Дизайн на 3D модели

Модели на осветяване.

Фотореалистични и нефотореалистични визуализации.

Материали и Текстури. BRDF, BSDF, BSSRDF, SSS и др.

доц. д-р Александър Пенев

Видове
Модели на Осветяване

Модели на осветяване

- Локални
  - Нереалистични;
  - Реалистични;
- Глобални
  - Реалистични;
  - Фото-реалистични;
  - Нефотореалистични;

Фото-реалистична Визуализация

Шрек

Аватар

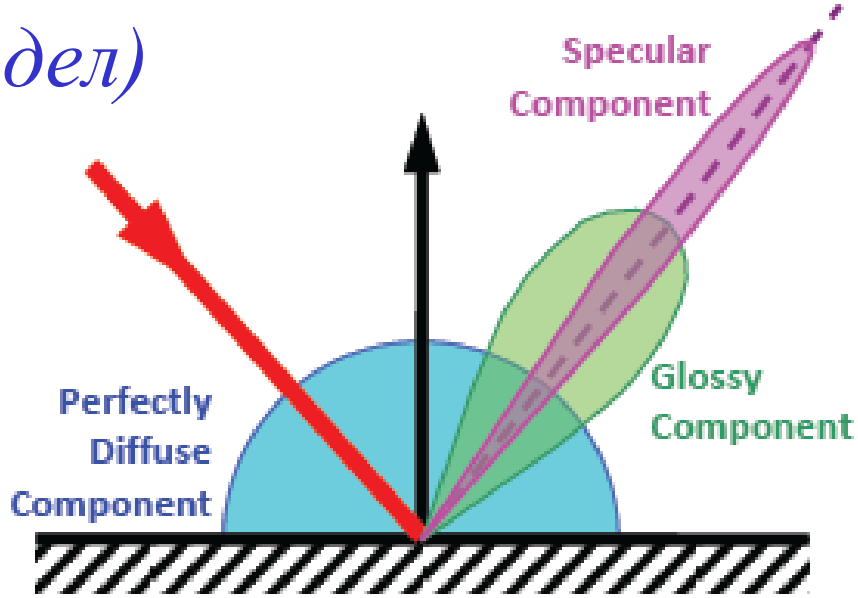
НЕфотореалистична Визуализаци

Използва се „NPR“ Rendering на тримерни сцени с използването на специални shader-и, които са проектирани така, че да се постигне ефект на рисувани на ръка изображения.

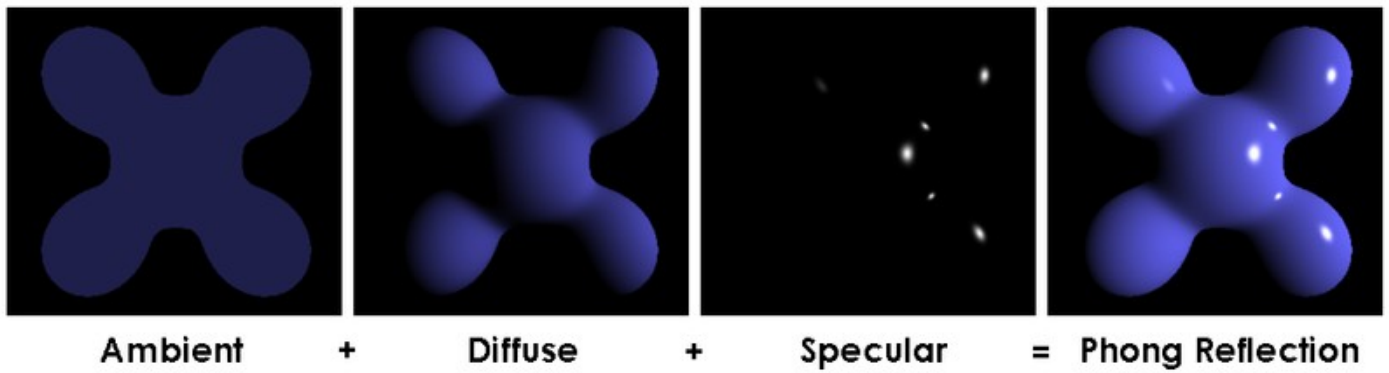
Моделиране на Светлината

Светлината в КГ (базов модел)

- Фонова, Обкръжаваща;
  Ambient
- Дифузно отразена;
  Diffuse
- Огледално отразена;
  Specular
- Излъчена;
  Emissive



Изображение от Brad Smith

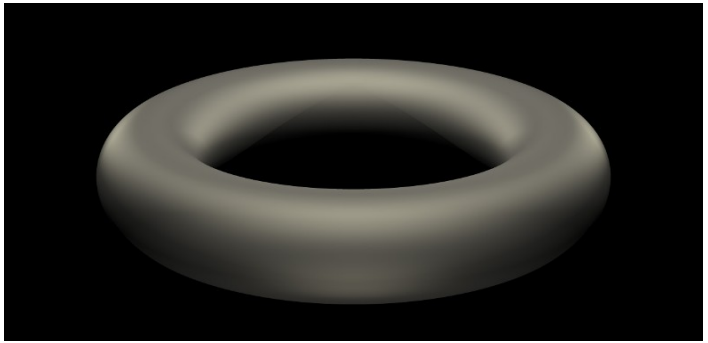


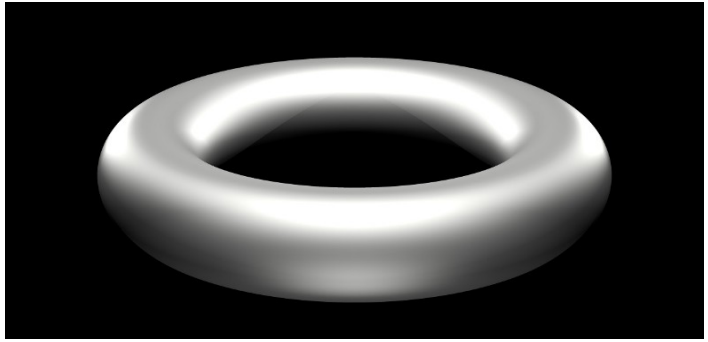
Материали

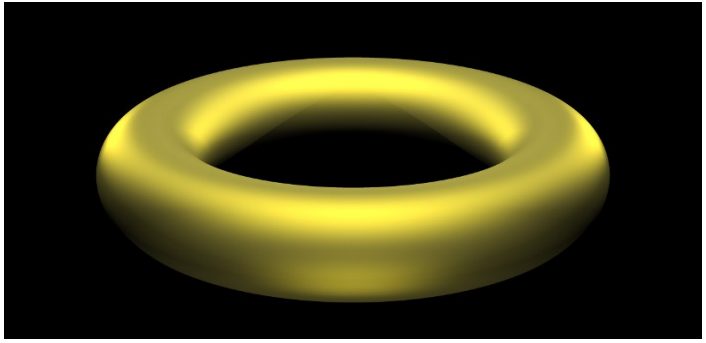
Материали

- Описват пространственото разпределение на коефициентите на отражение на светлината;
- Покомпонентно описание на това как се отразяват отделните „видове светлина“;
- Други характеристики на материала;

Материали







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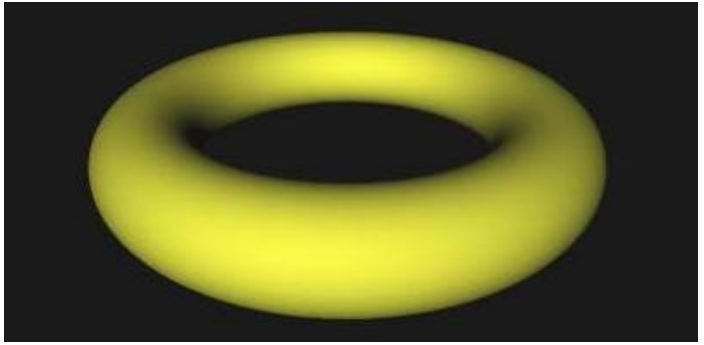
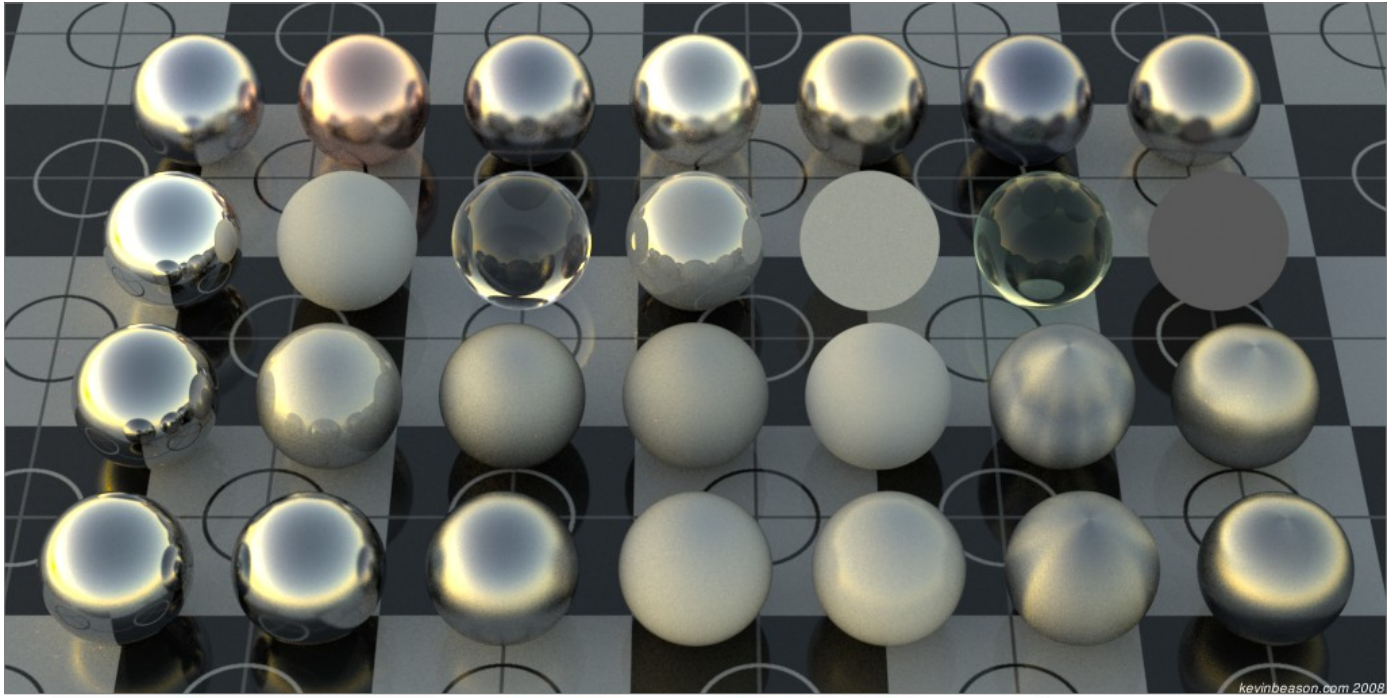
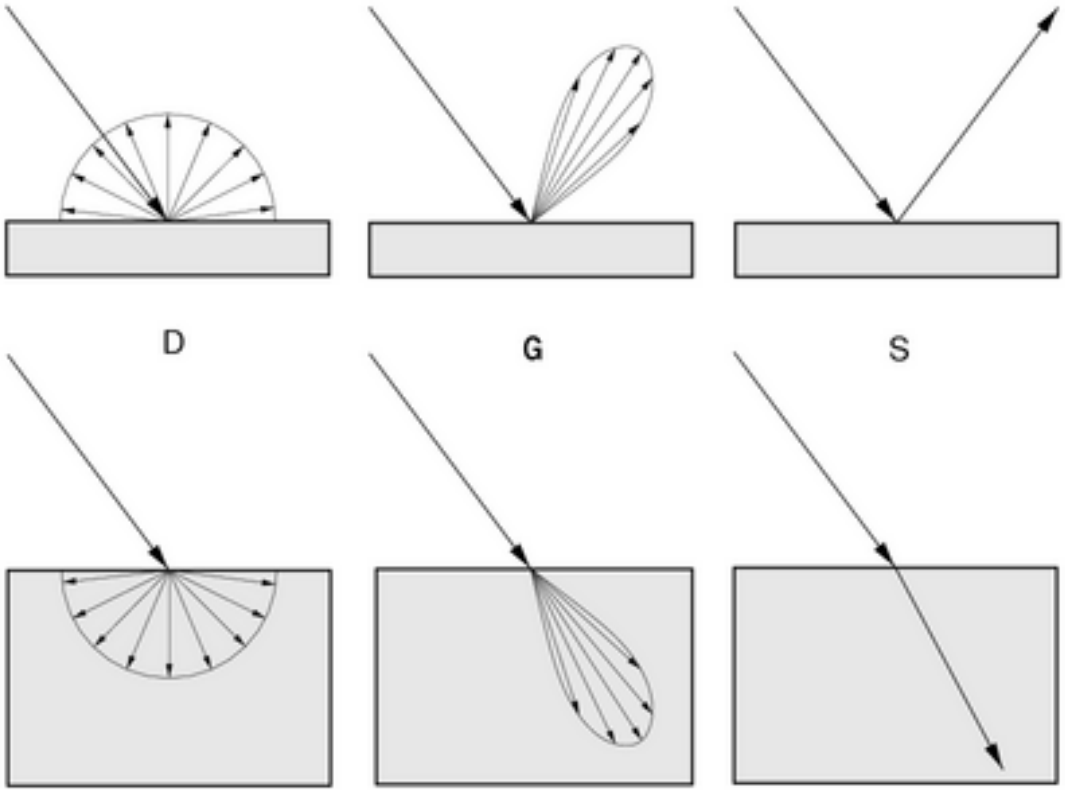
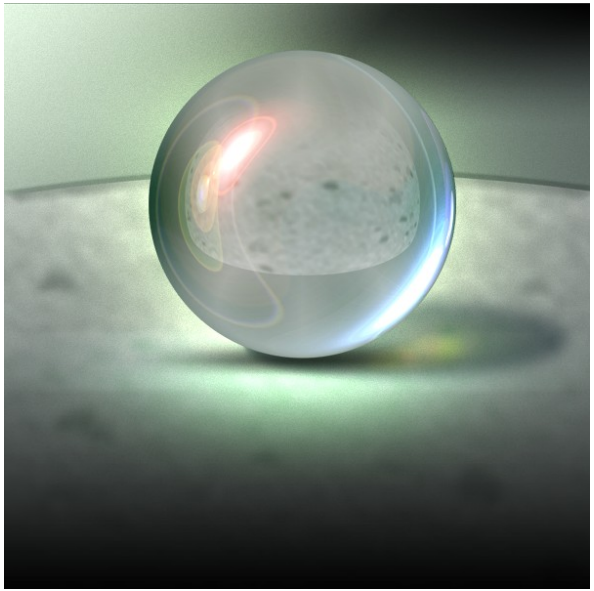


Материали



Прозрачни Материали



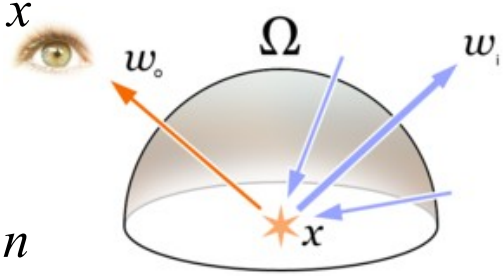


BRDF. BSSRDF. BSDF. SSS...

Основно уравнение (уравнение на Kajiya)

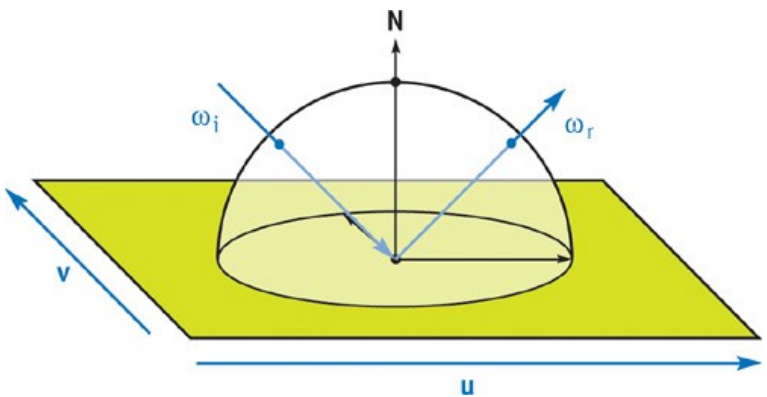
$$L_o(x,\omega_o,\lambda,t)=L_e(x,\omega_o,\lambda,t)+\int_\Omega f_r(x,\omega_i,\omega_o,\lambda,t)\,L_i(x,\omega_i,\lambda,t)(\omega_i\cdot n)\,d\,\omega_i$$

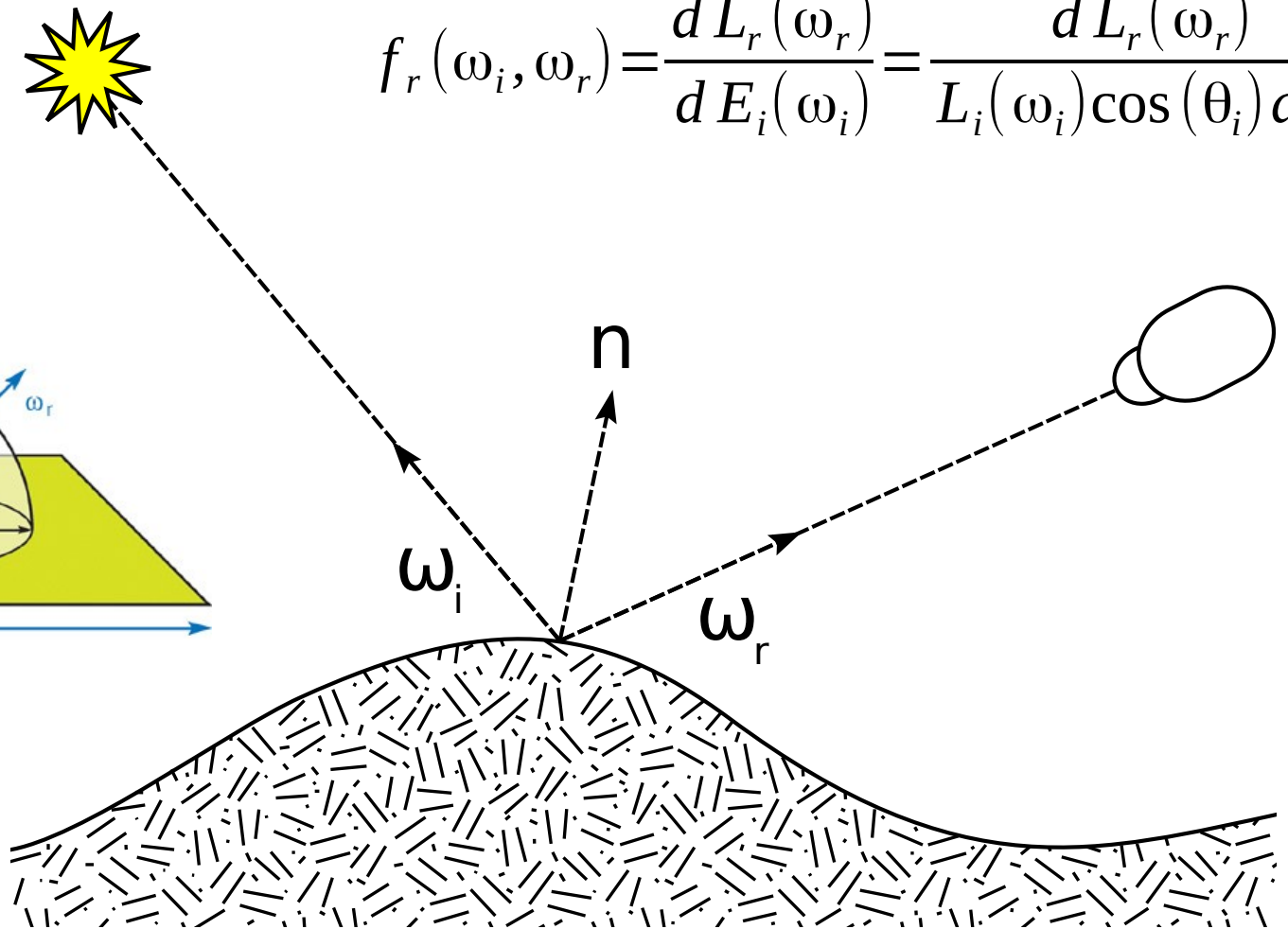
λ	Дължина на вълната
t	Момента от времето
n	Нормален вектор към повърхността
x	Точката в пространството за която се пресмята
ω_o	Направлението на изходящата светлина
ω_i	Посоката обратна на идващата светлина
$L_o(x,\omega_o,\lambda,t)$	Общата светлинна енергия за дължина на вълната λ
$L_e(x,\omega_o,\lambda,t)$	Общата излъчена от тялото светлина в x
$L_i(x,\omega_i,\lambda,t)$	Светлината идваща от ω_i
$\int_\Omega \ldots$	Интеграл по полусферата Ω
Ω	Единична полусфера центрирана спрямо n
$f_r(x,\omega_i,\omega_o,\lambda,t)$	BRDF функция опраделяща часта от светлината от ω_i отразена към ω_o



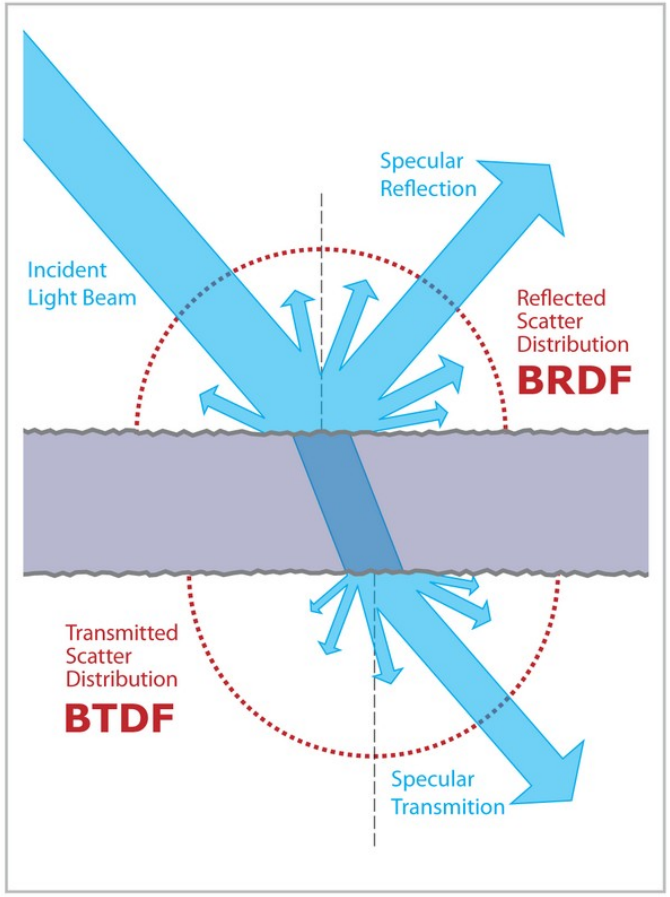
BRDF

$$f_r(\omega_i, \omega_r) = \frac{dL_r(\omega_r)}{dE_i(\omega_i)} = \frac{dL_r(\omega_r)}{L_i(\omega_i)\cos(\theta_i)\,d\omega_i}$$



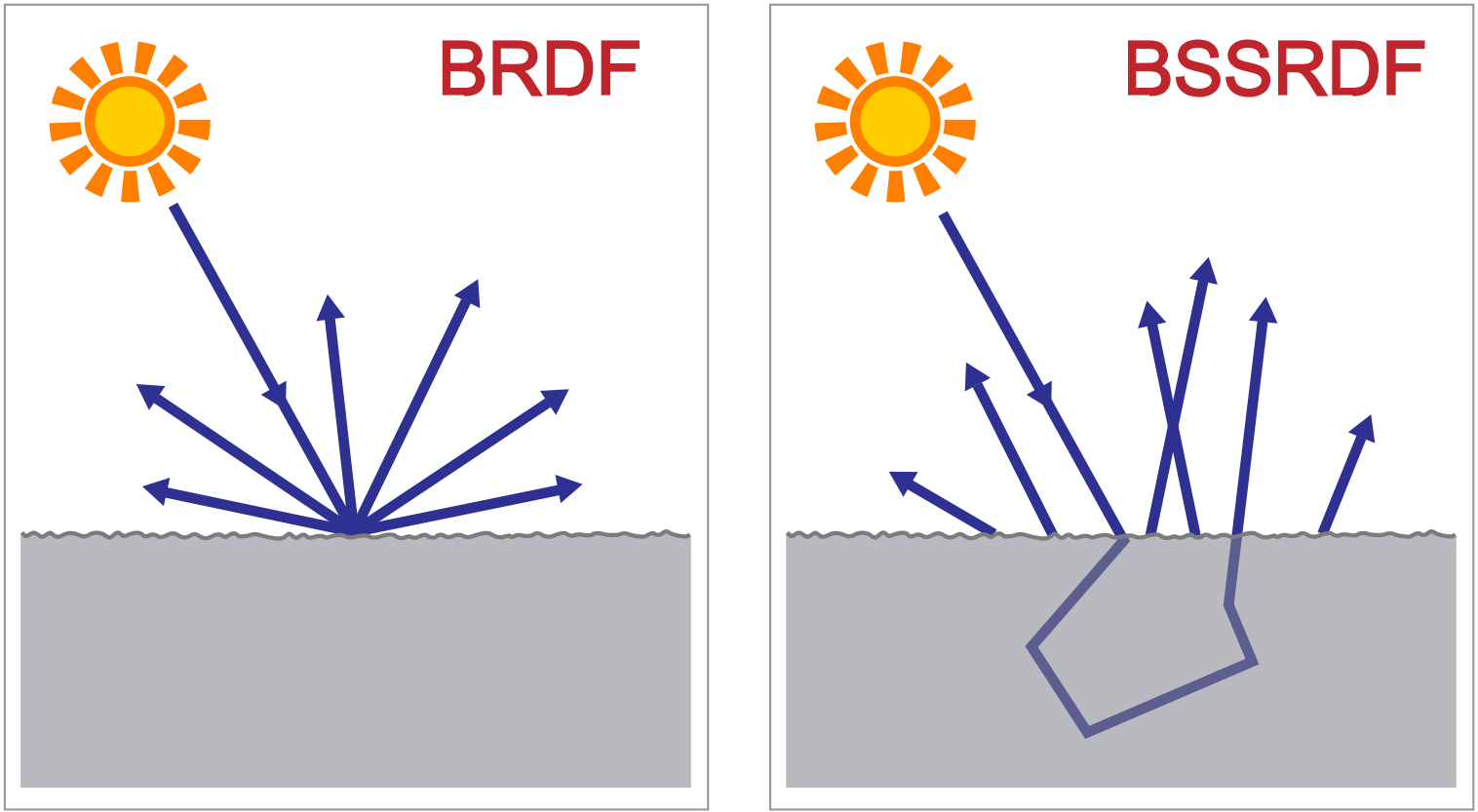


$BSDF = BRDF + BTDF$

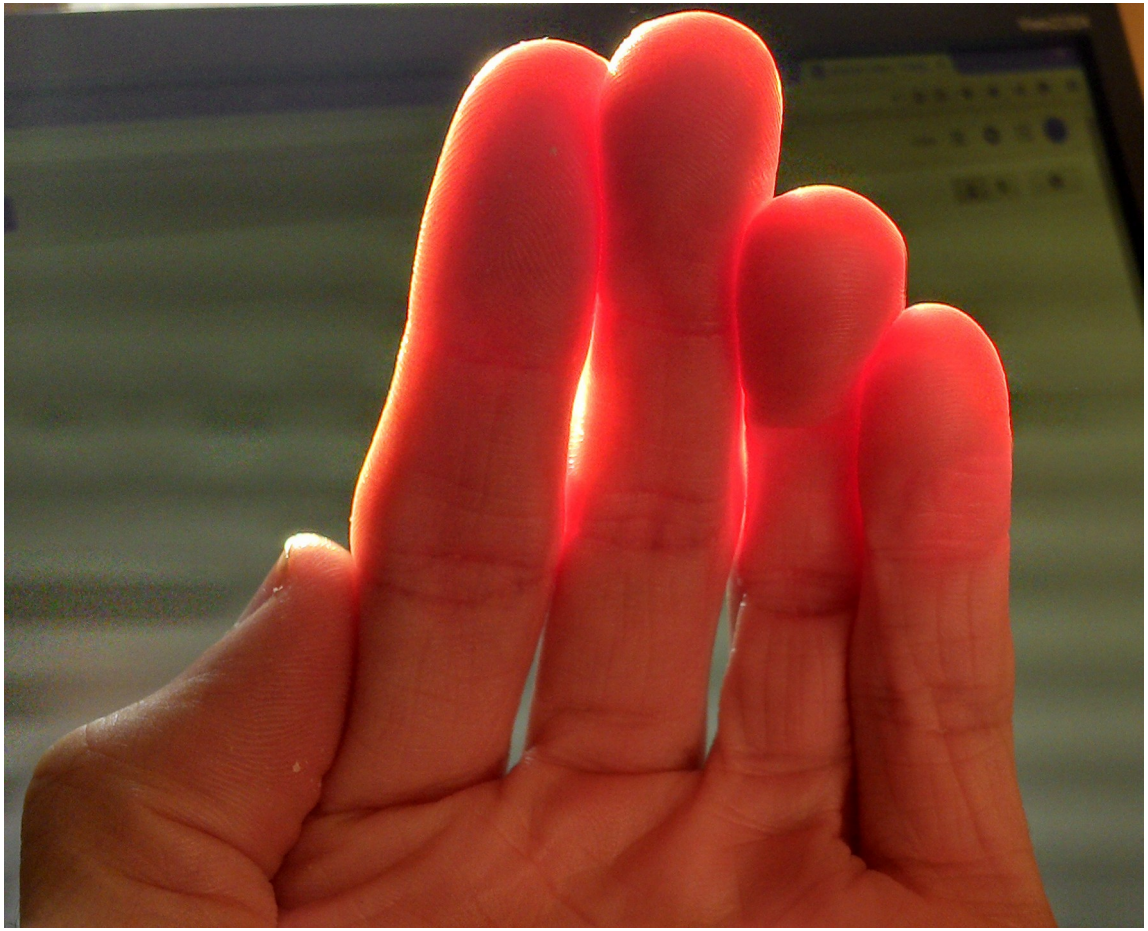


Модела BSDF (Bidirectional Scattering Distribution Function) добавя към модела BRDF, коефициенти определящи пространственото разпределение при пречупване на светлината – BTDF (Bidirectional Transmittance Distribution Function).

BSSRDF (Bidirectional Scattering-Surface RDF)

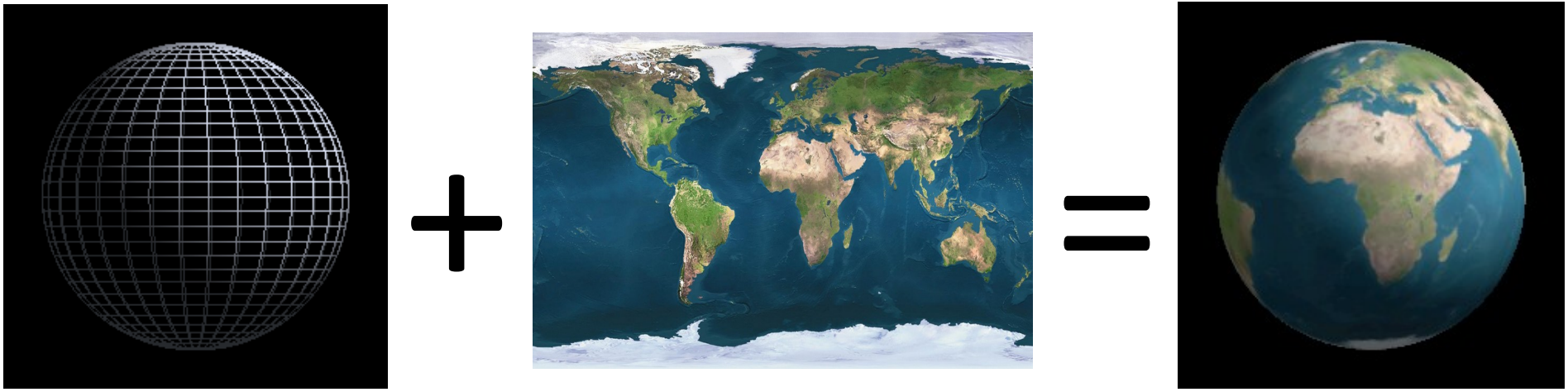


SSS (Subsurface scattering)



Текстури

Текстури



Геометрия

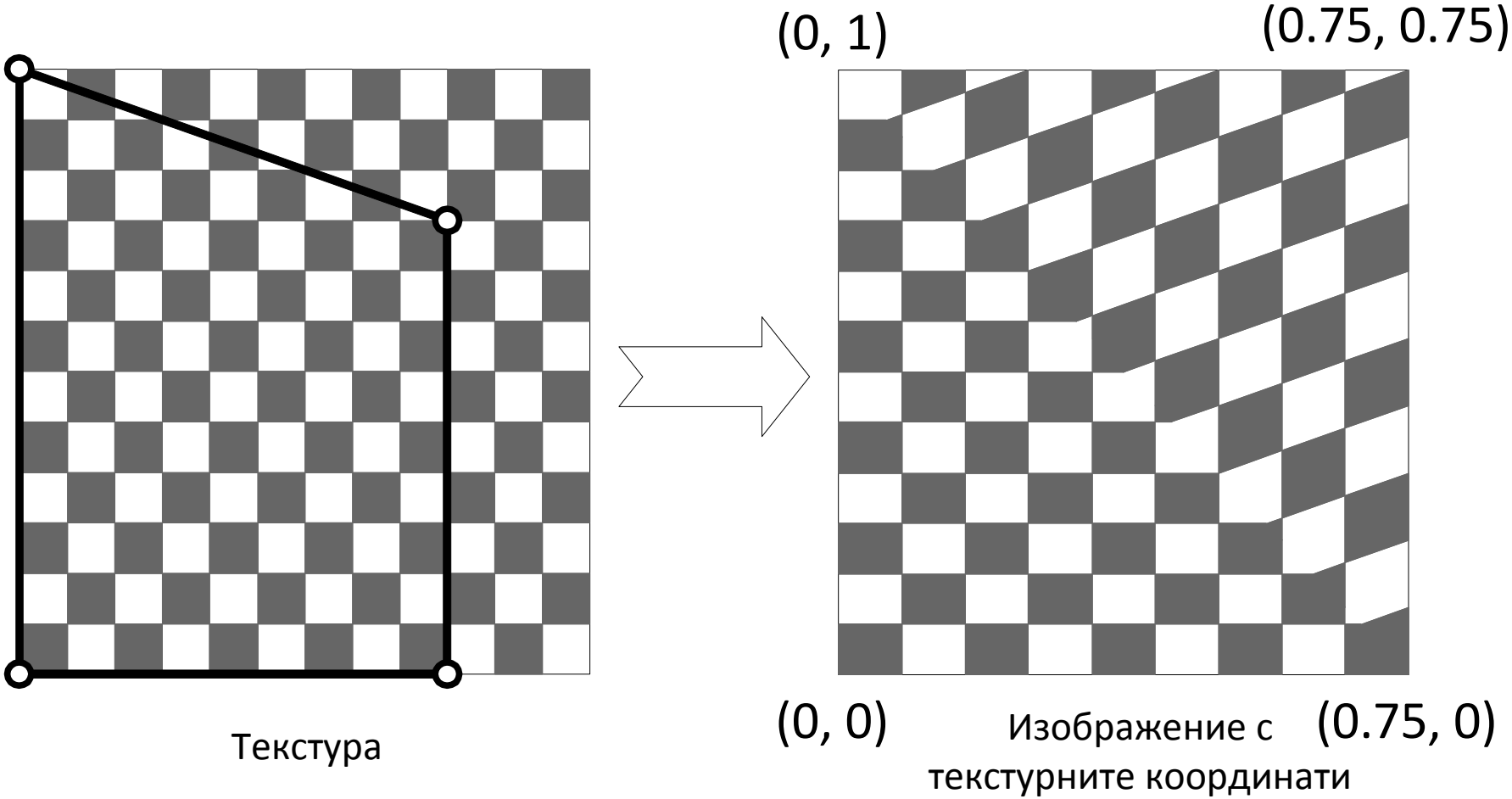
Текстура

По-голям Реализъм

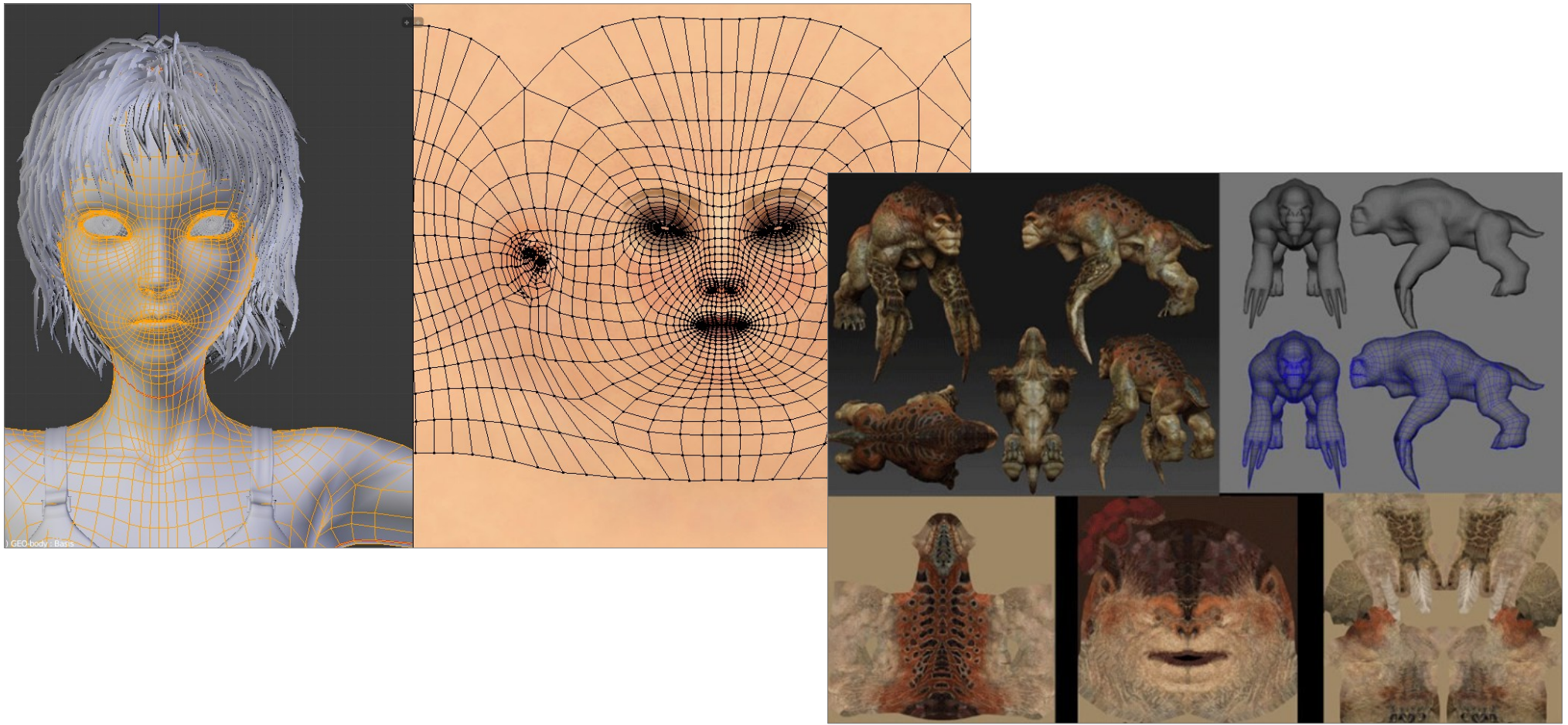
Текстурите в КГ

- Спестяват геометрия;
- Създават по-реални визуализации;
- Изискват текстурни координати в геометрията.

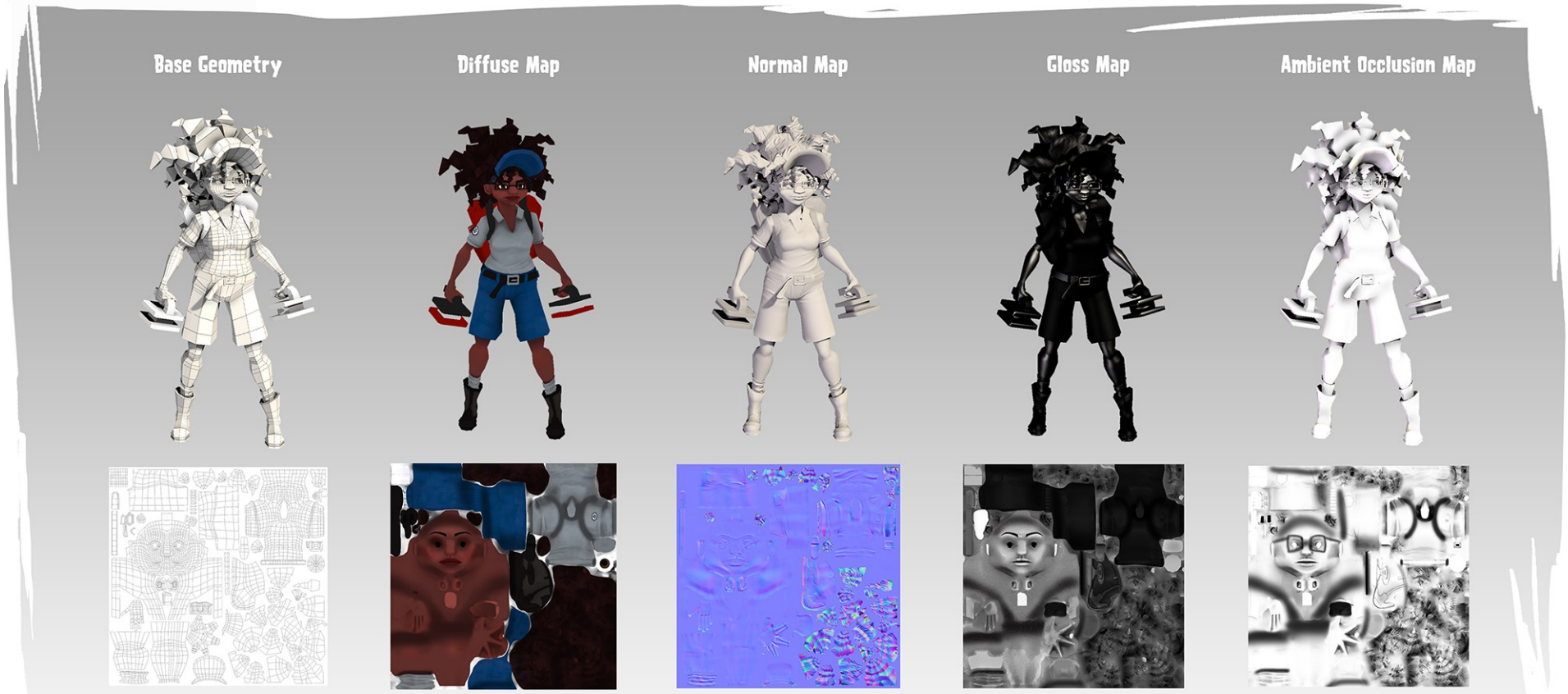
Текстурни координати (UV mapping)



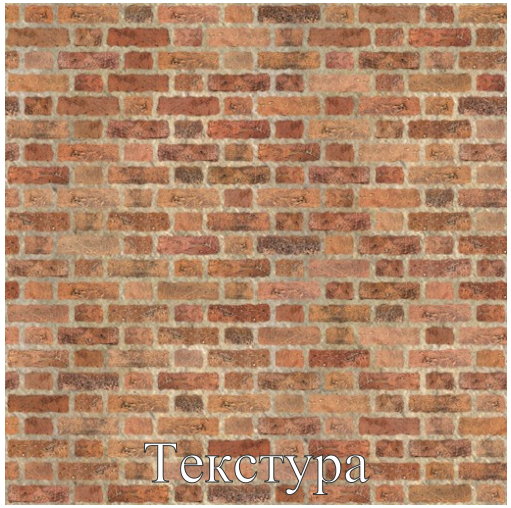
UV Mapping

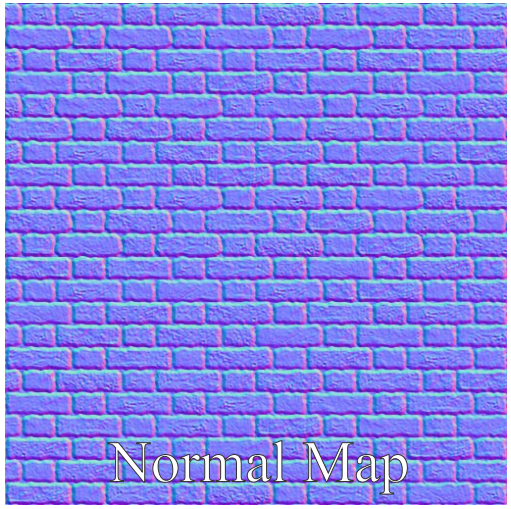


Различни видове текстури

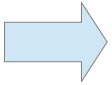


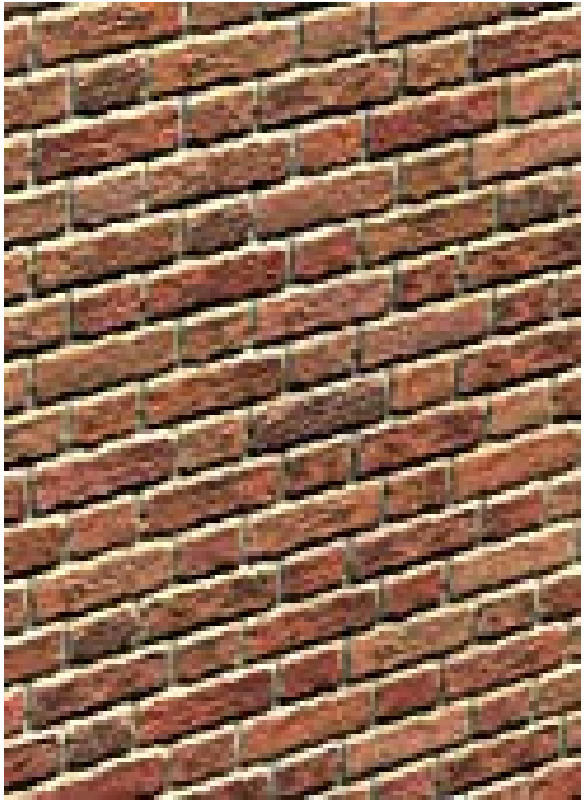
Bump Map





или



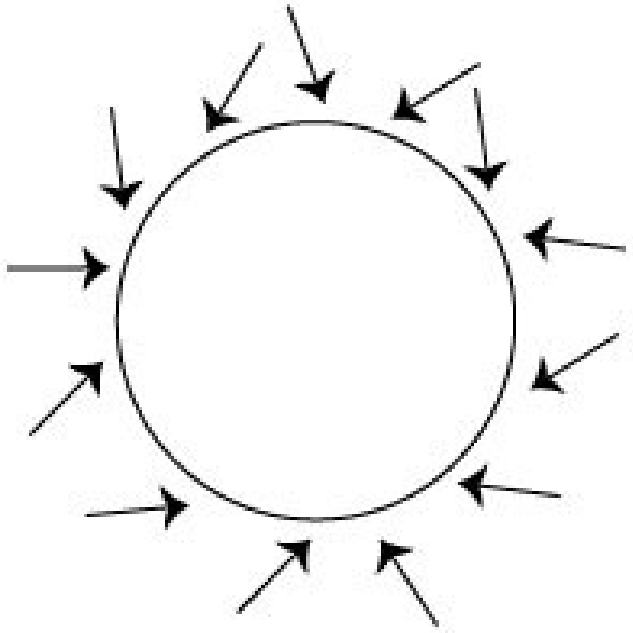


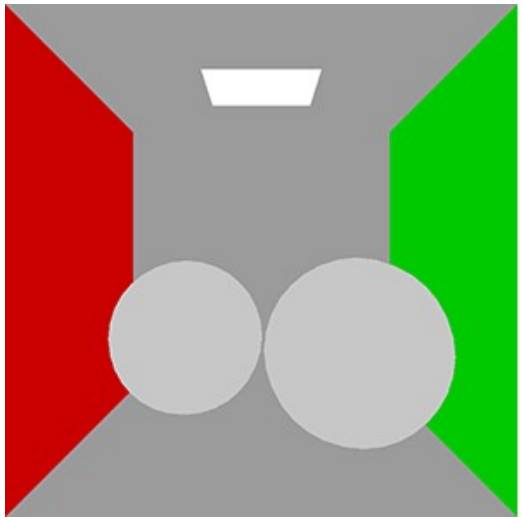
Видове Светлинни Източници

Видове Светлинни Източници

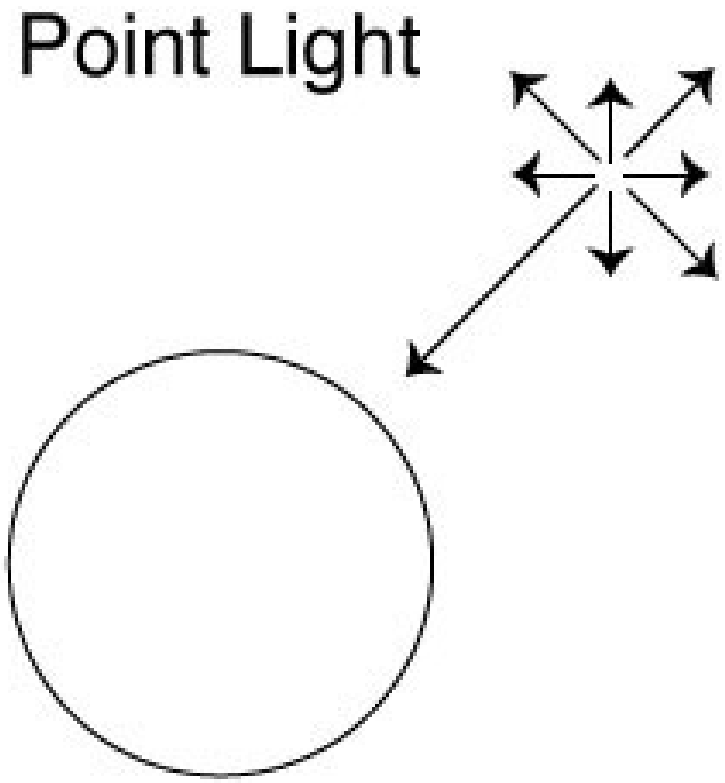
- Околна/Обкръжаваща/Фонова светлина (Ambient Light);
- Точкови (Point/Omni Lights);
- Прожектори (Spot Lights);
- Насочени (Directional Lights);
- Площи (Area Lights);
- Обемни (Volume Lights).

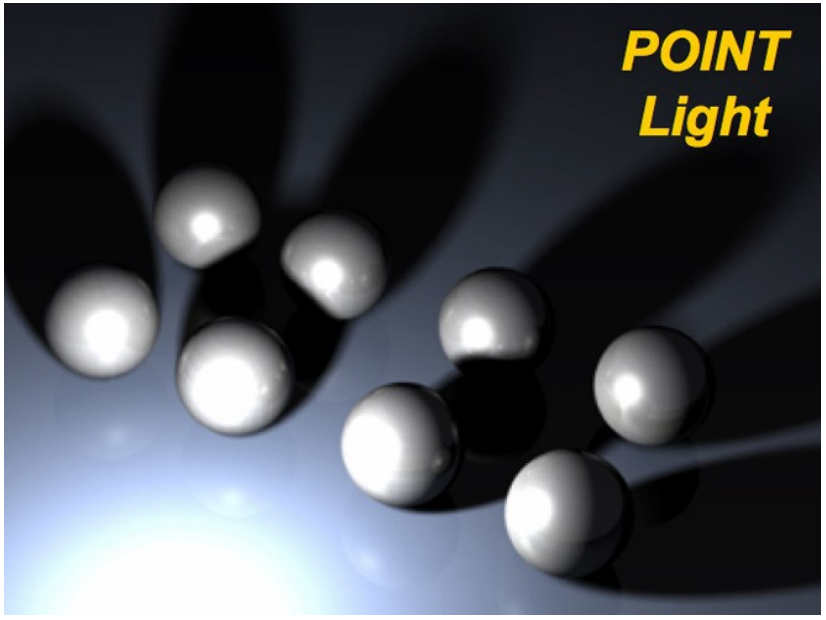
Околна/Обкръжаваща/Фонова светлина (Ambient Light)



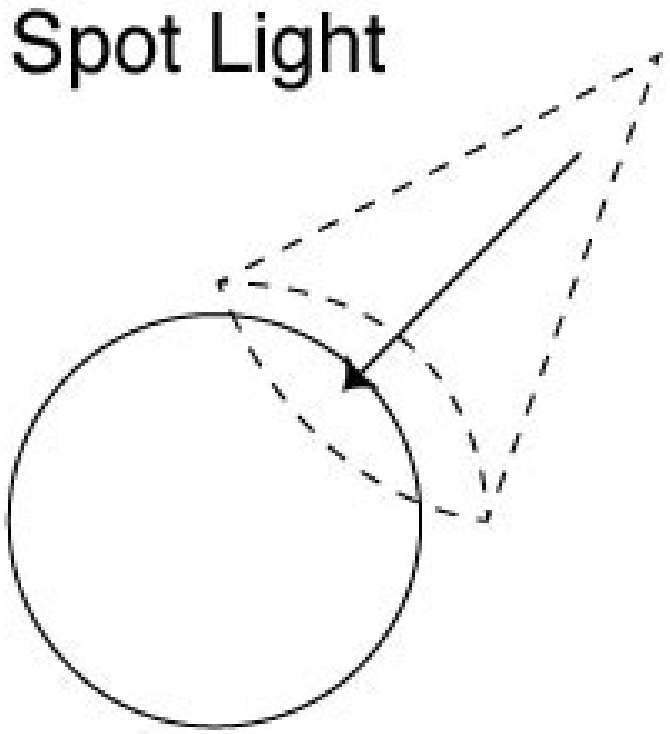


Точкови (Point/Omni Lights)

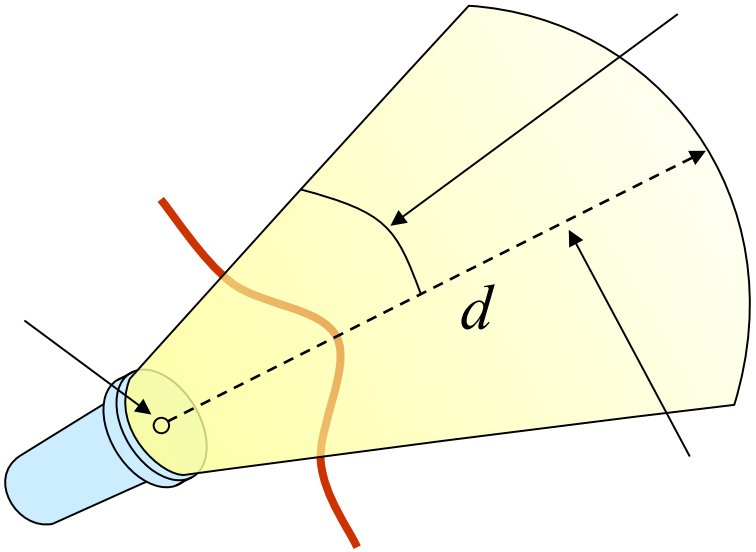




Прожектори (Spot Lights)

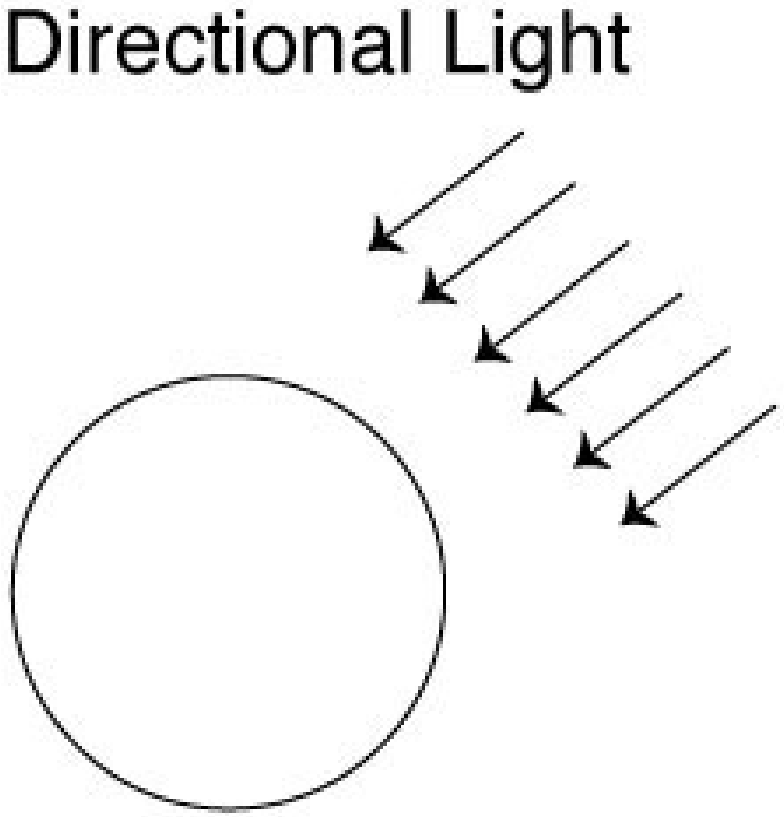


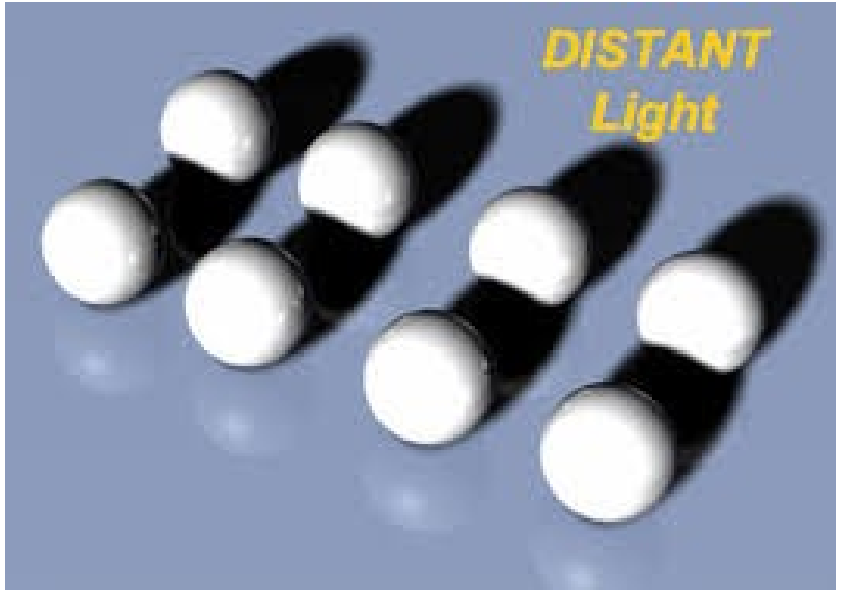
Параметри



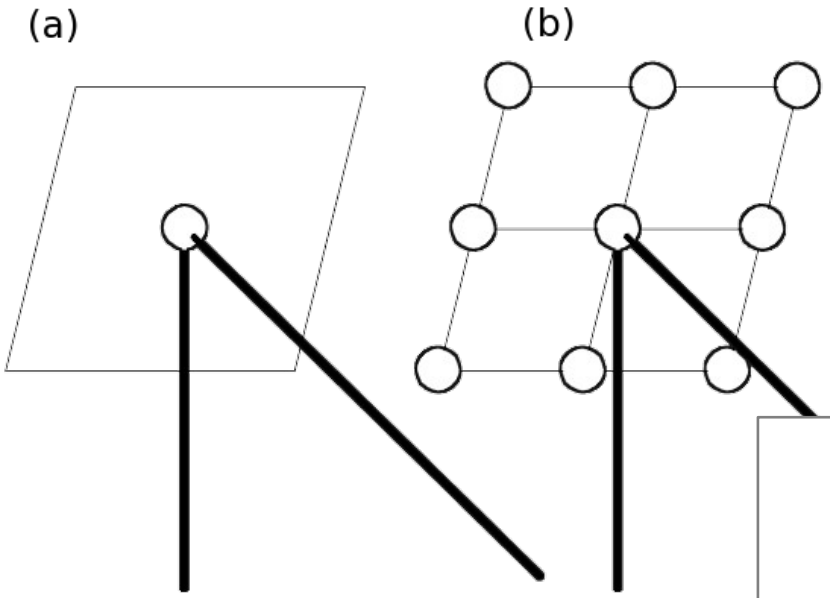
$$\textit{Коефициентна затихване} = \frac{1}{k_c + k_l \cdot d + k_q \cdot d^2}$$

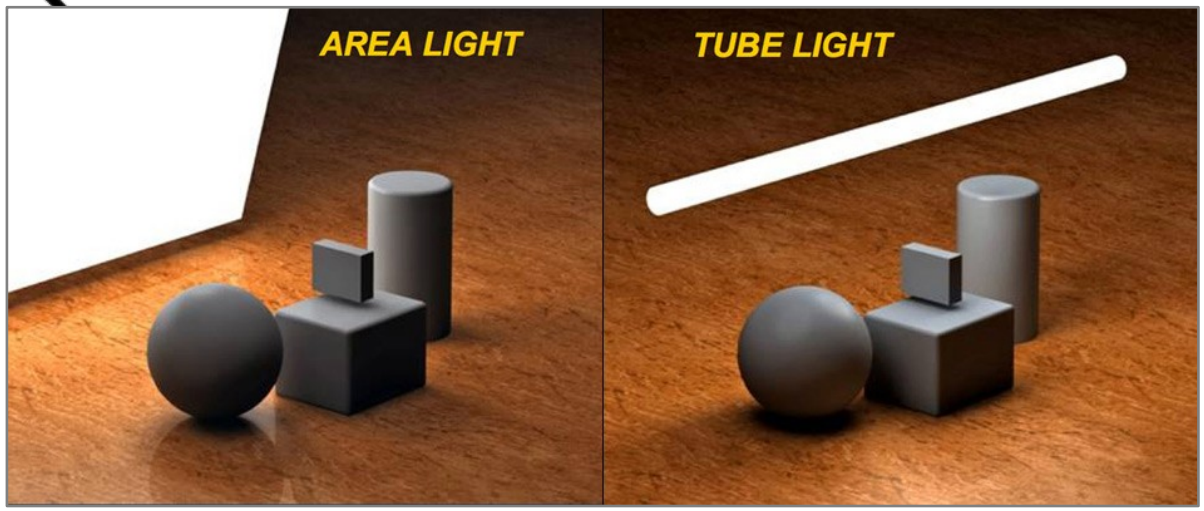
Насочени (Directional Lights)



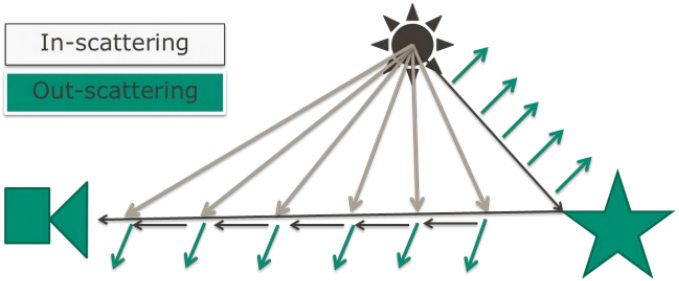


Площи (Area Lights)





Обемни (Volume Lights)



Въпроси?

apenev@uni-plovdiv.bg