A new Weaving Technique for Handling Overlapping Regions

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Presenting Overlapping Graphical Objects

Item 1
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Presenting Overlapping Graphical Objects

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Presenting Overlapping Graphical Objects
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Item 1
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Interpretation of Colors:

- Colors with RESERVED meaning can be generated.
- Colors with NO meaning can be generated.
Interpretation of Colors:

- Colors with *RESERVED* meaning can be generated.
- Colors with *NO* meaning can be generated.
Differentiation of Colors:

• Generated colors depend on blending function, involved colors...
Recognition of Shapes:

- Generated intersection areas may be due to different shape configurations.
Recognition of Shapes:

- Generated intersection areas may be due to different shape configurations.

Avoiding Transparency: Weaving

Set of Layers: \( L = l_1 \ldots l_n, n \in N \)

Set of Involved Layers: \( IL(x, y) \subset L \)

Selection Function: \( f_{\text{selection}}(x, y) \in IL(x, y) \)
Random Weaving


Selection Function:

\[ f_{selection}(x, y) = \text{random}(IL(x, y)) \]
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Selection Function:

\[ f_{\text{selection}}(x, y) = \text{random} \left( IL(x, y) \right) \]
Stack: \( \langle l_1 \ldots l_n \rangle \)_{column}
Stack: \( x = 0 \) \( \langle l_1l_2l_3l_4 \rangle_0 \)
Stack-Aligned Weaving

Stack:  
\[
\begin{align*}
  x = 0 & \quad \langle l_1 l_2 l_3 l_4 \rangle_0 \\
  x = 1 & \quad \langle l_2 l_3 l_4 l_1 \rangle_1 \\
  x = 2 & \quad \langle l_3 l_4 l_1 l_2 \rangle_2 \\
  x = 3 & \quad \langle l_4 l_1 l_2 l_3 \rangle_3
\end{align*}
\]

\[\text{n Stacks}\]
Stack-Aligned Weaving
Aligned Weaving

Stack-Aligned Weaving

$I_1$

$I_2$

$I_3$

$I_4$
Aligned Weaving

Stack-Aligned Weaving

\( I_1 \)

\( I_2 \)

\( I_3 \)

\( I_4 \)
Aligned Weaving

Stack-Aligned Weaving

\[ I_1 \]
\[ I_2 \]
\[ I_3 \]
\[ I_4 \]
Stack-Aligned Weaving
Stack-Aligned Weaving
Aligned Weaving

Stack-Aligned Weaving

\[ I_1 \]
\[ I_2 \]
\[ I_3 \]
\[ I_4 \]
Stack-Aligned Weaving

Selection Function:

\[ f_{selection}(x, y) = l_{top} \mid l_{top} \text{ is topmost in} \]
\[ \langle \ldots \rangle_{(x \mod n)} \text{ that is } \epsilon \text{ IL}(x, y) \]
Aligned Weaving

Modulo-Aligned Weaving

![Aligned Weaving Diagram]

- $I_1$
- $I_2$
- $I_3$
- $I_4$
Aligned Weaving

Modulo-Aligned Weaving

\[ x = 0 \ 1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9 \]
Aligned Weaving

Modulo-Aligned Weaving

\[ x = 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 \]

\[ k = 3 \quad 3 \quad 3 \quad 2 \quad 2 \quad 2 \quad 2 \quad 3 \quad 3 \quad 3 \]

\[ l_1, l_2, l_3, l_4 \]
Aligned Weaving

Modulo-Aligned Weaving

x \mod k

\begin{array}{cccccccccc}
x = 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\
\end{array}

k = 3 \quad 3 \quad 3 \quad 2 \quad 2 \quad 2 \quad 2 \quad 3 \quad 3 \quad 3
Modulo-Aligned Weaving

\( x = 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 \)
Selection Function:

\[ f_{selection}(x, y) = l_{mod} \mid l_{mod} \in IL(x, y) \text{ is } m^{th} \text{ element} \]

in \([ \ ]_x\); \( m = x \mod k; \ k = |IL(x, y)| \)
Application

Scatterplot: Overlapping
Application

Scatterplot: Random Weaving
Application

Scatterplot: Stack-Aligned Weaving
Application

Scatterplot: Stack-Aligned Weaving
Application

Transparency

Random Weaving

Stack-Aligned Weaving
Application

Scatterplot (Conv. Hull): Transparency


Application

Scatterplot (Conv. Hull): Modulo-Aligned Weaving
Interacting with Overlapping Graphical Objects

Picking
Picking (with Transparency)
Splat

G. Ramos et. al.
Interacting with Overlapping Graphical Objects

Splat
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Splat

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Interacting with Overlapping Graphical Objects

Layers Palette

Layers
- Layer 1
- Layer 2
- Layer 3
- Layer 4
Interacting with Overlapping Graphical Objects

New: Weaving

Selecting: $l_4$
Interacting with Overlapping Graphical Objects

New: Weaving

Selecting: \( I_3 \)
Task: Select and move shape to target area
Recorded Data: Time to Completion, Error Rate
Comparing Interaction Approaches

Time to Completion

Error Rate

- layer pal.
- transp.
- modulo-w.
- stack-w.
- splatter

5 Shapes

8 Shapes
Weaving presents overlapping objects without distortion or color generation.
Differentiation of colors and shape recognition are improved by Aligned Weaving.
Useful for interacting with overlapping objects.
Introduces (distracting) noise.

Future
- locally adapted patterns
- improved aesthetics (e.g., metrics from halftoning)
- application to 3D
THANKS FOR YOUR ATTENTION!

QUESTIONS WELCOME!