

Renderização de transparência com depth peeling

MATA65 - Computação Gráfica

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“Interactive Order-Independent
Transparency” (Cass Everitt, 2001)

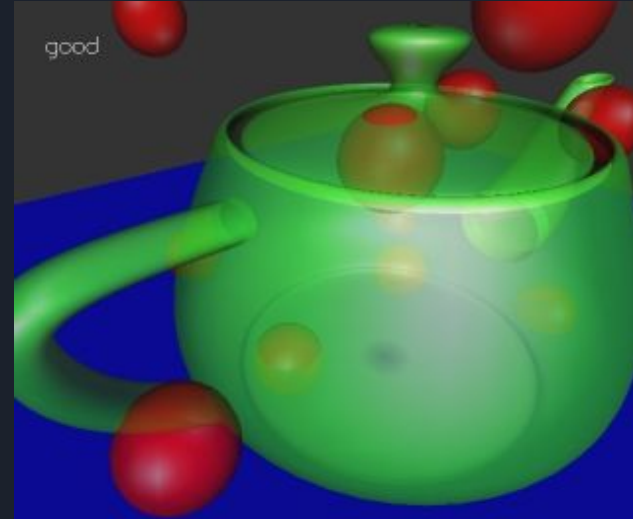
“Efficient Depth Peeling via Bucket
Sort” (Fang Liu et al, 2009)

Motivação

- Renderização de cenas com transparência



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“Interactive Order-Independent Transparency” (Cass Everitt, 2001)



Motivação

- Renderização clássica de transparência
 - Assume objetos ordenados por profundidade
 - Calcula cor do fragmento considerando componente alpha

$$\text{Color} = \alpha \cdot \text{FrontColor} + (1 - \alpha) \cdot \text{BackColor}$$

Motivação

- Renderização clássica de transparência
 - Lembra o Algoritmo do Pintor
 - Limitações
 - Objetos raramente estão ordenados

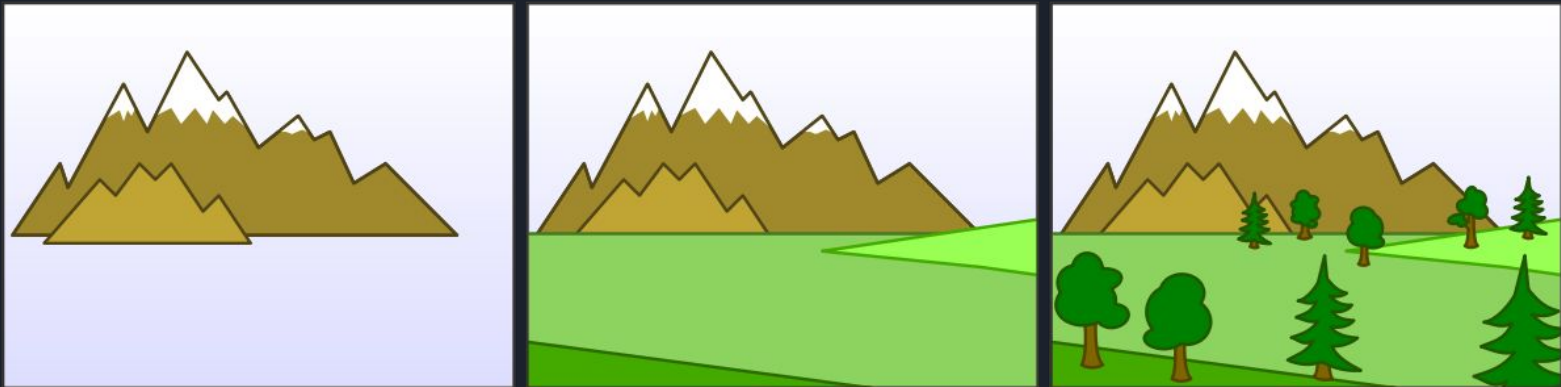


Imagem do Wikimedia Commons

Motivação

- Renderização clássica de transparência
 - Limitações
 - Pode inexistir ordenação válida

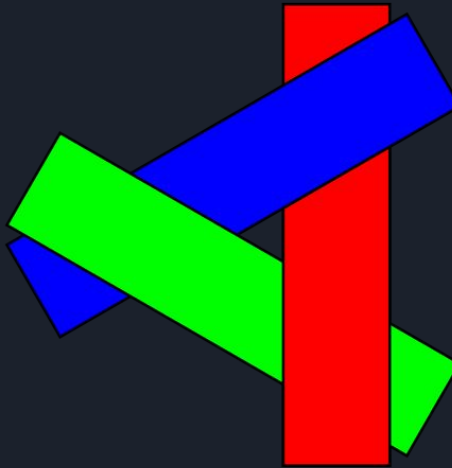
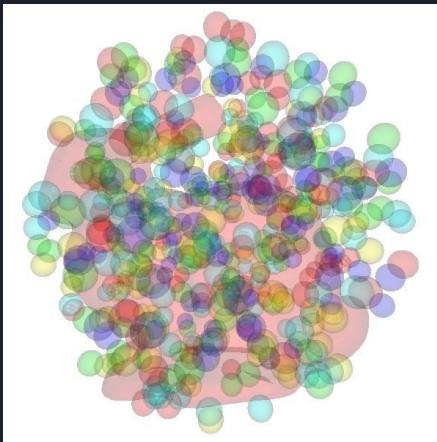


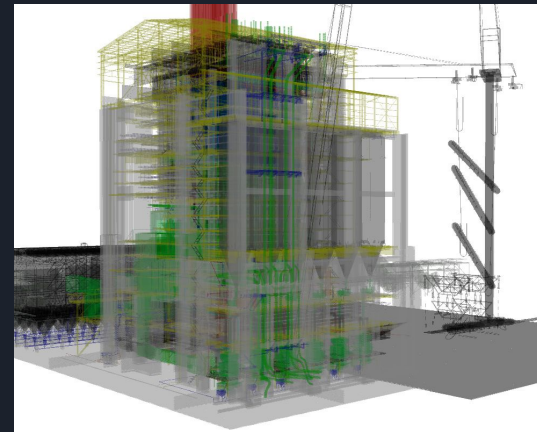
Imagem do Wikimedia Commons

Objetivo

- Renderização de cenas com transparência
 - Eficiente
 - Independente de ordem
- Soluções na etapa de rasterização



“Efficient Depth Peeling via Bucket Sort” (Fang Liu et al, 2009)



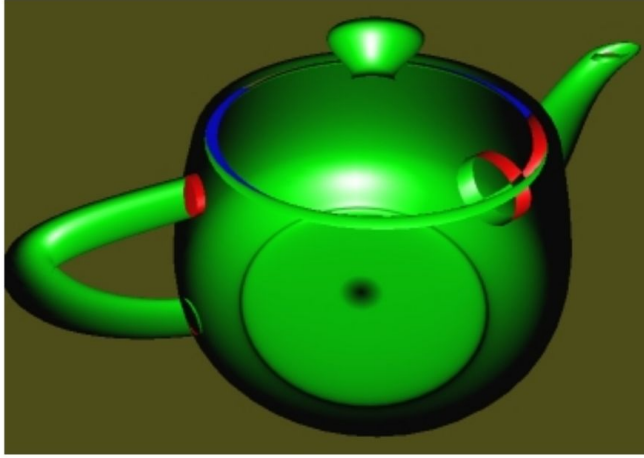
“Efficient Depth Peeling via Bucket Sort” (Fang Liu et al, 2009)

Depth peeling

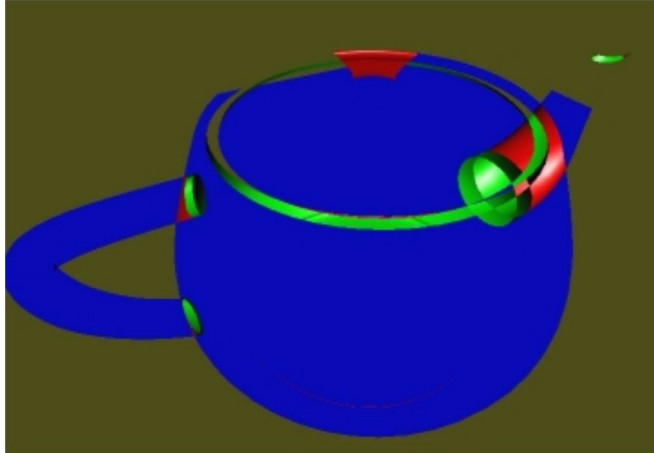
Layer 0



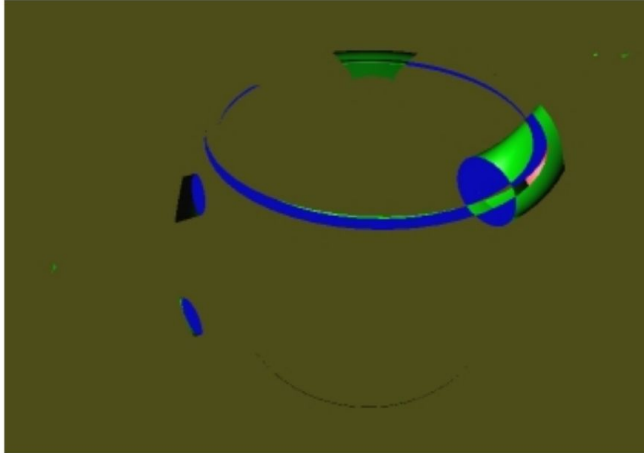
Layer 1



Layer 2



Layer 3



“Interactive
Order-Independent
Transparency” (Cass
Everitt, 2001)

Depth peeling

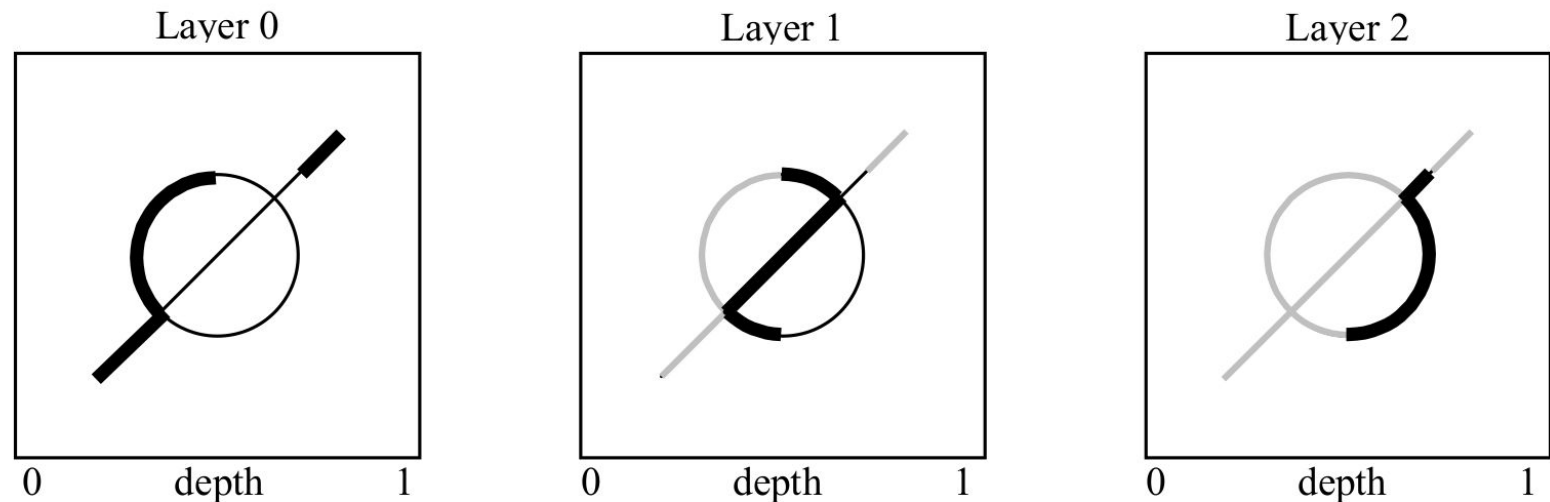
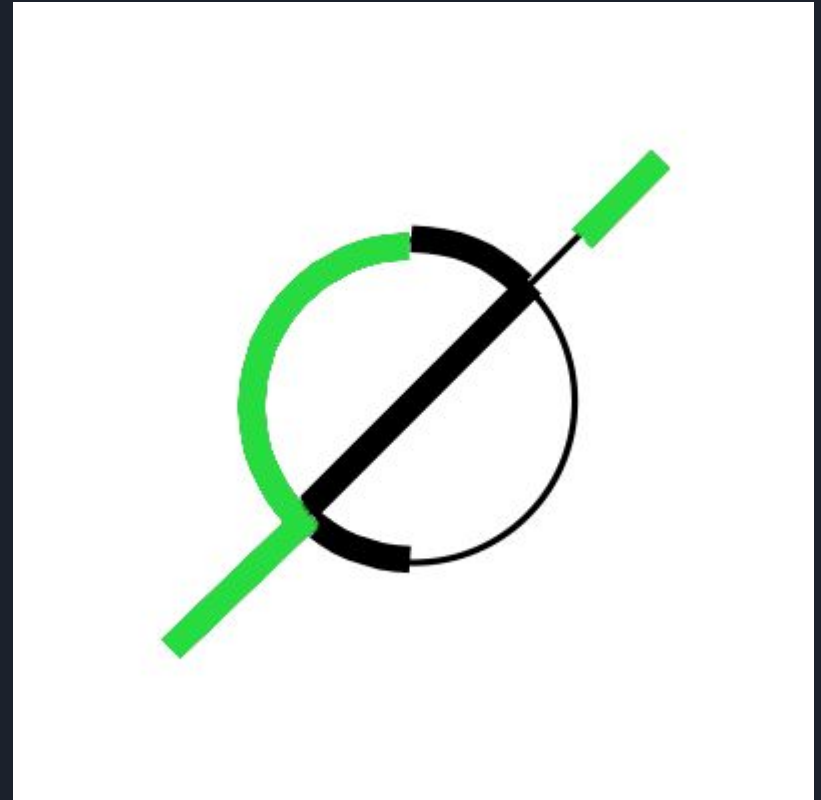
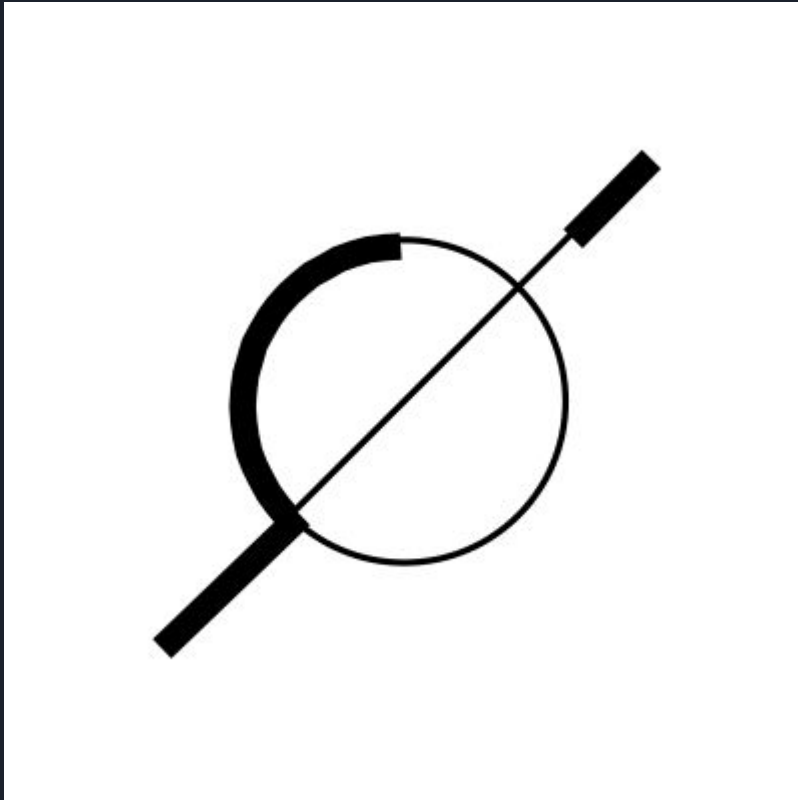


Figure 4. Depth peeling strips away depth layers with each successive pass. The frames above show the frontmost (leftmost) surfaces as bold black lines, hidden surfaces as thin black lines, and “peeled away” surfaces as light grey lines.

“Interactive Order-Independent
Transparency” (Cass Everitt, 2001)

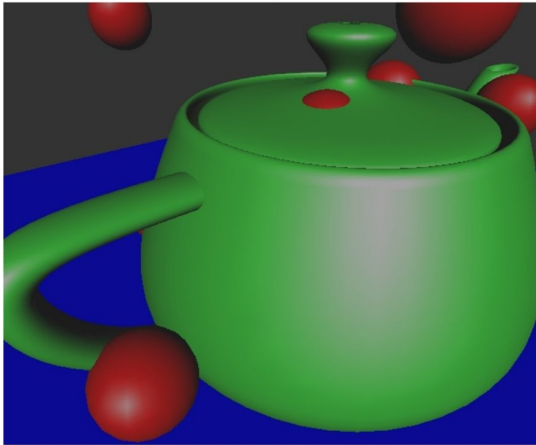
Dual-depth buffer depth peeling



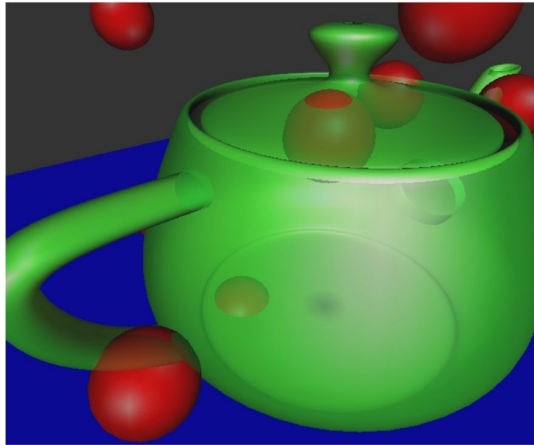
Adaptada de “Interactive
Order-Independent Transparency”
(Cass Everitt, 2001)

Depth peeling

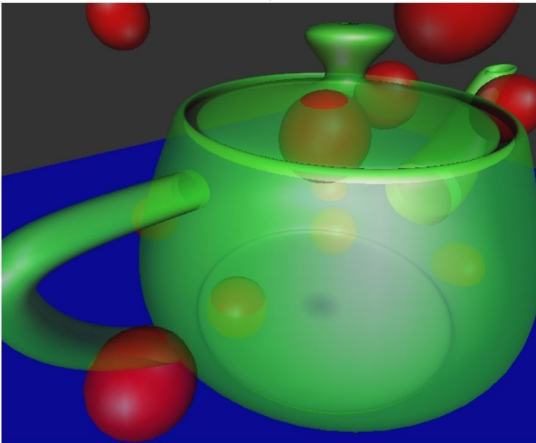
1 layer



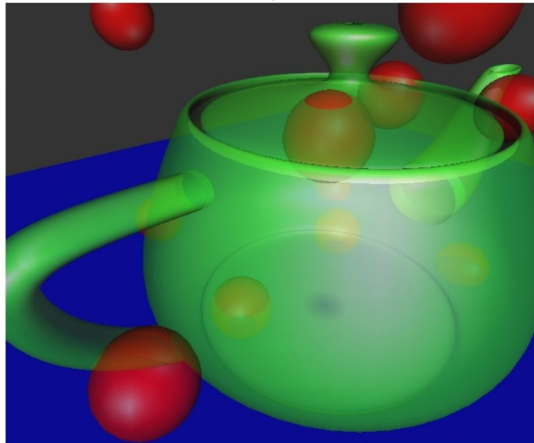
2 layers



3 layers



4 layers



“Interactive
Order-Independent
Transparency” (Cass
Everitt, 2001)

Bucket depth peeling

- Requer apenas dois passes
 - Primeiro passe: ordenação dos fragmentos
 - Segundo passe: cálculo de cor do pixel

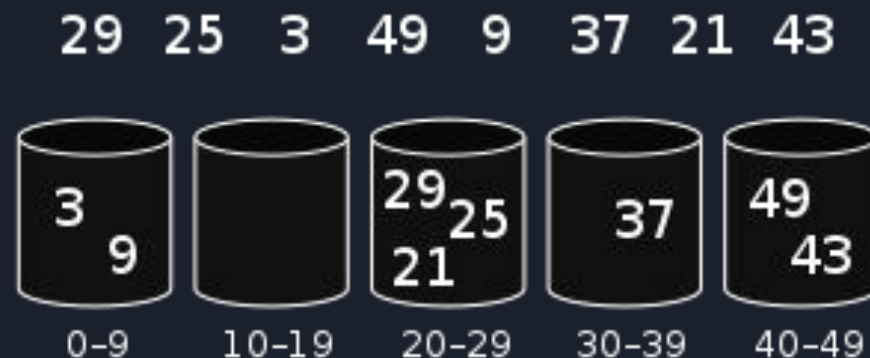


Imagem adaptada do Wikimedia Commons



Bucket depth peeling

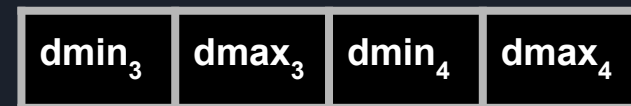
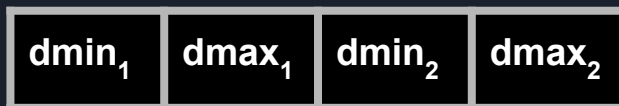
- Conceitos
 - Para cada pixel:
 - $zNear$
 - $zFar$
 - Divisão uniforme de $[zNear, zFar]$ em 16 subintervalos
 - Intervalo pode ser calculado em tempo constante

$$k = \left\lfloor 16 \cdot \frac{d_f - zNear}{zFar - zNear} \right\rfloor$$



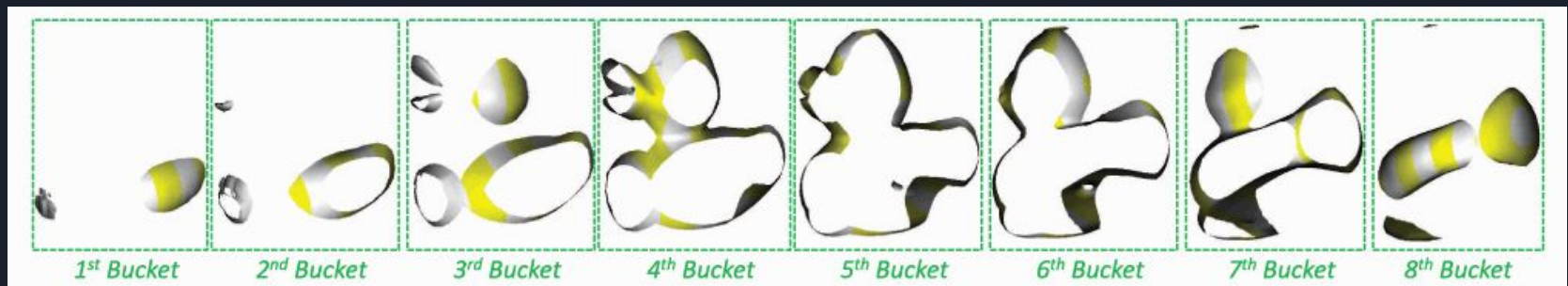
Bucket depth peeling

- Implementação
 - Para cada um dos 16 intervalos, são mantidos dois valores (buckets)
 - $dmin_k$
 - $dmax_k$
 - Buffers MRT
 - MAX/MIN blending
 - Não sofre com RMW
 - $(dmin_k, dmax_k)$ sofre MAX-blending com $(1 - d_f, d_f)$



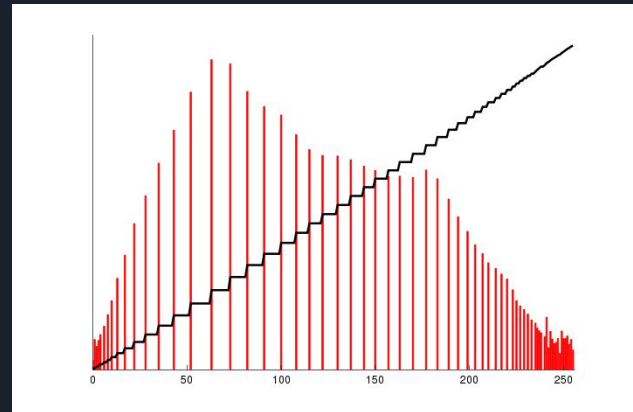
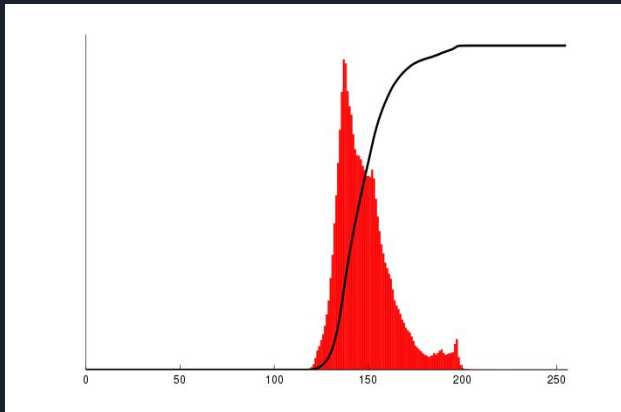
Bucket depth peeling

- Consegue renderizar até 32 camadas
- Acurácia
 - Funciona bem para cenas uniformemente distribuídas
 - Poucas colisões
 - Gera artefatos para cenas mal distribuídas
 - Colisões frequentes
- Variação: multi-pass

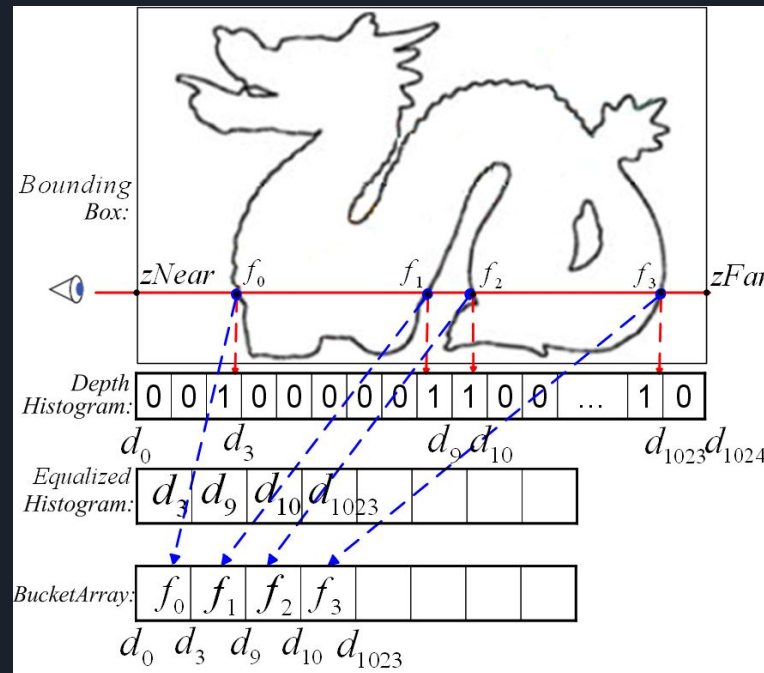


Adaptada de “Depth-Fighting Aware Methods for Multifragment Rendering” (A. Vasilakis & I. Fudos, 2013)

Adaptive bucket depth peeling



Adaptive bucket depth peeling



“Efficient Depth Peeling via Bucket Sort” (Fang Liu et al, 2009)

Resultados



BDP



BDP2



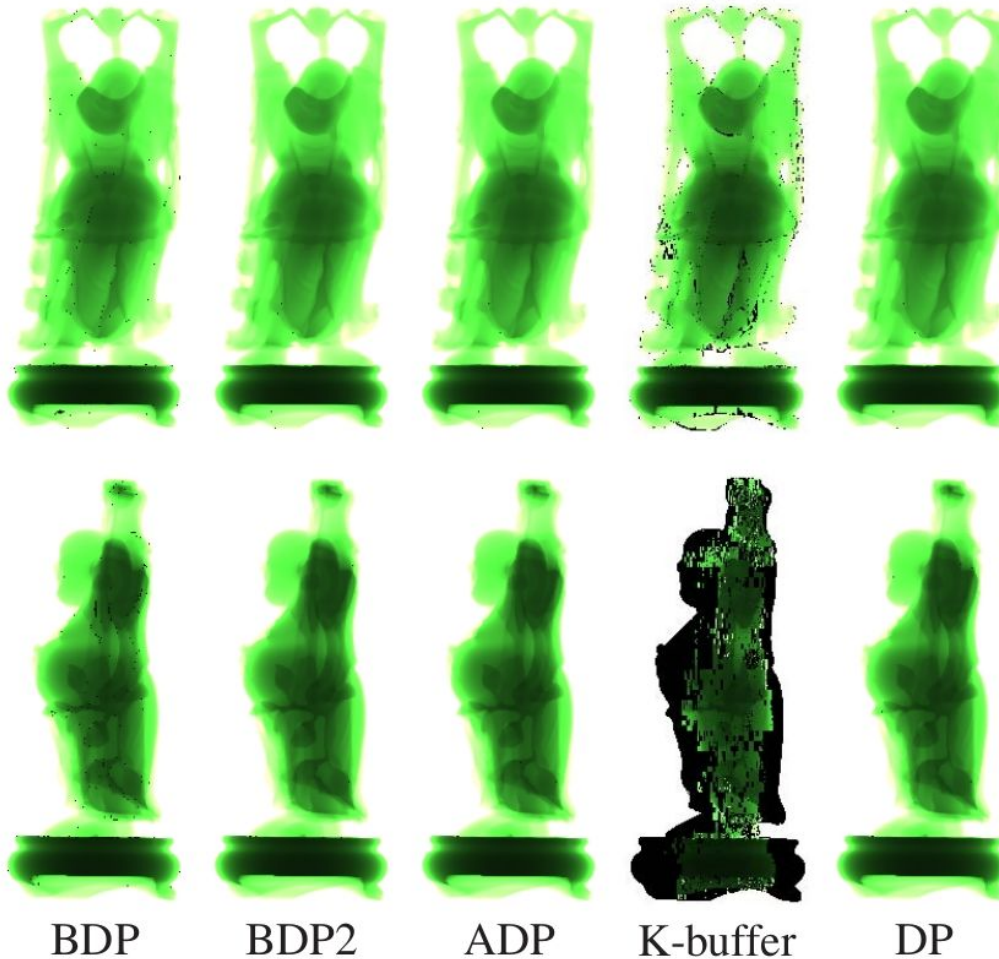
ADP



DP

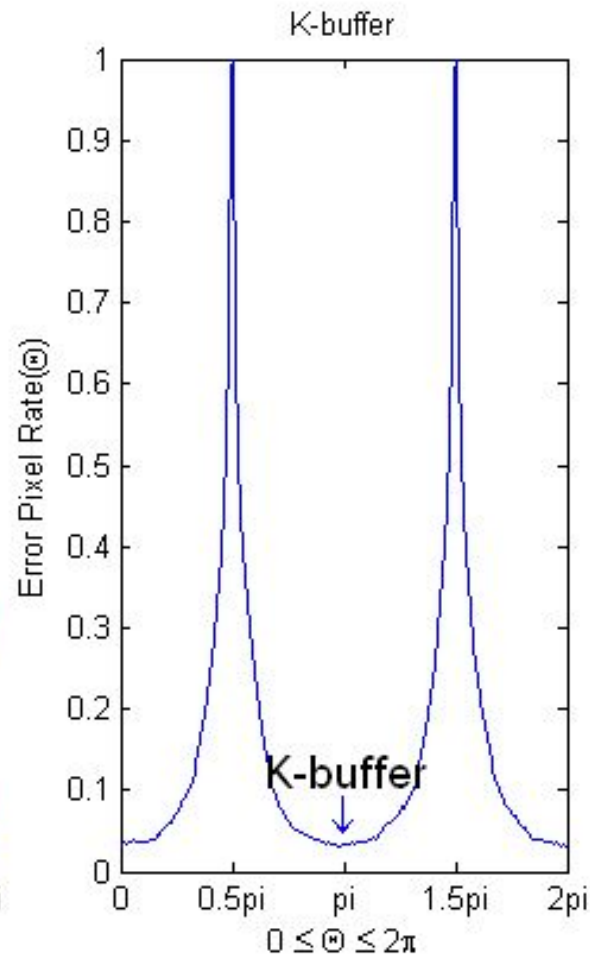
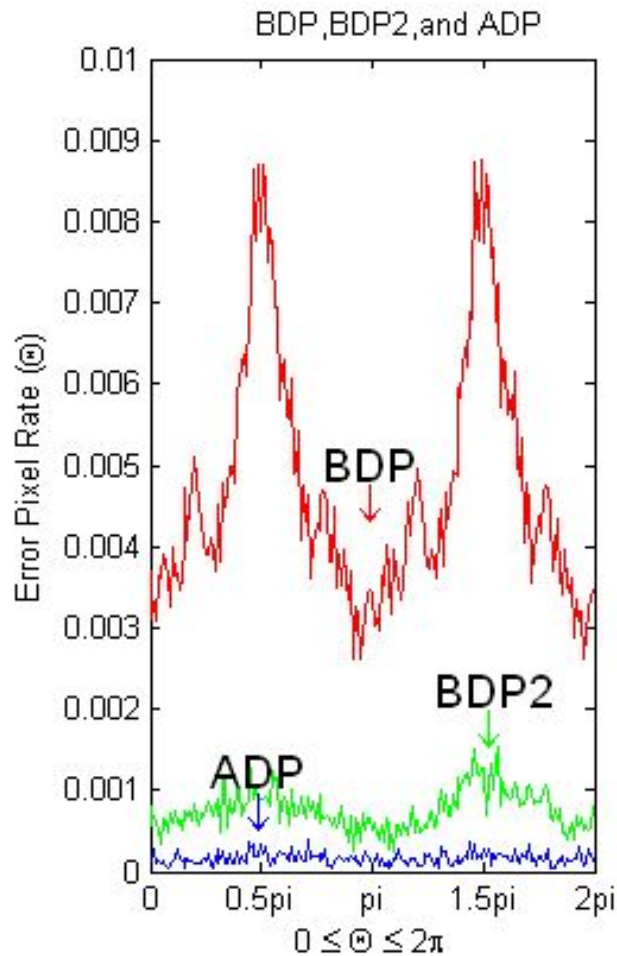
“Efficient Depth Peeling
via Bucket Sort” (Fang
Liu et al, 2009)

Resultados



“Efficient Depth Peeling
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Resultados



“Efficient Depth Peeling
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Resultados

Model	Dragon	Buddha	Powerplant	Lucy	Stpauls
Tri No.	871K	1,087K	12,748K	28,055K	14K
BDP	256fps	212fps	24.15fps	10.93fps	434fps
BDP2	128fps	106fps	12.79fps	5.71fps	256fps
ADP	106fps	91fps	12.31fps	5.37fps	212fps
K-buffer	206fps	183fps	23.98fps	10.49fps	468fps
[Liu 2006]	49fps	39fps	0.83fps	0.75fps	155fps
	5g	6g	27g	14g	22g
Dual DP	37fps	32fps	1.34fps	0.87fps	199fps
	8g	8g	16g	12g	14g
DP	24fps	20fps	0.76fps	0.54fps	242fps
	13g	13g	32g	21g	26g

“Efficient Depth Peeling via Bucket Sort” (Fang Liu et al, 2009)



Perguntas?