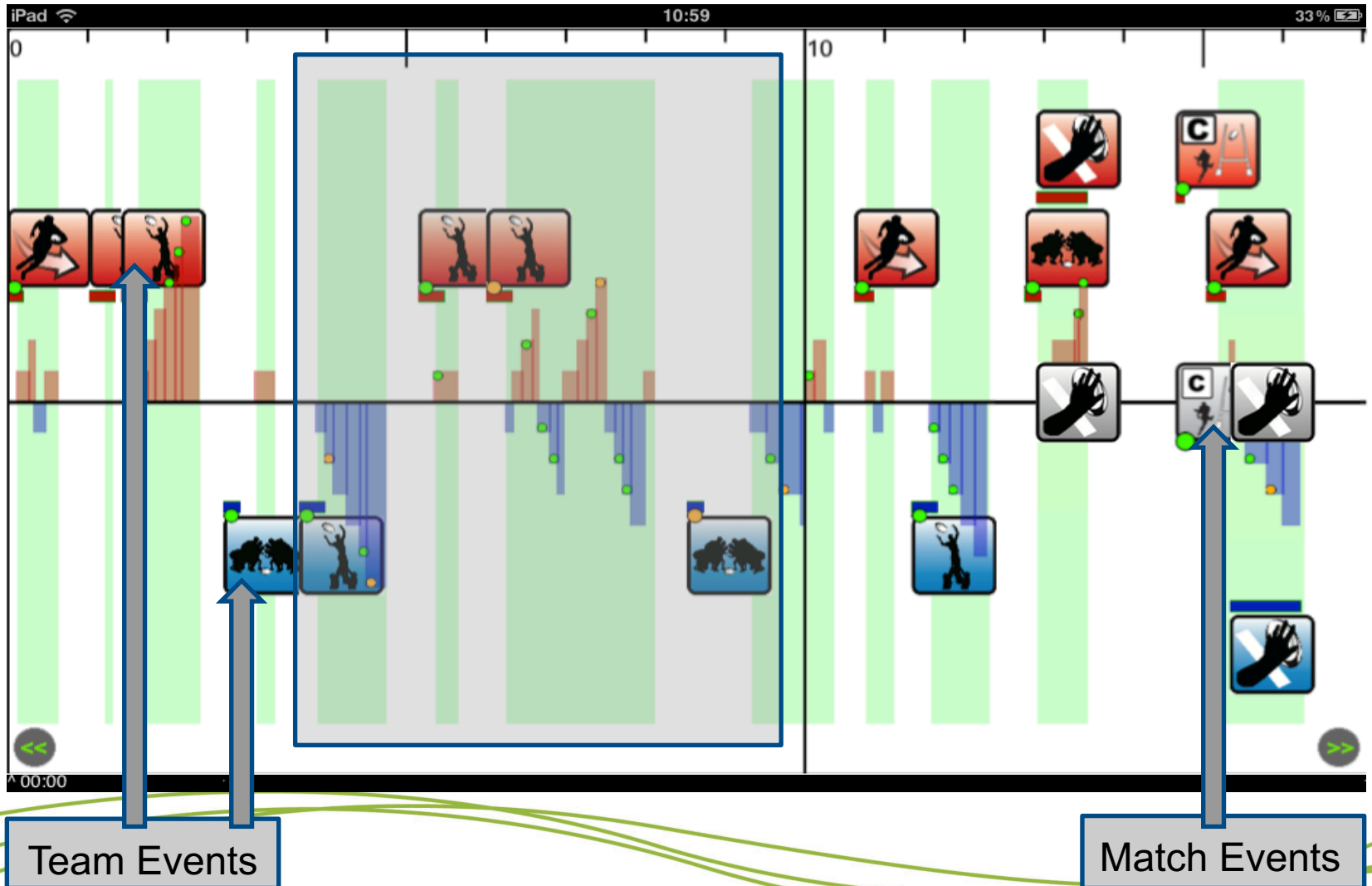
- Metaphoric Glyphs can come in different forms, ranging from abstract representation to photographic icons.
 - Abstract representation – requires learning.
 - Photographic icon – would restrict use of colour channel, distracting, and possibly confusing
- We consider metaphoric designs that lie between these two schemes.



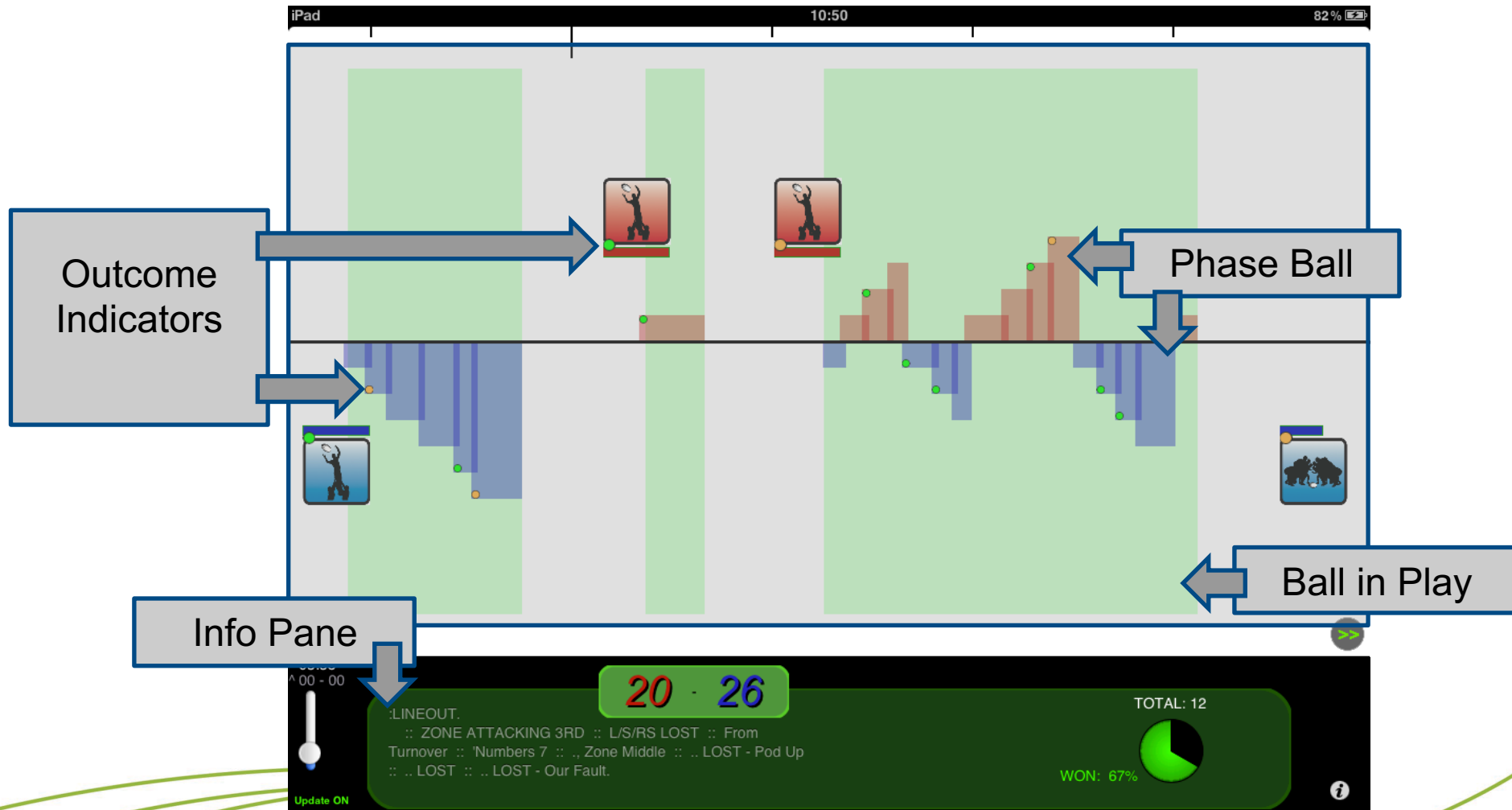
Resultant Glyph Design



MatchPad Interface



MatchPad Interface

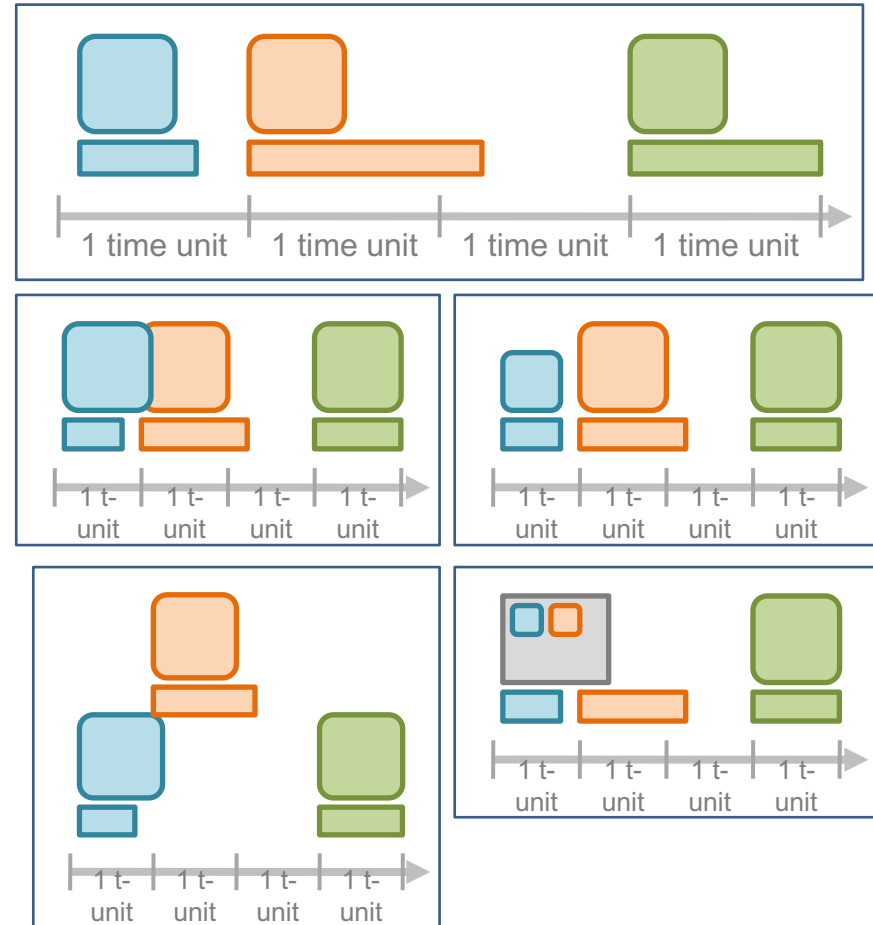


Visualization Interaction

- One of our initial requirements is to support rapid information seeking.
- To support this, we need a fast layout algorithm to respond to user's interactions.
- We utilize intuitive tablet gestures including swiping, pinch-to-zoom, and multi-tap, combined with a scale-adaptive layout to avoid glyph occlusions.

Scale-Adaptive Layout

- As the timeline is condensed, glyphs may become occluded.
- Four layouts are considered in a deterministic approach:
 1. Horizontal stacking
 2. Size reduction
 3. Vertical stacking
 4. Macro glyph



Evaluation – Welsh Rugby Union

The main thing for us is visualizing the data and visualizing it in a very easy to interpret manner.

It is a great tool for oversight when matches are very intense, to see what are the key events and how they interact with each other.

With the iPad it is about portability. We have it with us all the time so when the coach wants to know something we can show it immediately on the MatchPad.



Evaluation – Sports Science



*Greater visual clarity,
and more suitable for
rapid in-match decision
making.*

*Metaphoric glyphs
intuitive to interpret...
other approaches would
require learning and
could be misunderstood.*

*Spatial positioning and
'off-ball' positioning could
also be displayed.*

*How often is a player
involved – quick indicator
of player fatigue.*

*Live possession statistics
would also be beneficial.*

Expansion to Other Sports

- Working with Barnsley FC to adapt the MatchPad for other sports.
- Simply requires replacement of the “event dictionary”.
- Looking to introduce additional features such as live possession from notational analysis.



SportsViz MatchPad Video

Thank you for listening.

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