THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

MANUEL DE CONSTRUCTION D’IMAGES

¤

Filippo Fanciotti, Olivier Meystre

THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

I
PERSPECTIVE

¤

Olivier Meystre

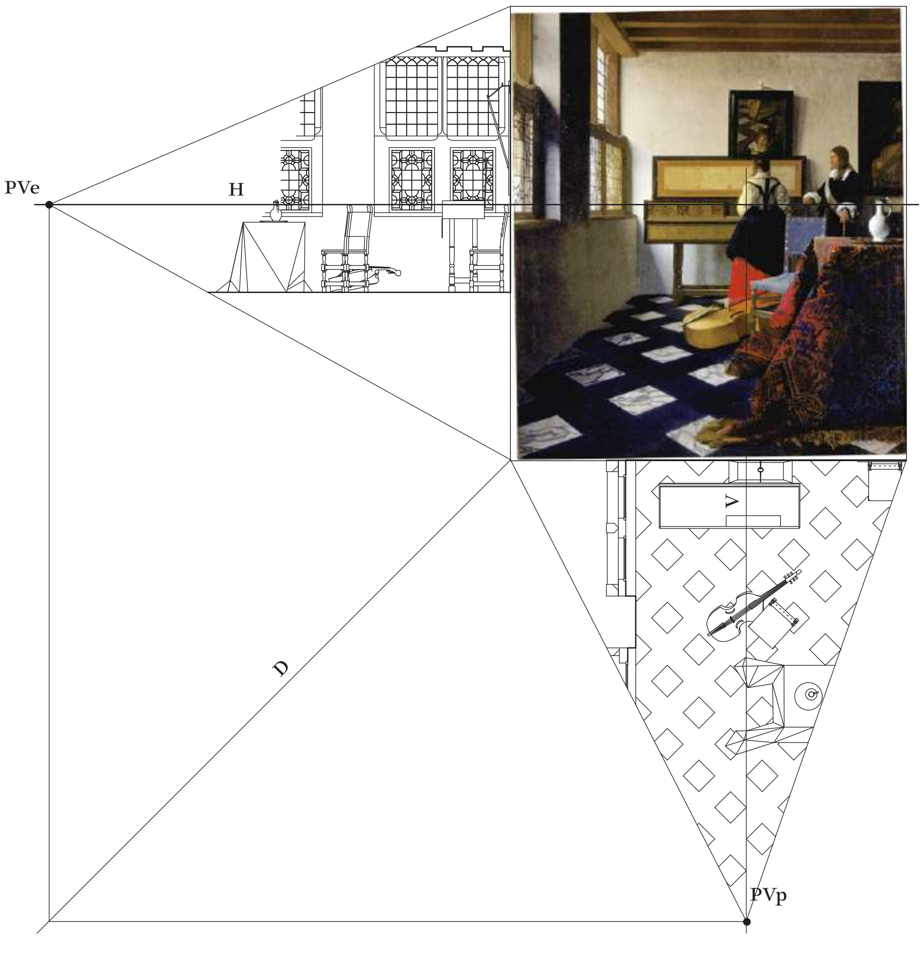
MÉTHODE DE CONSTRUCTION DE PERSPECTIVE INVERSE

Olivier Meystre

Toute vue perspective (photographie, dessin, tableau) est susceptible d'être lue comme une construction géométrique issue de projections orthogonales des objets représentés. En d'autres termes, il est possible de partir d'une perspective et faire le chemin inverse pour obtenir le plan et l'élévation des éléments figurés. Les pages suivantes exposent une méthode (qui n'est pas l'unique) pour reconstruire, à l'inverse, n'importe quelle perspective.

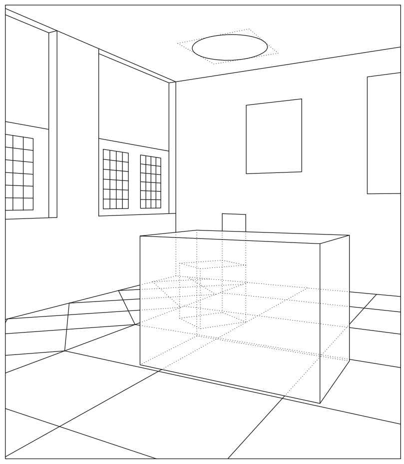
n. b. : Si cette méthode s'appuie sur des outils de la géométrie qui sont scientifiques et rigoureux, il faut noter qu'une image perspective peut être le résultat d'une infinité de configurations spatiales et de points de vue. Le travail exposé ici implique donc une lecture critique, une appréciation, de ce qui est effectivement représenté dans la perspective. Aucune règle ne peut dicter si l'angle que l'on voit dans une perspective est droit ou quelconque, pas plus que l'on ne peut être sûr que deux points sont coplanaires ou placés sur des plans très éloignés.

La méthode présentée permet de reconstruire les projections de l'ensemble d'une vue perspective en géométral.



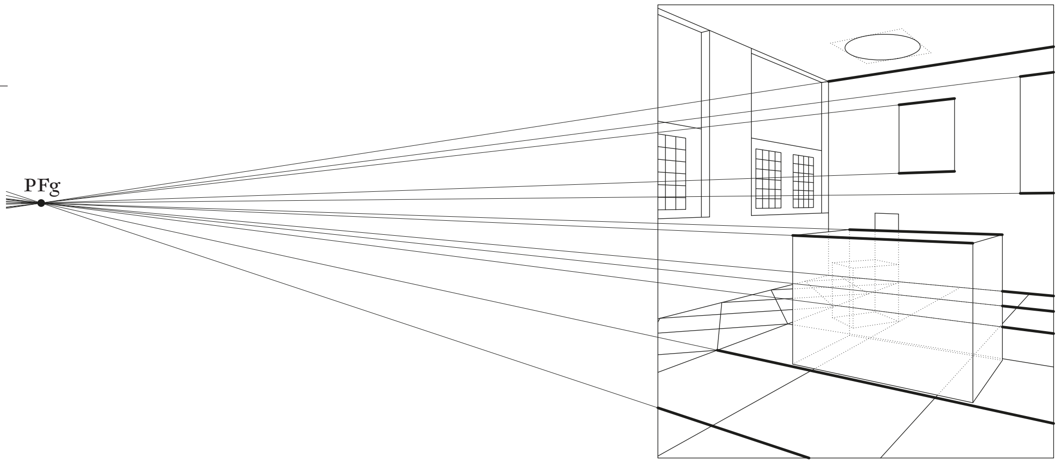
Méthode de construction de perspective inverse à partir d’une vue perspective quelconque

(vue oblique ou dite à deux points de fuite)



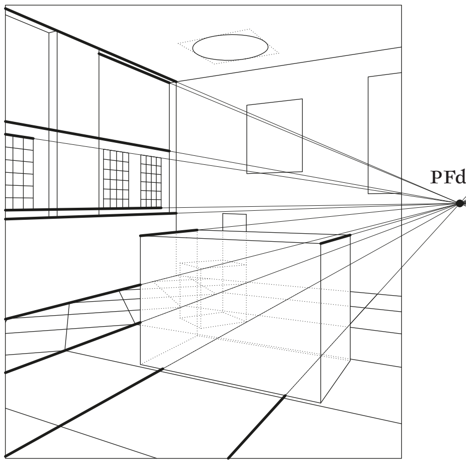
Recherche du point de fuite gauche (PFg)

Tracer les fuyantes convergentes.



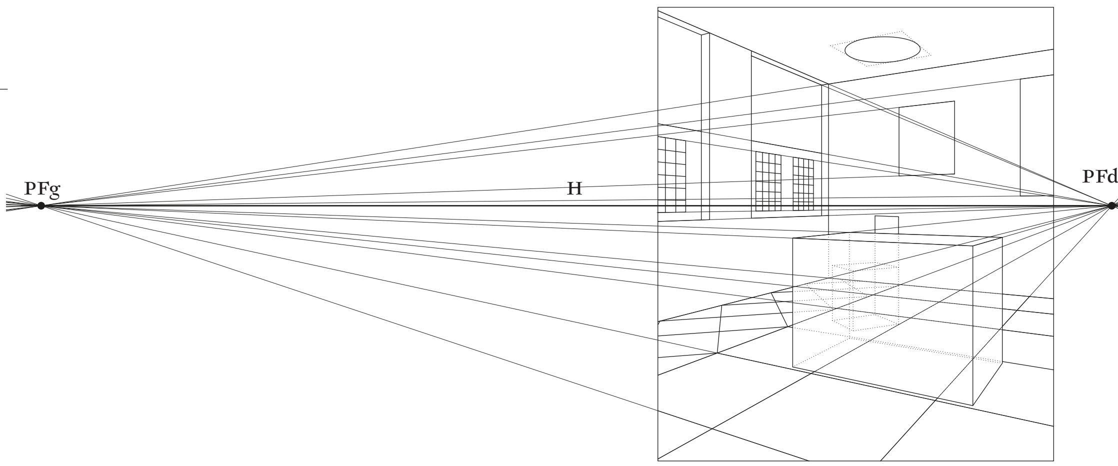
Recherche du point de fuite droit (PFd)

Tracer les fuyantes convergentes des lignes manifestement perpendiculaires (dans la réalité) à celles convergentes au point de fuite gauche.



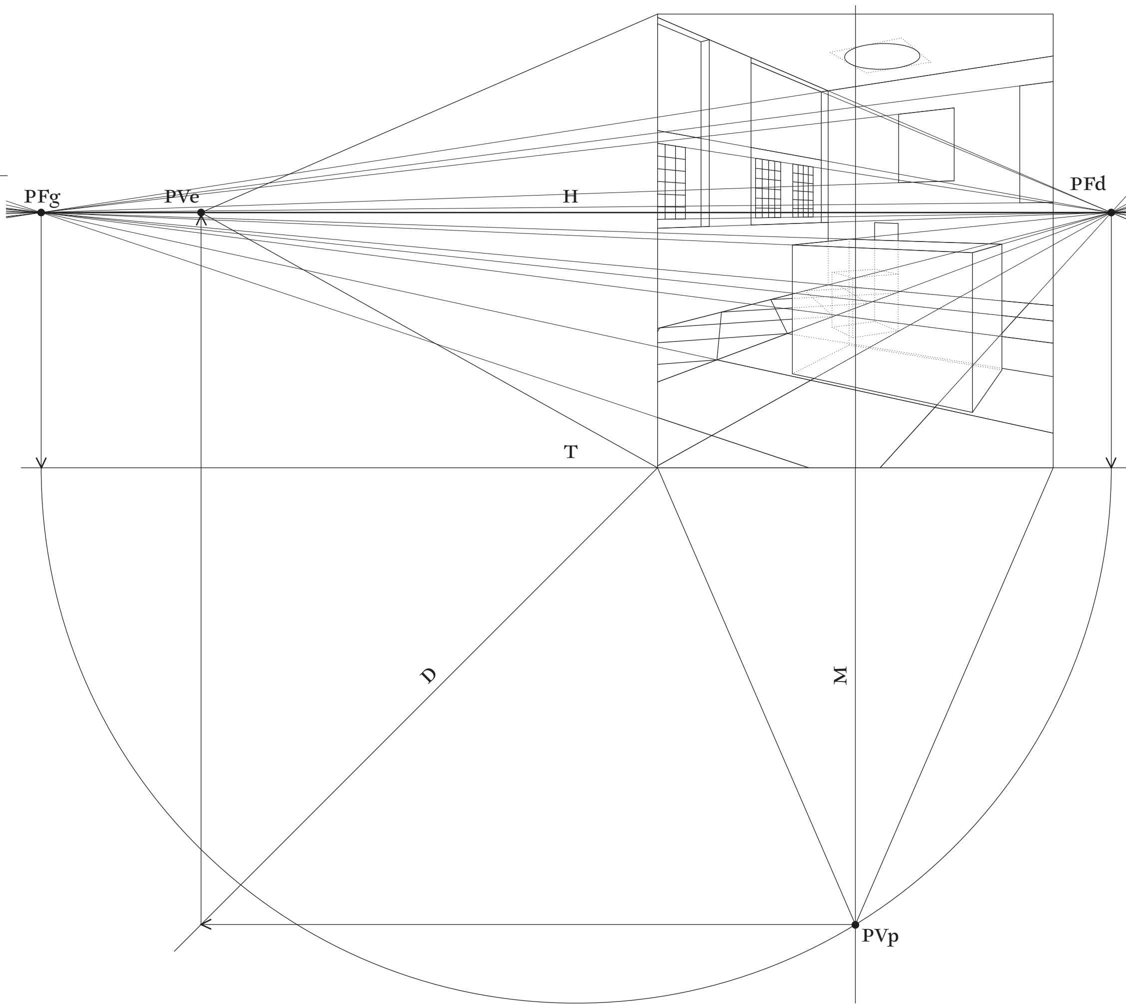
Etablissement de la ligne d’horizon (H)

La ligne d’horizon relie les deux points de fuite.



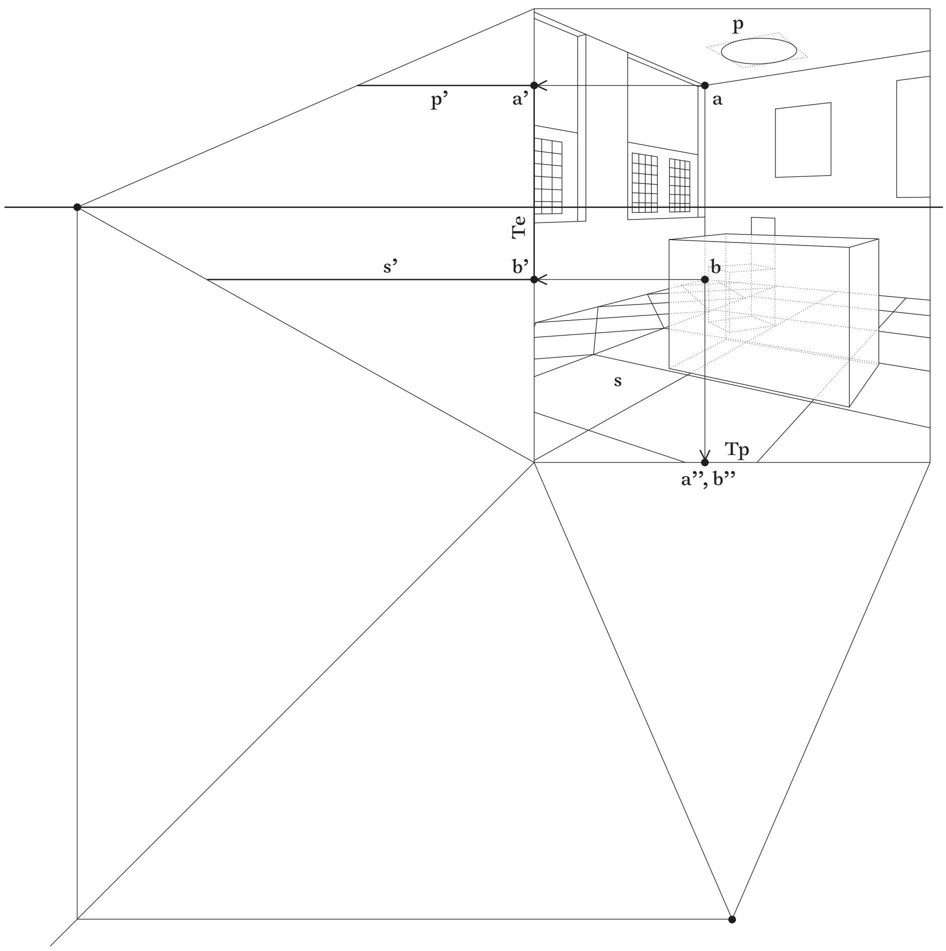
Positionnement du point de vue dans la projection en plan et dans la projection en élévation latérale.

Reporter les points de fuite sur la ligne de terre (T) (ou ligne du tableau en plan).
Tracer un demi-cercle de diamètre correspondant à la distance entre les deux points de fuite.
Le point de vue en plan (PVp) s'obtient par l'intersection du demi-cercle avec l'axe médian (M) de la vue perspective.
Le point de vue en élévation (PVe) se trouve en reportant le point de vue en plan par l'intermédiaire d'une droite à 45° (D) et en trouvant l'intersection avec l'horizon (H)



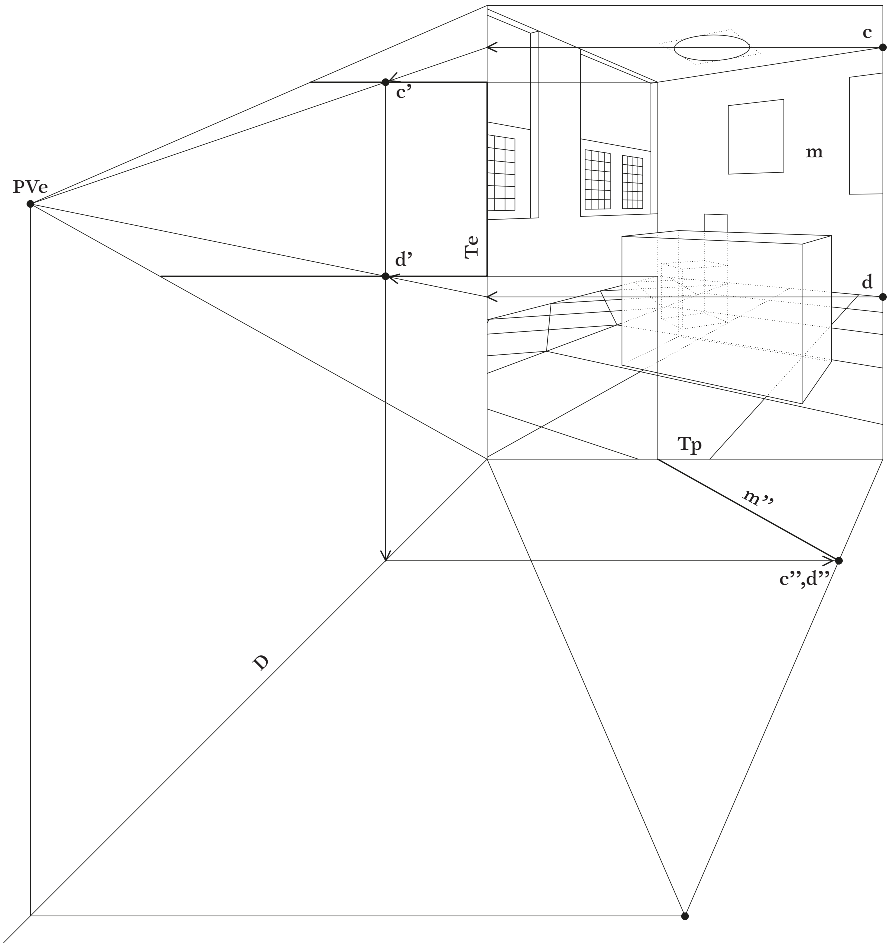
Recherche des premiers points dans les projections en élévation et en plan.

Sélectionner dans la vue perspective les points les plus éloignés du spectateur, c'est-à-dire du point de vue. Ici, les points a et b.
Les reporter orthogonalement sur le tableau (Te et Tp choisi arbitrairement pour coïncider avec les limites de la vue perspective).
On peut dès lors tracer en élévation la ligne du plafond (p') et celle du sol (s')



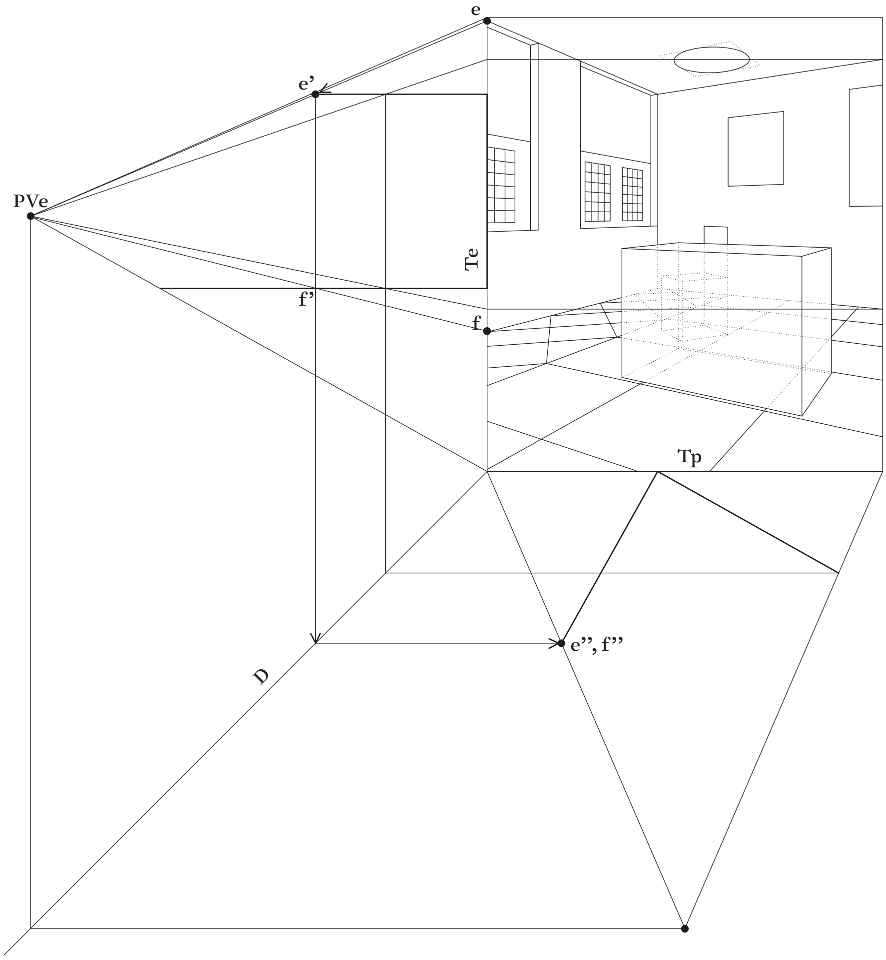
Recherche des points suivants selon les principes d’alignement et/ou de coplanarité.

Sélectionner dans la vue perspective les points se situant dans des mêmes plans que les points obtenus précédemment. Ici c et d se trouvant respectivement au sol et au plafond.
Les reporter orthogonalement sur le tableau.
Tracer des droites reliant ces point sur le tableau et le point de vue (PVe). L’intersection de ces droites avec le plafond et le sol correspond à leur image en élévation.
Reporter, par l’intermédiaire de D, les points obtenus sur la projection en plan.
Tracer le mur abcd (m) en plan.



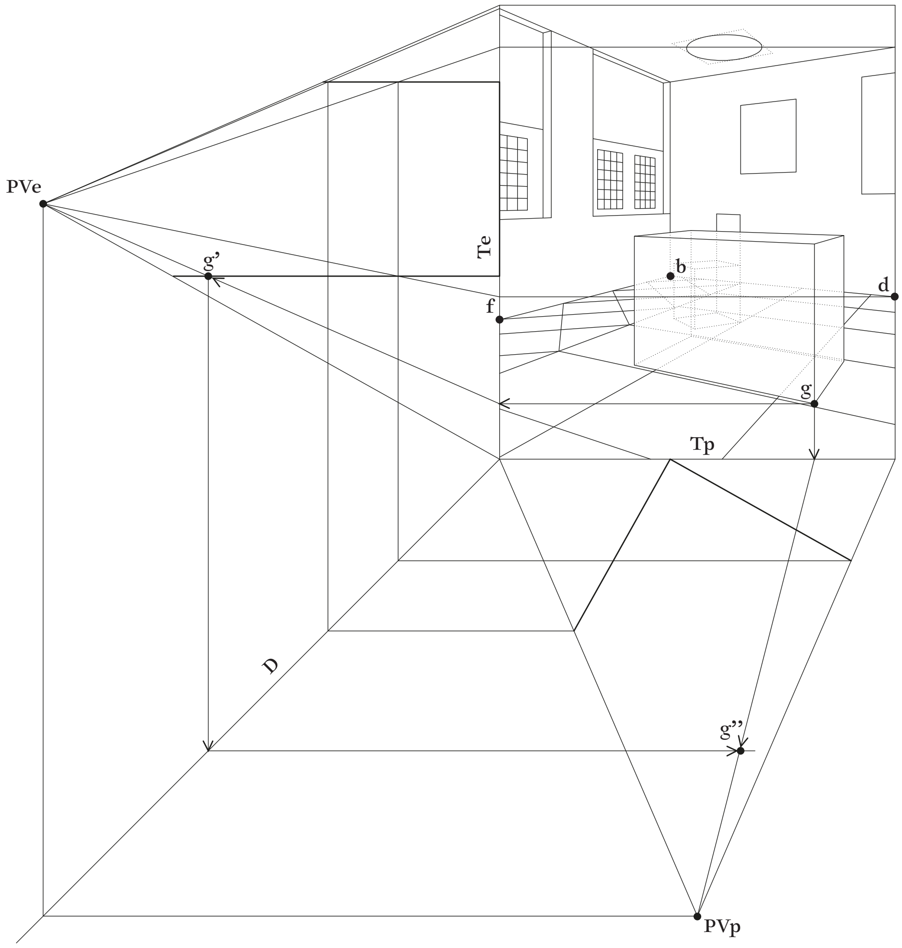
Suite de recherche des points suivants selon les mêmes principes

Sélectionner des points situés dans le plan perpendiculaire au mur abcd.
Les points e et f se confondent ici avec leur report sur le tableau (Te).
Tracer, comme précédemment les droites reliant ces points sur le tableau et le point de vue (PVe). Les intersections de ces droites avec respectivement le plafond et le sol correspondent à leur image en élévation.
Reporter, par l’intermédiaire de D, l’arrête obtenue sur la projection en plan (e’’, f’’).

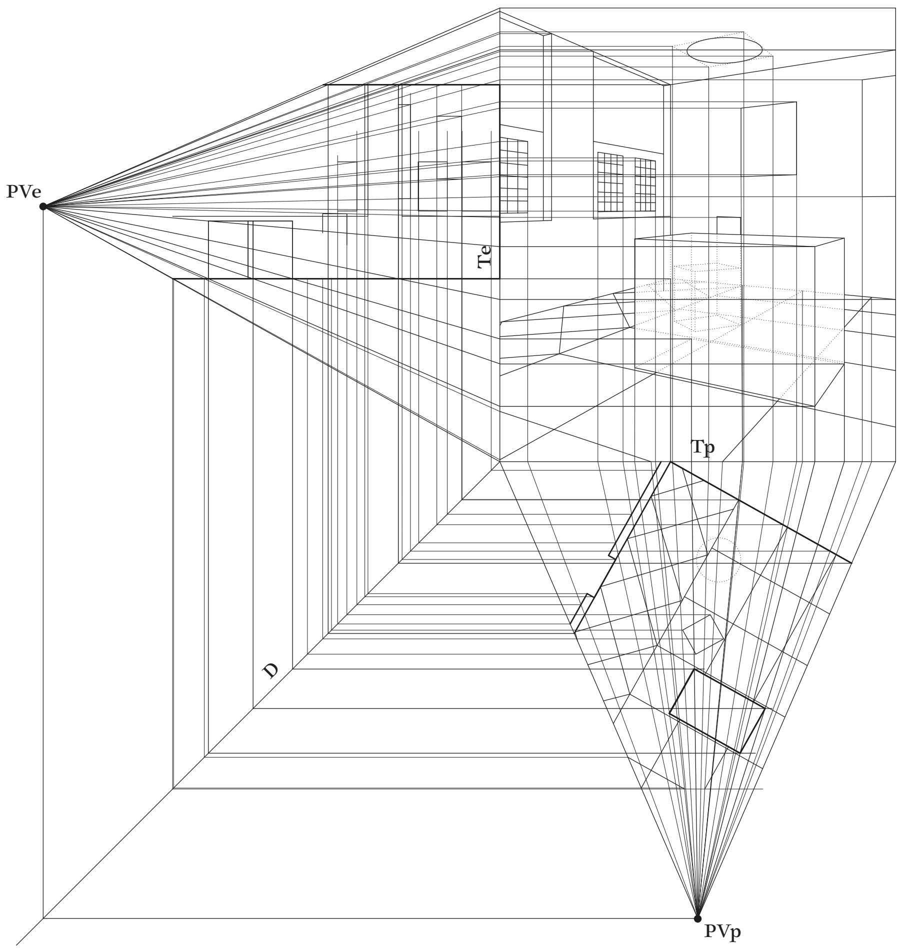


Recherche d’un point se situant au milieu d’un plan dont on connaît déjà les sommets.

Soit le point g, coplanaire à bdf. Utiliser la méthode déjà utilisée pour retrouver g’ en élévation.
Reporter orthogonalement g sur le tableau en plan (Tp).
Tracer la ligne reliant ce point sur le tableau au point de vue en plan (PVp).
À l’intersection de la ligne de report de g’ se trouve g’’.

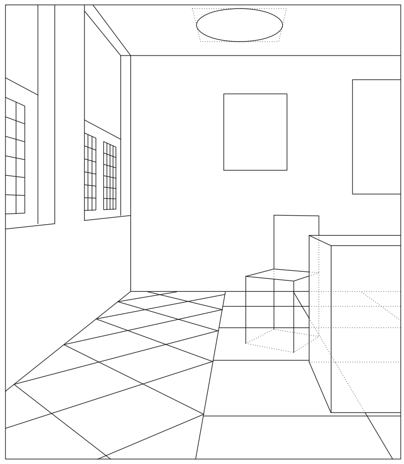


Tous les autres points de l’image se retrouvent de manière analogue, par report orthogonal sur les tableaux (Te, Tp), convergence aux points de vue en plan et en élévation (PVe, PVp) et allers-retours entre la projection en plan et celle en élévation par l’intermédiaire de la droite D.



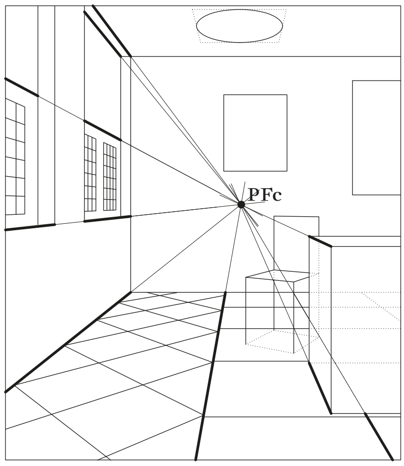
Le cas particulier de la perspective centrale

(dite aussi à un seul point de fuite ou frontale)



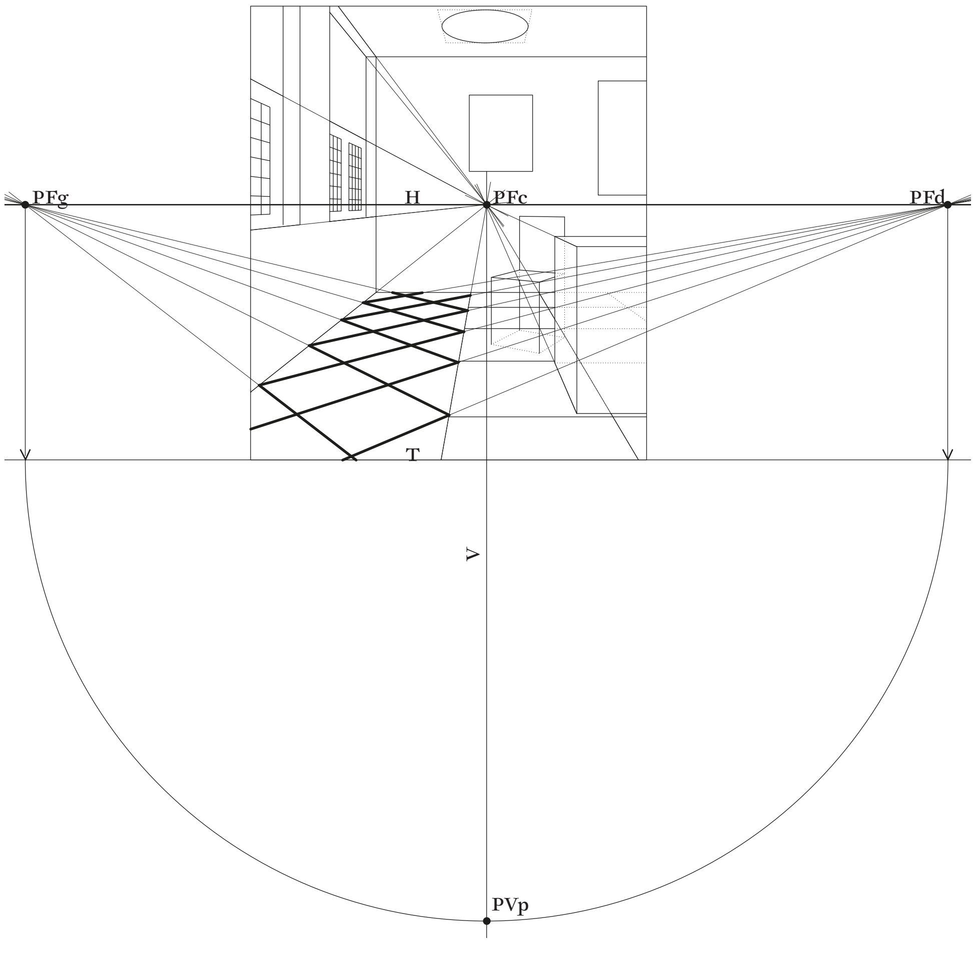
Recherche du point de fuite central (PFc)

Tracer les fuyantes convergentes.
La spécificité de ce type de perspective est qu'elle n'offre pas facilement des fuyante pour trouver des points de fuite droite et gauche, indispensables au placement du point de vue.



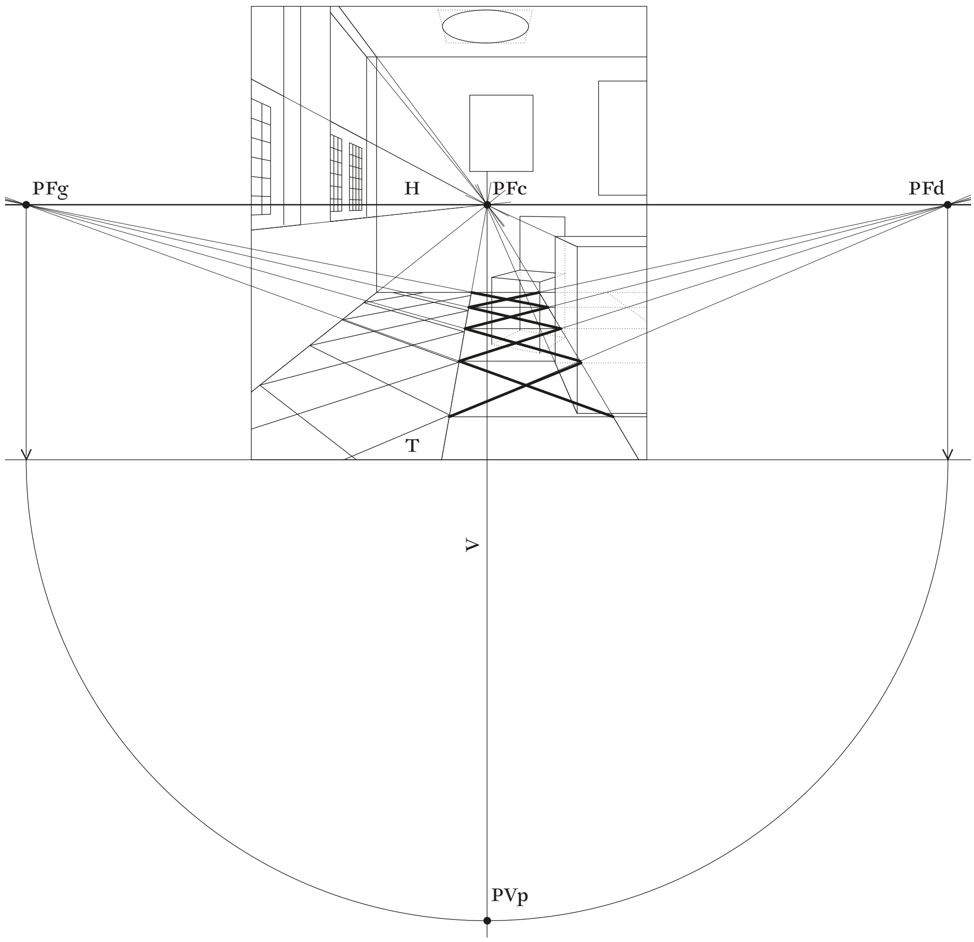
Recherche de points de fuite latéraux par des lignes obliques

Identifier les lignes orientées à 45° de l'axe de vue de la perspective, ici le dallage en carré «sur la pointe».
Tracer les fuyantes convergentes au points de fuite gauche et droite (PFg, PFd).
Reporter les points de fuite sur la ligne de terre (T) (ou ligne du tableau en plan).
Tracer un demi-cercle de diamètre correspondant à la distance entre les deux points de fuite.
Le point de vue en plan (PVp) s'obtient par l'intersection du demi-cercle non pas avec l'axe médian de l'image mais l'axe de vue (V), passant par le point de fuite central (PFc).



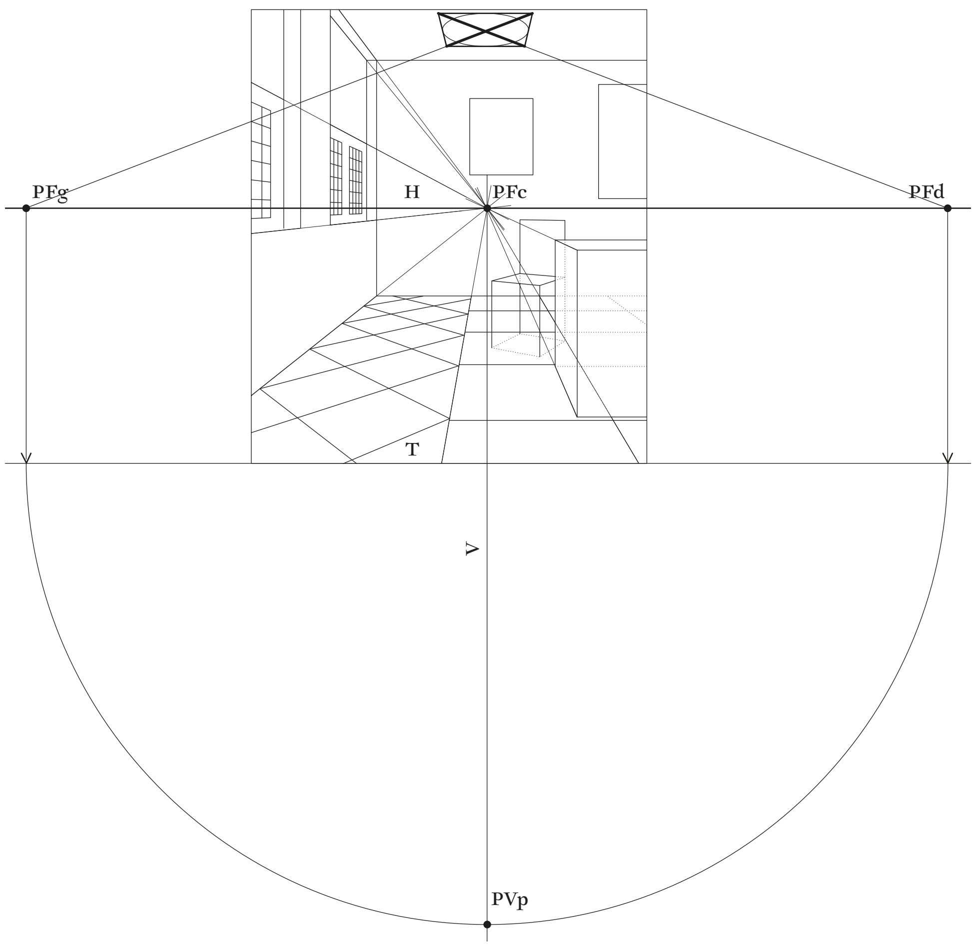
Recherche de points de fuite latéraux par des lignes obliques construites ad hoc

En l’absence de lignes obliques, identifier des éléments carrés (ici le pavage).
En construire les diagonales.
Tracer les fuyantes convergentes au points de fuite gauche et droite (PFg, PFd).
Le point de vue s’obtient de la même manière que précédemment.



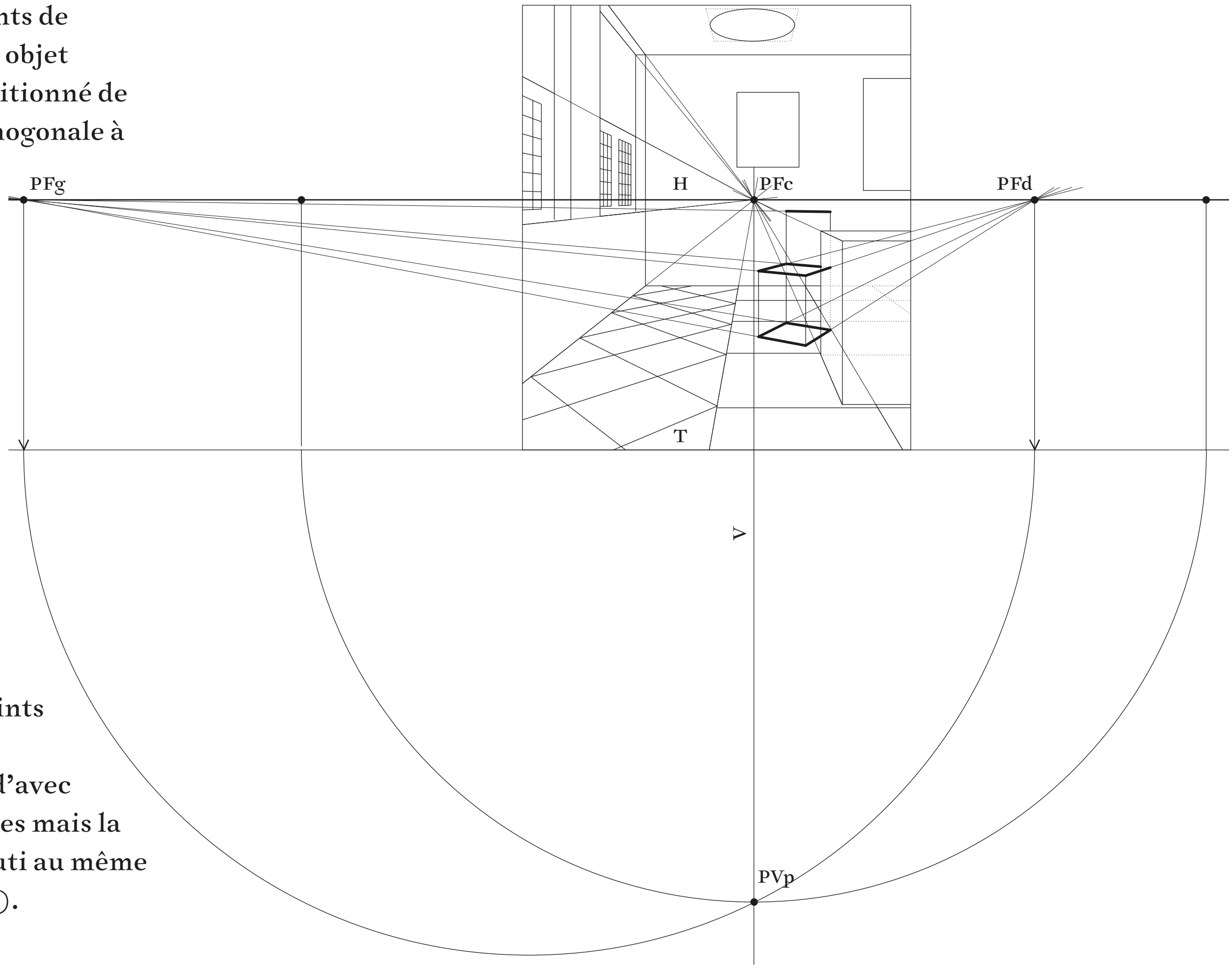
Recherche de points de fuite latéraux par les diagonales d’un carré circonscrit à un cercle

Tracer le carré en perspective en fonction du point de fuite central.
Tracer les diagonales du carré ainsi obtenu.
Le croisement de ces fuyantes avec l’horizon correspond aux points de fuite.
n.b.: vu le caractère incertain de la construction du carré et le nombre très réduit de fuyantes utilisées, cette méthode est imprécise. Elle mérite de n’être utilisée qu’en complément à d’autres.



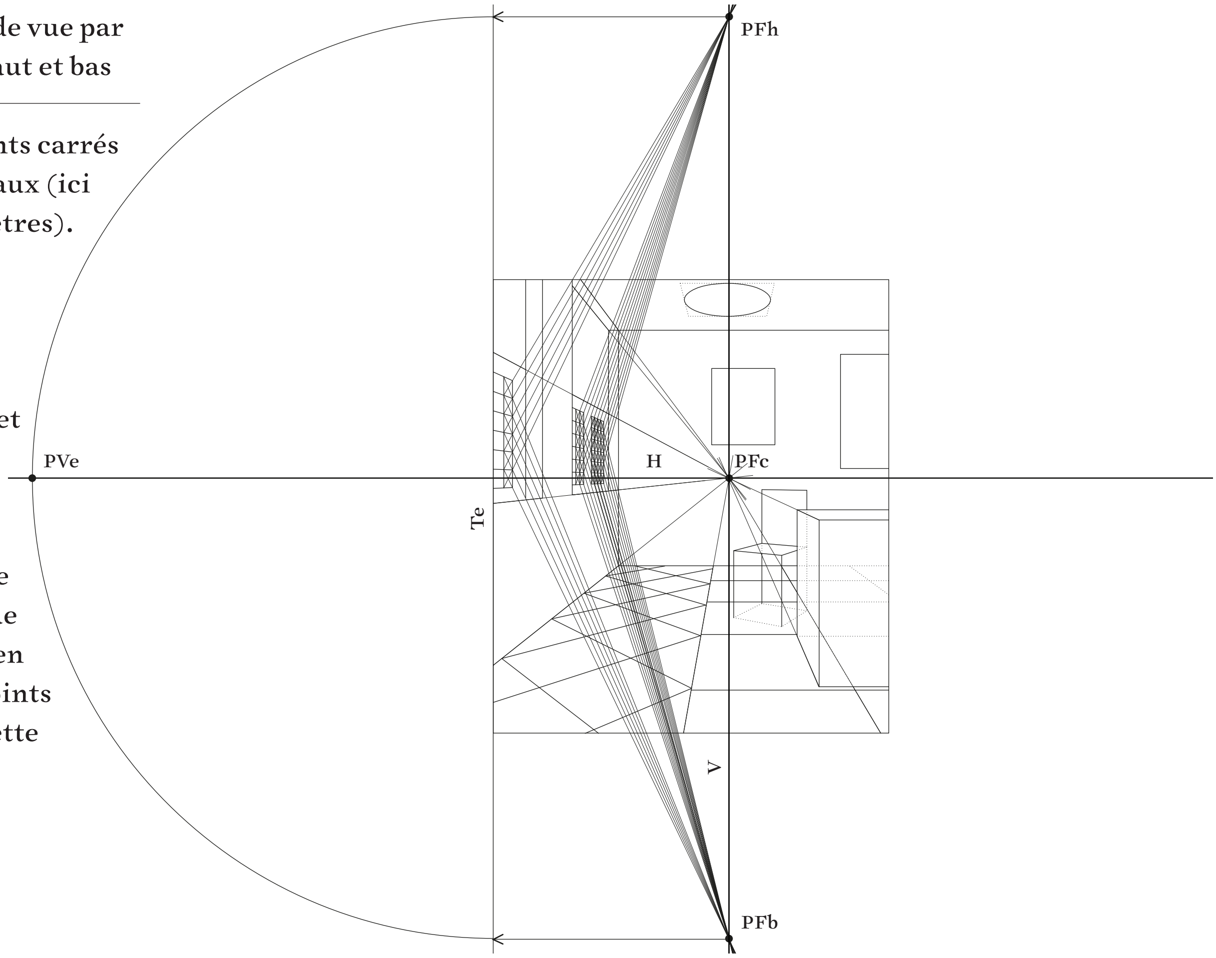
Recherche de points de fuite latéraux par objet rectangulaire positionné de manière non-orthogonale à l'axe de vue.

Identifier un (ou plusieurs) objet(s) placé dans la vue perspective de manière non-orthogonale au reste des objets de la vue. Procéder comme dans les options précédentes. On obtient des points de fuite gauche et droite différents d'avec les autres méthodes mais la construction abouti au même point de vue (PVp).

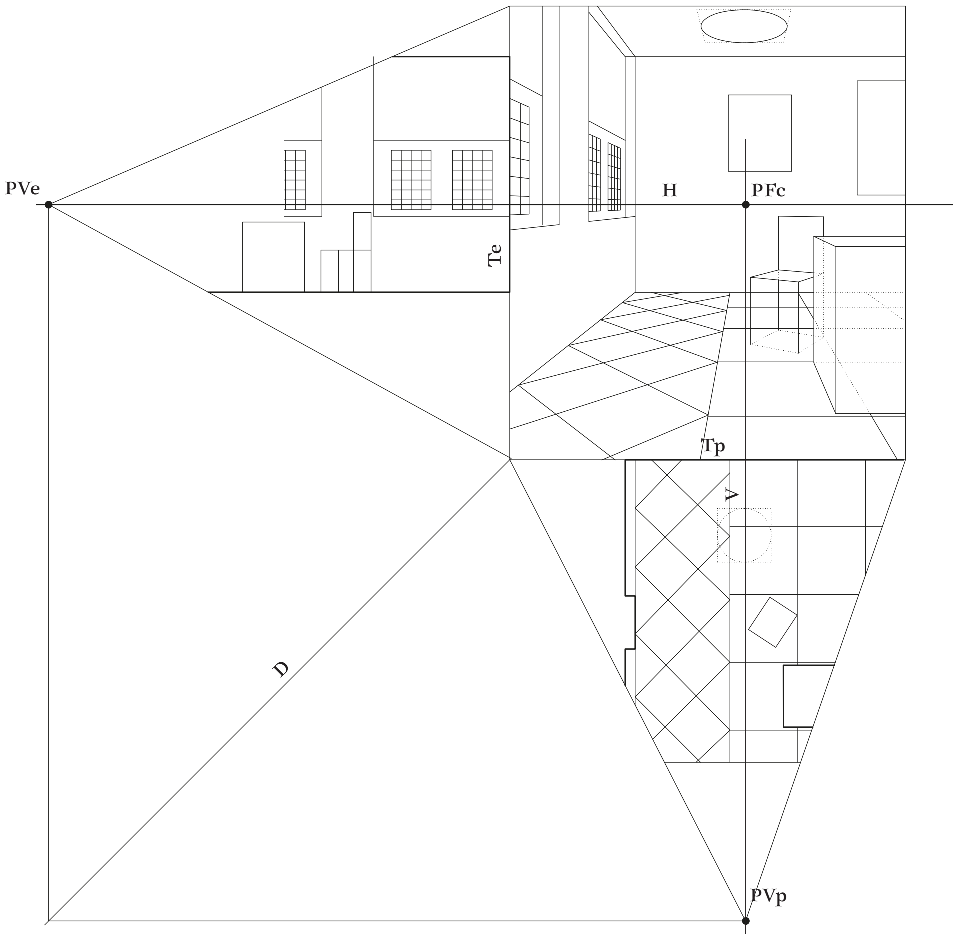


Recherche du point de vue par des points de fuite haut et bas

Identifier des éléments carrés dans les plans verticaux (ici les carreaux des fenêtres). En construire les diagonales. Tracer les fuyantes convergentes au points de fuite haut et bas (PFh, PFb). Le point de vue dans la projection en élévation s'obtient de manière analogue que pour le point de vue en plan, le report des points de fuite se faisant, cette fois, latéralement.

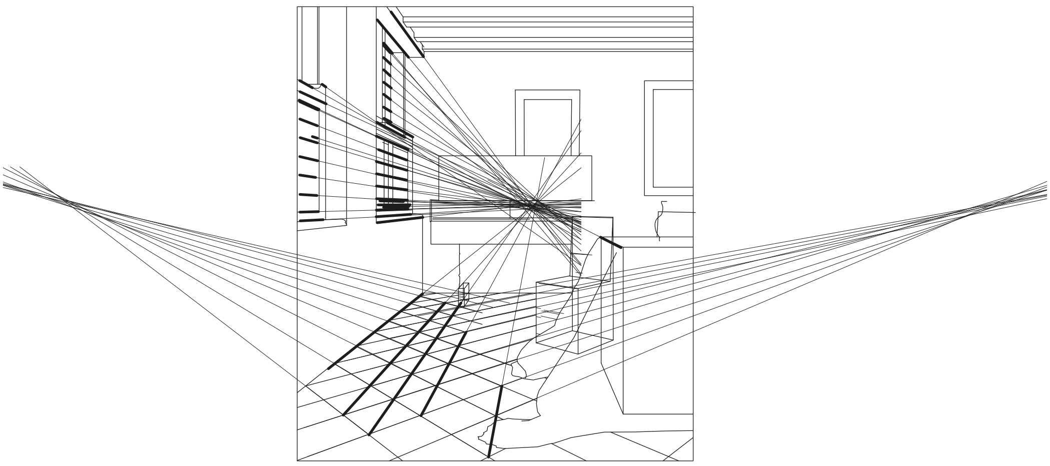


Le reste de la construction de la perspective inverse dans le cas d'une perspective centrale se fait de manière analogue à celle d'une perspective quelconque.

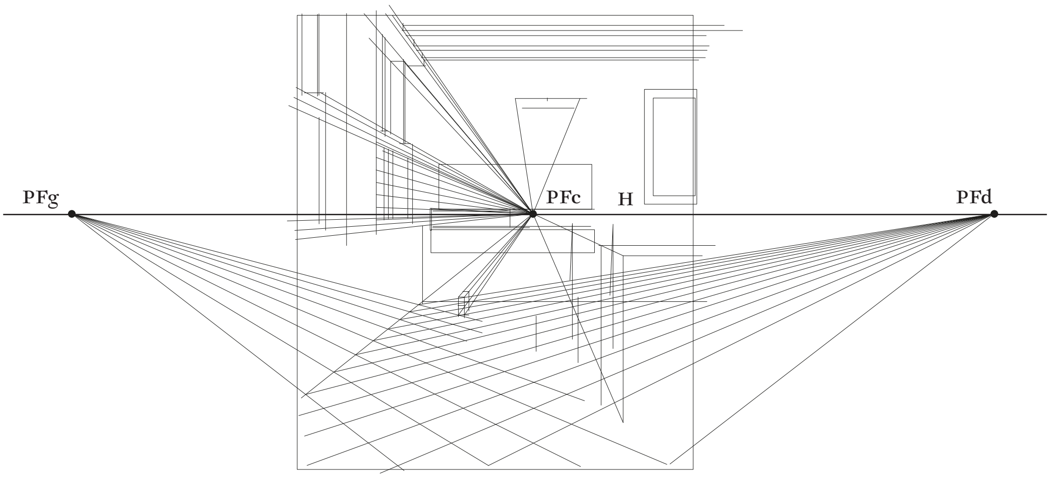


Perspective inverse : la réalité du cas concret

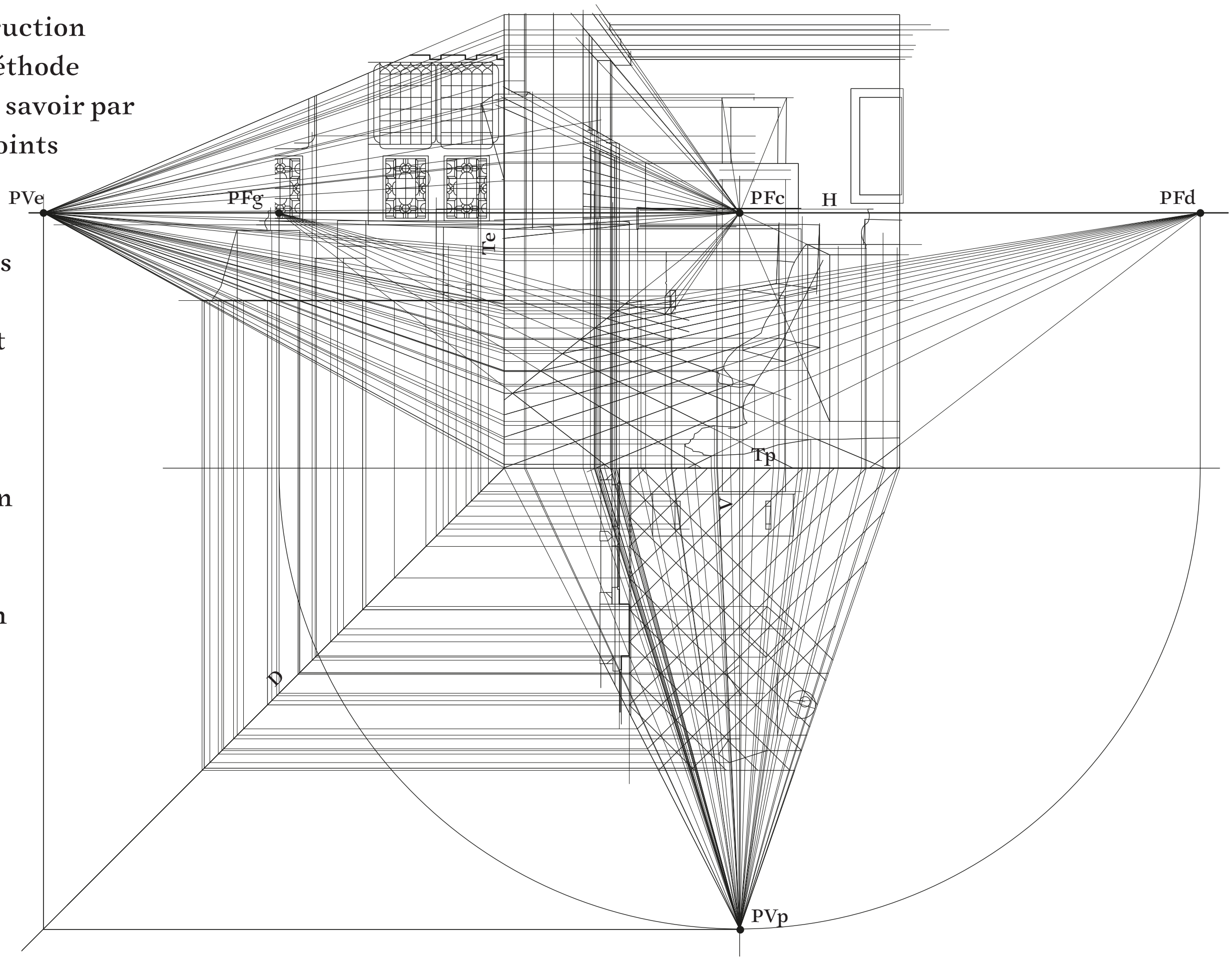
Dans la réalité d'une vue perspective, il faut noter que les fuyantes, même redessinées avec soins, ne convergent que rarement très précisément sur un seul point. Un travail d'interprétation et de pondération est donc requit pour placer les différents points de fuite.

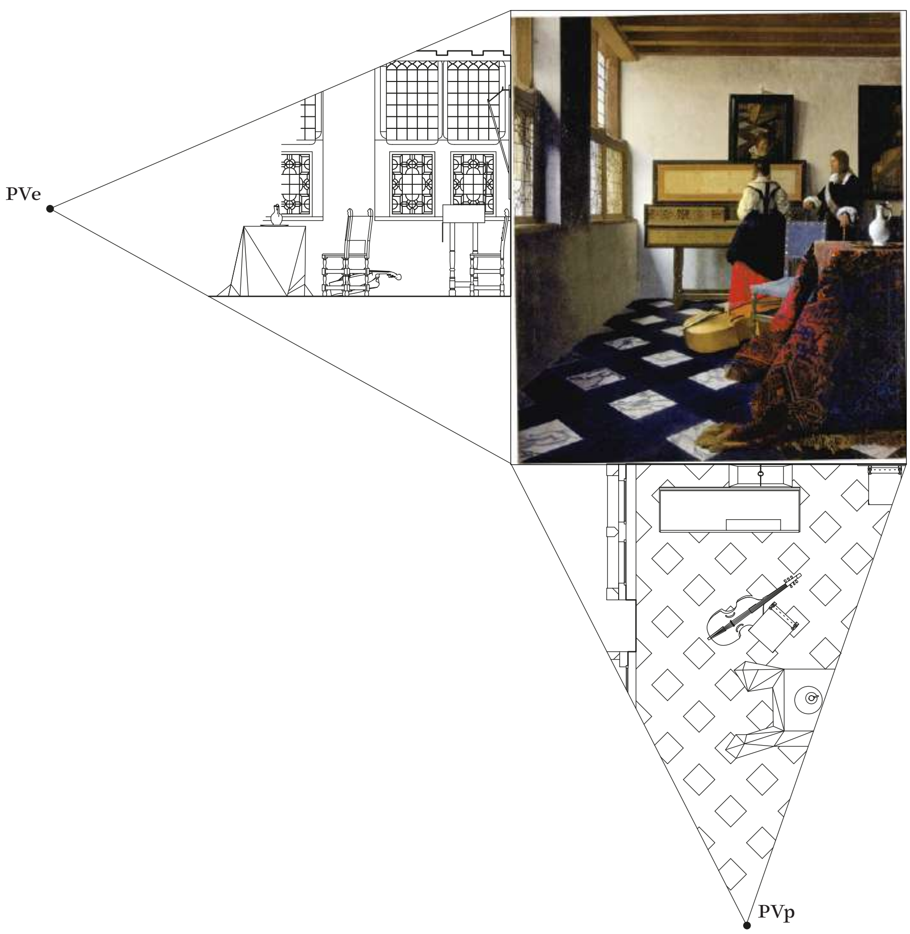


Quand les points de fuite (PF) sont fixés (alignés sur l'horizon), il est impératif de redessiner l'ensemble de la vue perspective en fonction. Il s'agit donc de faire converger les fuyantes, très précisément cette fois, et de construire les différentes arrêtes visibles en rapport. C'est ensuite sur cette base redessinée que la construction de la perspective inverse se fera.



Le reste de la construction s’effectue avec la méthode exposée plus haut, à savoir par établissement des points de vue en élévation et en plan (PVe, PVp), identifications de points à reconstruire, report orthogonal sur les tableaux (Te, Tp), convergence aux points de vue en plan et en élévation et allers-retours entre la projection en plan et celle en élévation par l’intermédiaire de la droite D.





THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

II

MAQUETTE

¤

Olivier Meystre

MANUEL DE CONSTRUCTION DE MAQUETTES EN VUE DE PHOTOGRAPHIE

Olivier Meystre

Tout modèle se doit de répondre à un usage, une destination. En effet, on ne conçoit une maquette que dans un but défini, que ce soit pour tester une résistance physique (faire une simulation), apprécier une volumétrie (maquette d'implantation), juger d'une apparence ou d'un mode de mise en œuvre (prototype, mock-up). Le type de maquette dont il est question ici est celui qui a pour objectif la réalisation d'une image. Sa conception et sa réalisation sont donc dictées par les nécessités liées à la prise de vue photographique, du rendu de la lumière et de la véracité dans l'apparence des éléments en présence.
Les pages suivantes exposent les techniques utilisées pour la production de maquettes qui seront photographiées en vue d'être ensuite intégrées dans une seule image perspective.

Maquette en papier blanc, d'après la *Leçon de musique* de Vermeer

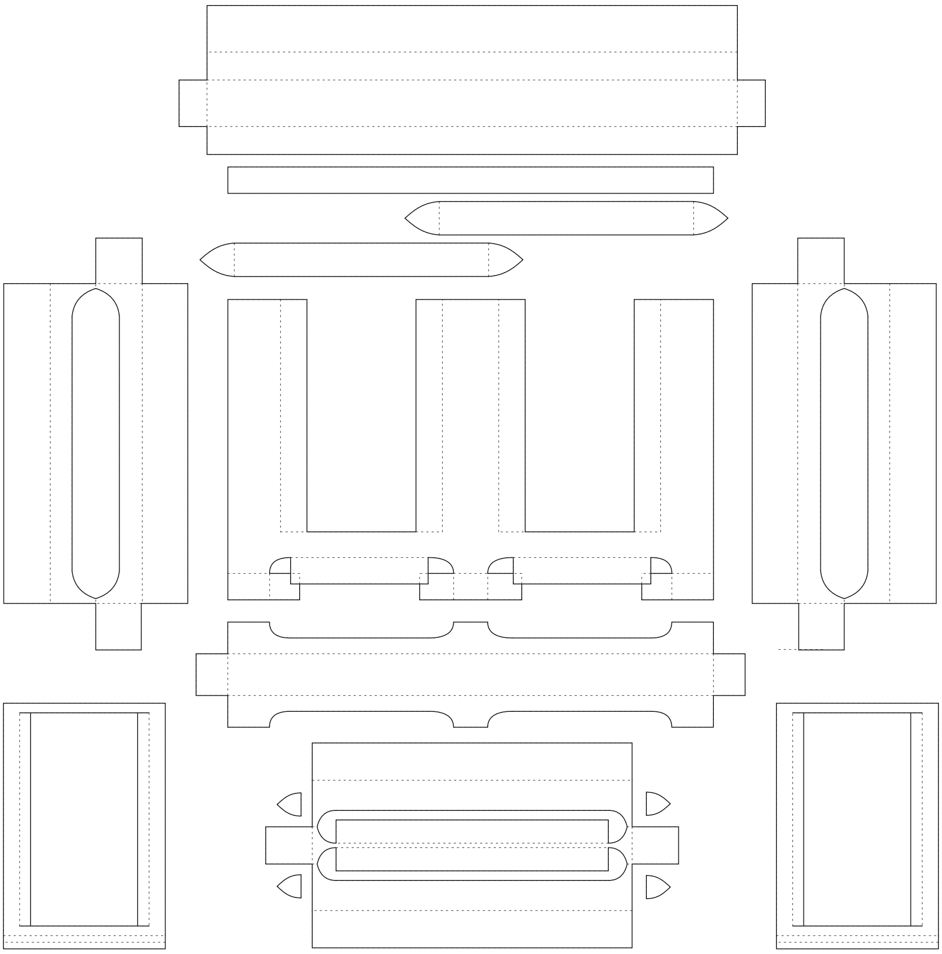
LAPIS

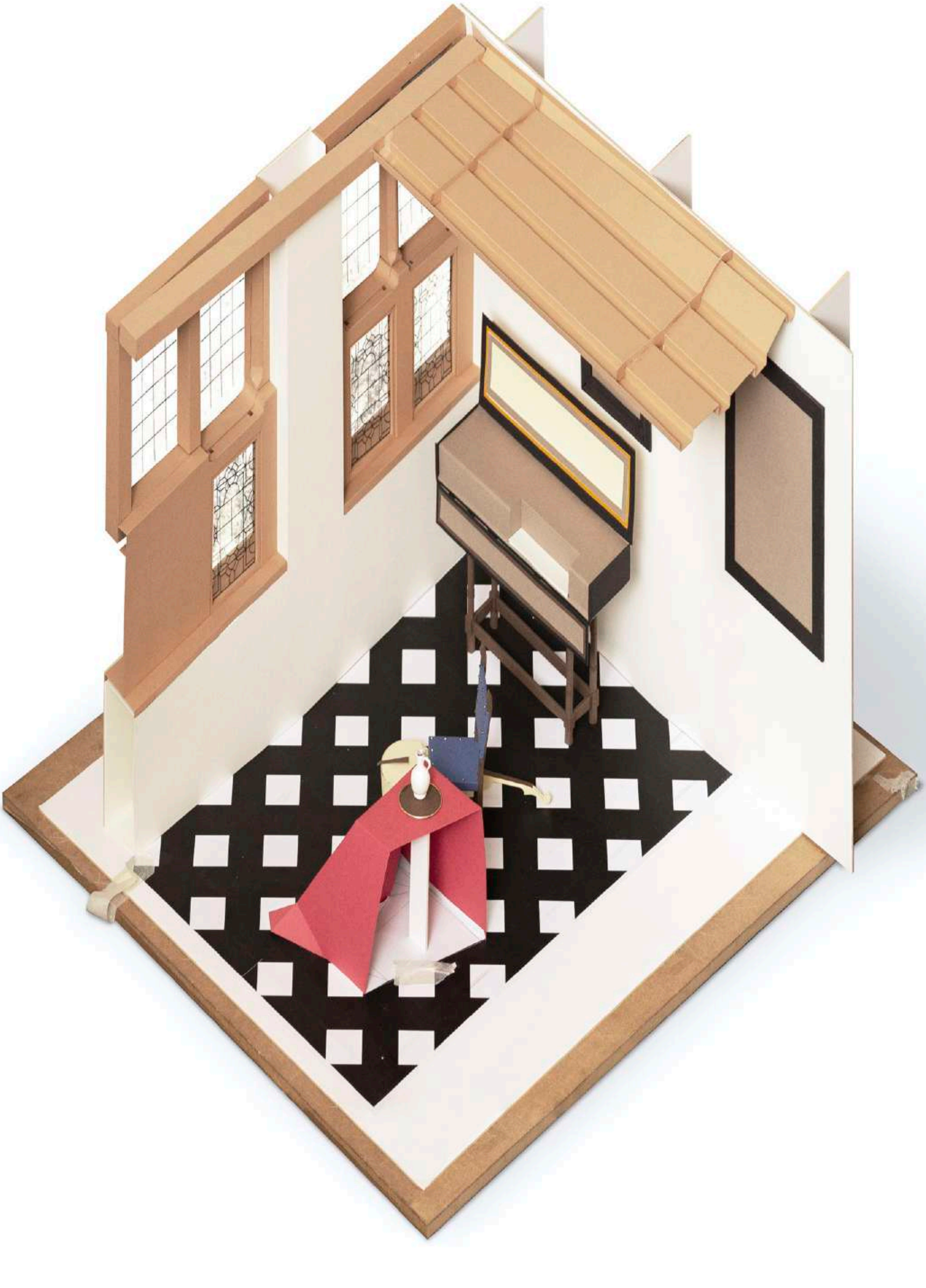
Papier découpé et plié

Etant donné que son utilisation sera limitée à la prise de vue photographique, la maquette ne doit pas être réalisée dans un matériau pérenne. Pour les mêmes raisons, tout ce qui n'apparaîtra pas en photo ne demande pas d'être modélisé. Cela étant, la technique du papier découpé et plié est surement la plus appropriée car elle permet une production avec un nombre très restreint d'outils légers et permet la réalisation facile d'un niveau élevé de détail.
Un cutter, une règle métallique et de la colle redécollable en spray (pour coller les dessins de découpe) suffisent à un modélisation telle que présentée ici, à l'échelle 1/10e. L'avantage du papier est qu'il se trouve facilement décliné dans des très nombreuses couleurs et type de qualité de surface, offrant des possibilités très grandes de représentation des différentes qualité de matériaux. L'épaisseur négligeable du matériau permet aussi de produire des plans de découpe en développé, issus directement des dessins en géométral ou d'un modèle 3D.

Outils requis pour la construction de la maquette ci-contre

Plan de découpe de la fenêtre en développé



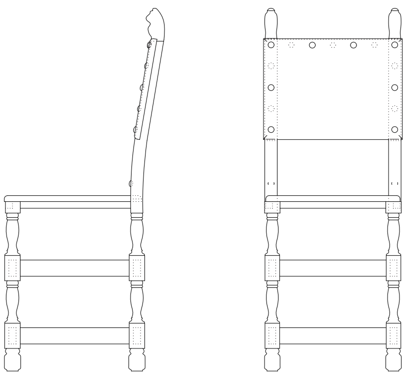


Production des objets en papier au 1/10e

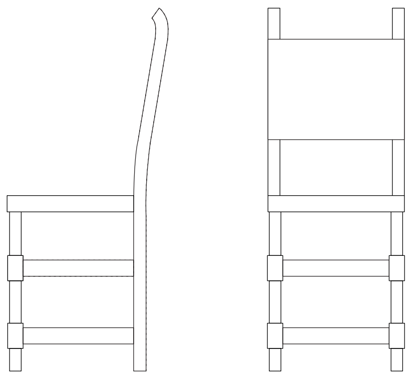
À partir du dessin en géométral, on peut aisément dessiner le développé des objets à modéliser. Imprimés sur un papier standard, ces dessins seront collés à la colle repositionnable sur le papier (ou carton) choisi. On découpera au cutter le pourtour de chaque forme et on incisera légèrement aux endroits où se fera un pli. Il suffira ensuite de décoller le patron pour aboutir au pliage et collage de l'élément tridimensionnel. Le choix du papier se fera selon plusieurs critères:

- résistance: plus l'élément représenté est grand, plus le papier ou le carton doit est résistant. Il est à noter que les plis participent énormément la résistance, fonctionnant comme de très efficaces raidisseurs. On peut donc tabler sur des grammages de papier plutôt faibles.
- couleur: il est intéressant d'utiliser un papier dont la couleur se rapproche le plus possible de celle de l'objet représenté. Les effets de reflets et d'interactions en tous genres sur la photographie réalisée ensuite seront plus réalistes. Cependant, une option est de produire une maquette qu'en papiers blancs et de la coloriser en post-production à l'ordinateur.
- texture: plus encore que la couleur, ce critère est très important car l'effet dû à une surface plus ou moins lisse ou réfléchissante est très difficile à recréer en post-production.

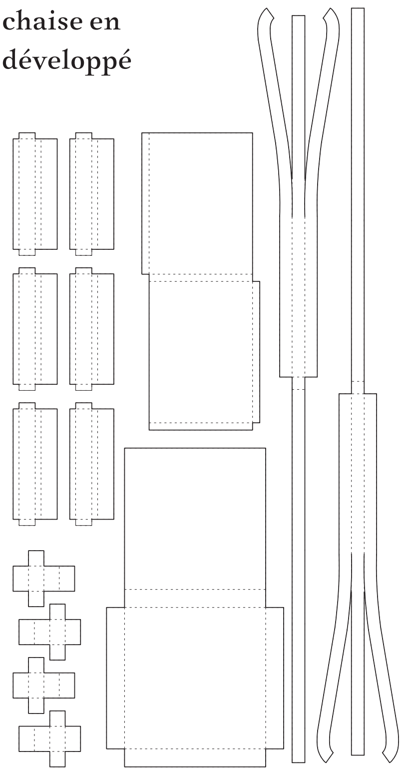
Dessin précis en géométral



Re-dessin simplifié prenant en compte le niveau de détail requis pour cette maquette au 1/10e.



Elements constitutifs de la chaise en développé



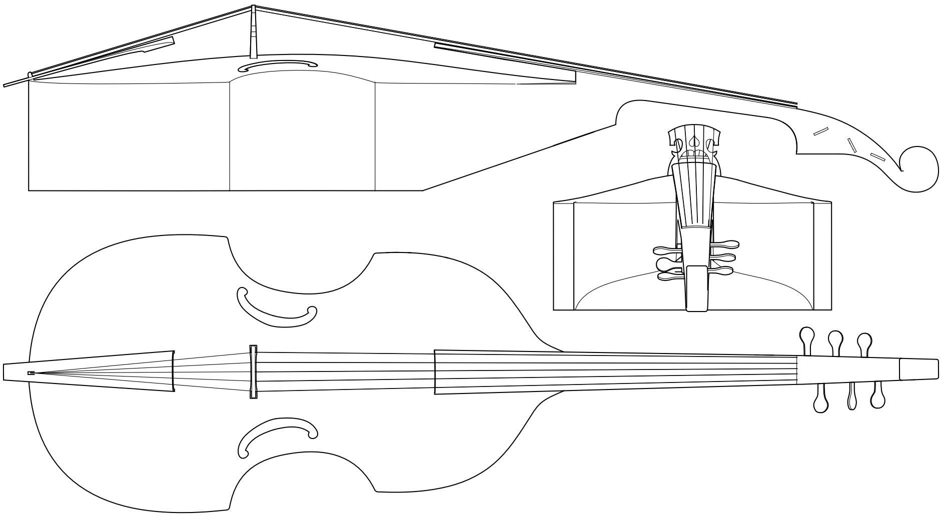
Un papier standard révèle les ombres portées de manière franche, diffuse la lumière de manière homogène et permet de modéliser tout type de matériaux mat.

Un papier ou carton légèrement satiné produit des reflets atténués et changeant en fonction de l'angle de vue. Il peut être utilisé pour représenter tout type de surface lisse, sans pour autant produire un effet brillant ou miroir.

La feuille d'acétate (ou tout autre matériau parfaitement lisse) produit des reflets très nets et sert dans des cas particuliers, quand une brillance maximum est requise.

Objets réalisés en papiers de couleur pliés (à l'exception de la cruche, en pâte à modeler séchant à l'air et des boutons dorés de la chaise).
Échelle 1/10e.

Bois découpé, poncé et verni

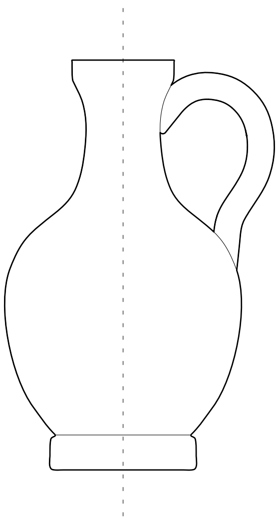


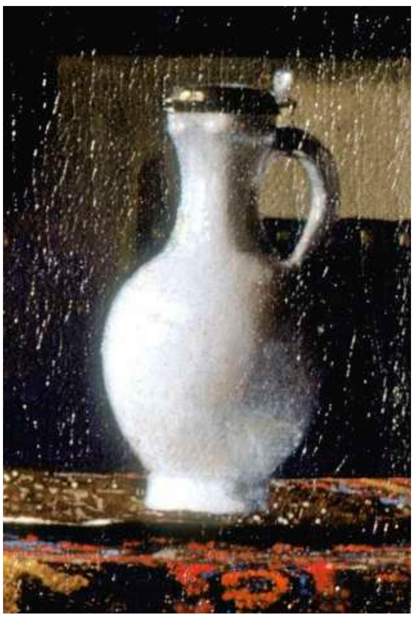
Dans une maquette destinée à être photographiée pour la production d'une image, certains éléments requièrent des niveaux de détail et de réalisme particulièrement importants. Il s'agit souvent d'objets placés proches du point de vue de l'observateur. Pour arriver au niveau de rendu souhaité, il convient de réaliser ces objets clefs à une plus grande échelle que le reste de la maquette, de les photographier indépendamment et de les réintégrer à l'image finale par collage numérique . Ici il a été décidé de travailler au 1/3 pour la viole de gambe, échelle qui permet de se rapprocher au mieux de la réalité matérielle d'un travail de lutherie sans pour autant impliquer l'utilisation de trop de matériaux.
Si la technique du papier découpé et plié est très performante à l'échelle 1/10e, au 1/3 il vaut mieux se rapprocher des matières originales; ici le bois.

Comme cet élément de maquette est conçu pour n'être vu que d'un certain angle et dans le but exclusif d'être photographié, il a été produit en bois massif. Après avoir reporté le dessin sur le bloc de bois, on dégrossit la forme générale de la viole de gambe à la scie à ruban. La ponceuse permet ensuite d'affiner les courbes. La surface gauche de la partie supérieur de la viole requiert un travail au ciseau à bois, lissé ensuite au papier de verre. Toutes les surfaces sont alors poncée très finement avant de recevoir plusieurs couches de mordant (teinture pour bois). Finalement, un verni brillant vient donner la juste valeur de réflectivité aux surfaces.

Argile peint et verni

Cas similaire à la viole de gambe, la cruche, par sa surface courbe et réfléchissante ne se prête pas à la modélisation en papier. L'importance de cet élément dans la composition du tableau implique aussi qu'il soit très fidèle visuellement à l'original et donc construit à une grande échelle. Ici aussi le 1/3 a été choisi.
La mise en œuvre est similaire à de la poterie à la différence qu'on pouvait se limiter à produire un objet plein.
L'argile a été modelé en fonction d'un patron découpé dans un carton, puis lissé à la main, peint à la gouache et verni.





Modelage de la cruche en argile

Peinture à la gouache blanche

Vernissage brillant

THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

III
PHOTOGRAPHIE

¤

Olivier Meystre

MANUEL DE PHOTOGRAPHIE DE MAQUETTE

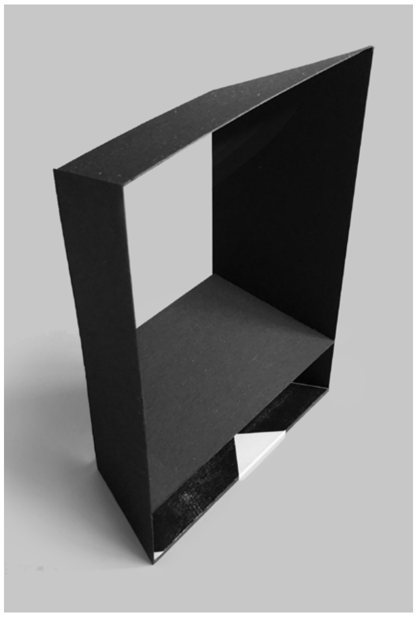
Olivier Meystre

La photographie de maquette constitue une technique très performante pour produire des images architecturales, particulièrement des vues intérieures. Par le contrôle en direct de l'éclairage, dont on voit le résultat des modifications instantanément, et par le réalisme des effets de propagation de la lumière dans un espace, cette technique rivalise avec les meilleurs rendus dit 3D (ou peut les compléter).
Les pages suivantes exposent les différents paramètres à maîtriser pour en contrôler tous les aspects.

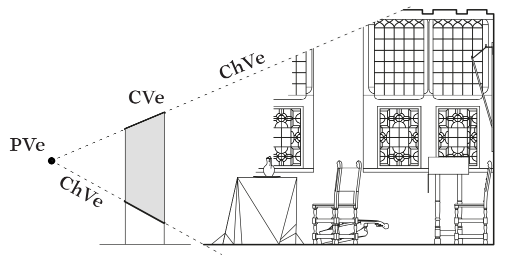
Prise de vue en studio d'une maquette au 1/10e d'après la *Leçon de musique* de Vermeer

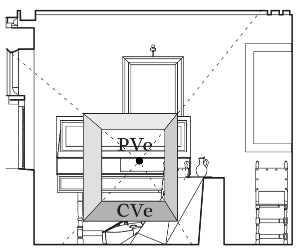
LAPIS

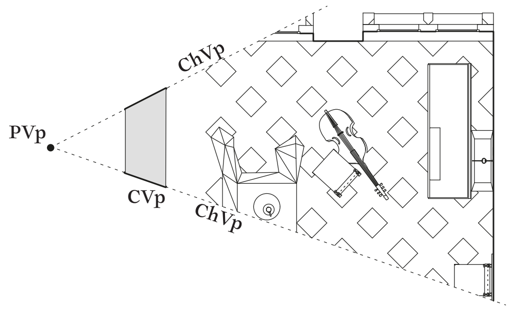
Placement de l'appareil photographique

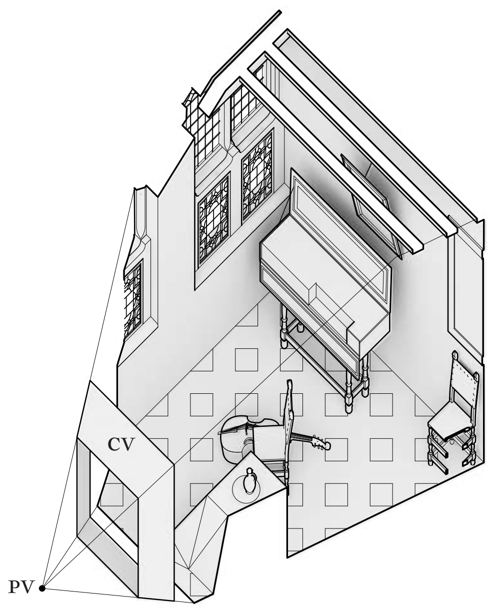


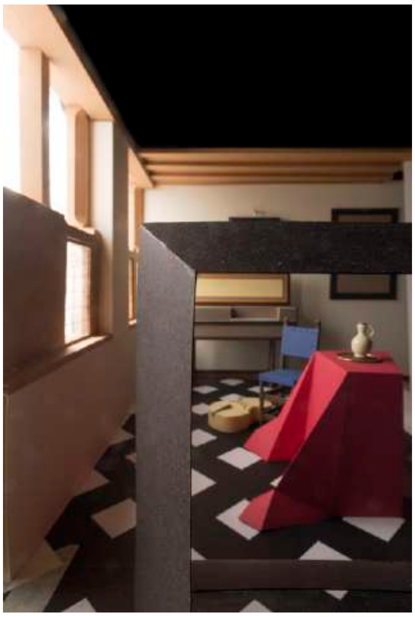
Le paramètre essentiel d'une prise de vue photographique est le placement de l'appareil, le choix du point de vue. Dans le cas particulier de la reconstruction d'un tableau, il s'agit de retrouver, à l'aide de l'appareil photo, le point de vue exact obtenu par la perspective inverse (PV). Pour y arriver avec précision et éviter des tâtonnements laborieux, on peut construire un cadre de visée (CV). Basé sur les limites du champ de vision des projections orthographiques en plan (ChVp) et en élévation latérale (ChVe), il consiste en une portion de la pyramide de vision (portion dont la profondeur est à choisir en fonction de la place disponible entre l'objectif de l'appareil photo et les éléments de premier plan de la maquette). Une fois ses dimensions définies, on peut le construire en y incluant un support susceptible de le maintenir à la bonne hauteur. Le cadre de visée est à placer ensuite au bon endroit sur le sol de la maquette générale. On peut dès lors placer l'appareil afin que n'apparaissent dans le viseur que les tranches des éléments de carton formant le cadre de visée.







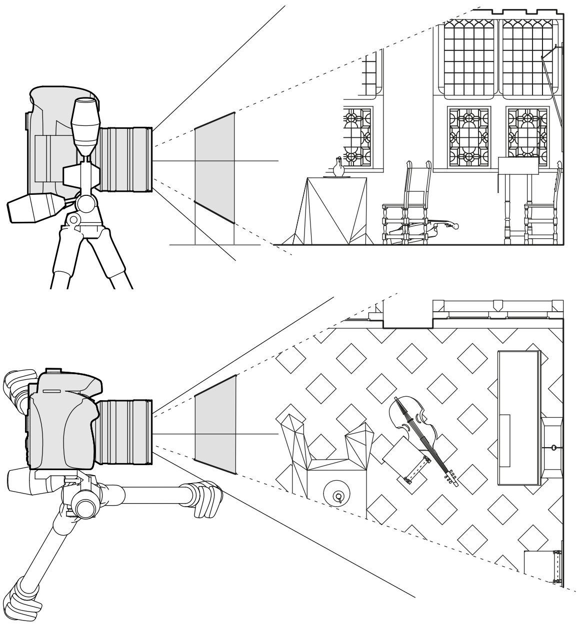


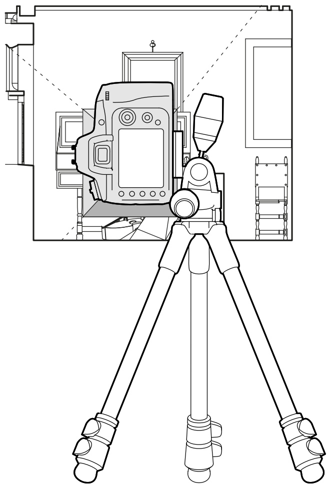


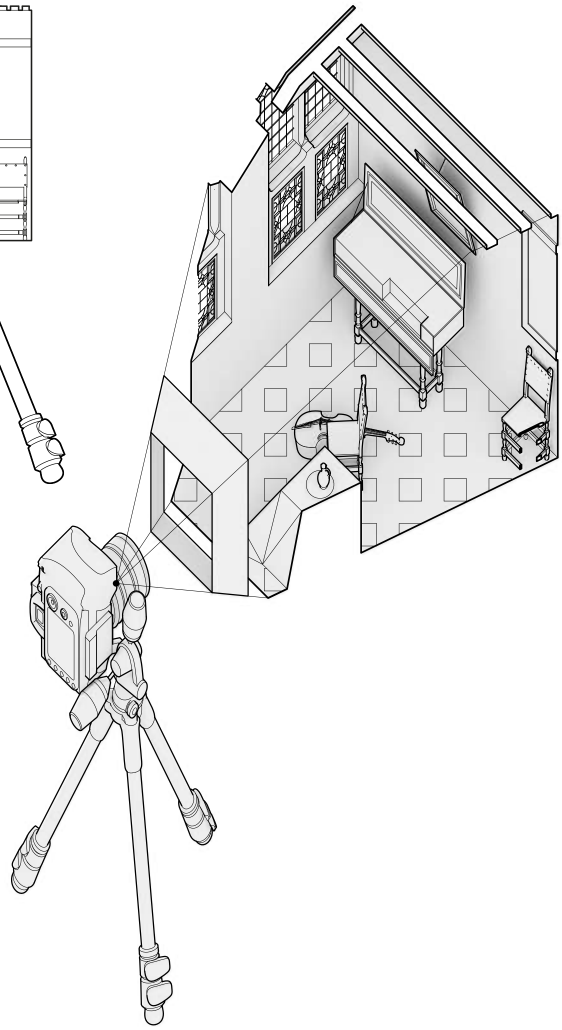
Appareil placé trop haut et trop à gauche.

Appareil placé à la bonne hauteur (cadre en haut et en bas n’est plus visible que par l’épaisseur du carton) mais trop à gauche.

Tous les côtés du cadre de visée ne sont plus visibles que par leur tranche. L’appareil est donc placé au bon endroit, tant latéralement, en hauteur que dans la profondeur.



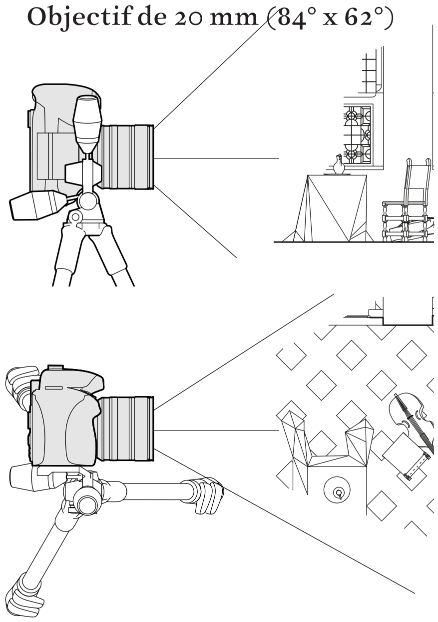


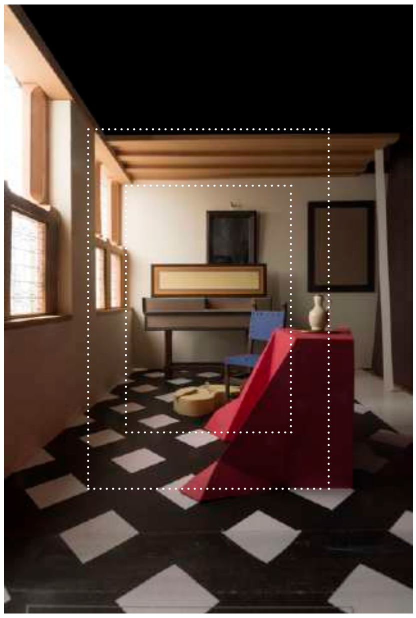


Effets du changement de distance focale de l'objectif (zoom)

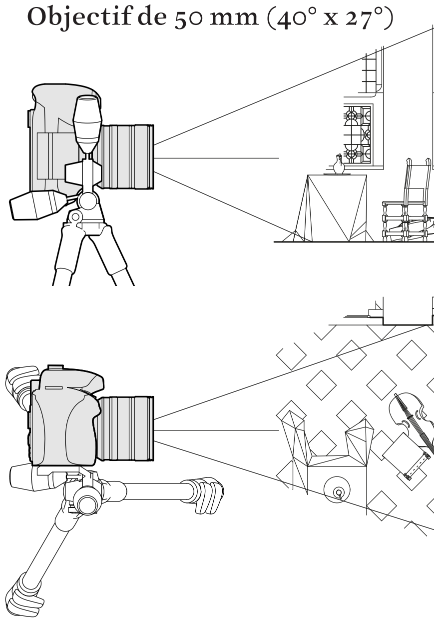
Contrairement à une idée répandue, le fait de changer la distance focale d'un objectif photographique (=zoomer) sans déplacer l'appareil ne change en rien la perspective de l'image. Il en résulte seulement un recadrage, un changement de l'angle de champ.

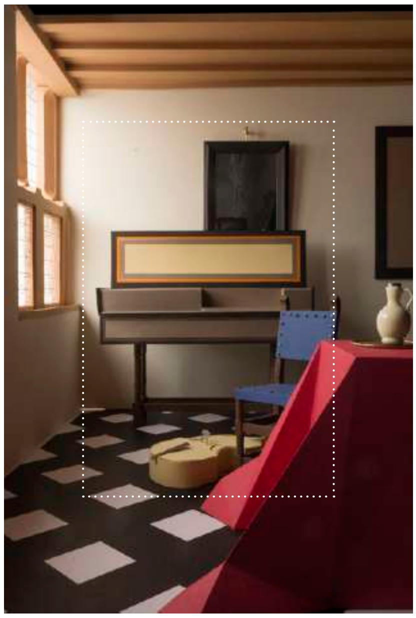
Objectif de 20 mm (84° x 62°)



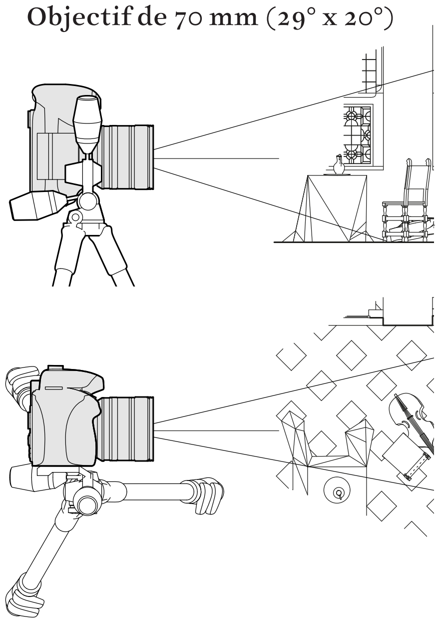


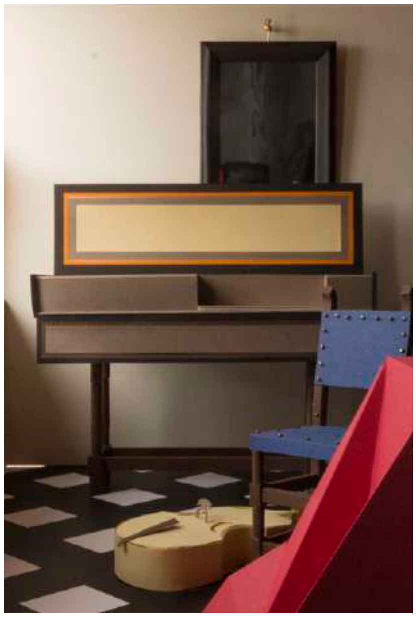
Objectif de 50 mm (40° x 27°)



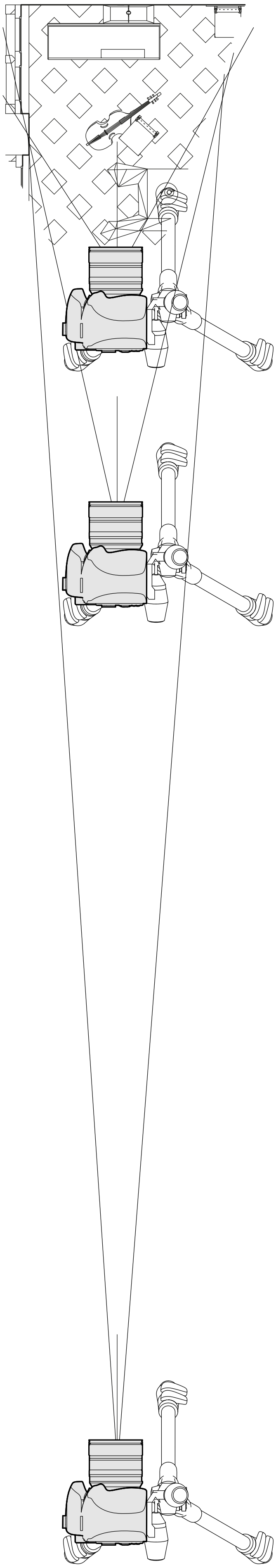


Objectif de 70 mm (29° x 20°)

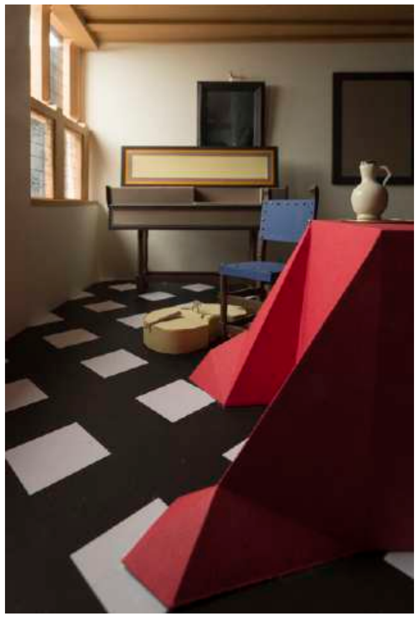


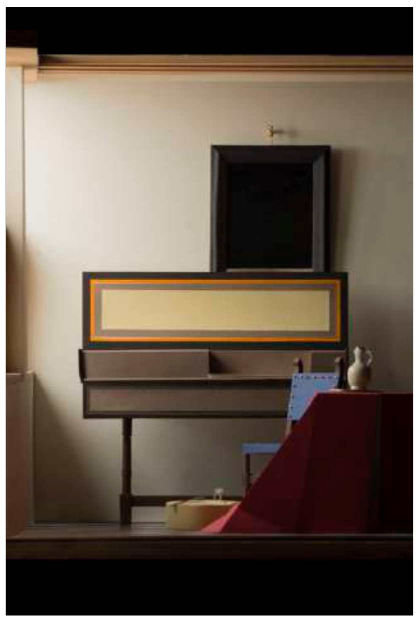


Effets de l'éloignement ou du rapprochement de l'appareil photographique



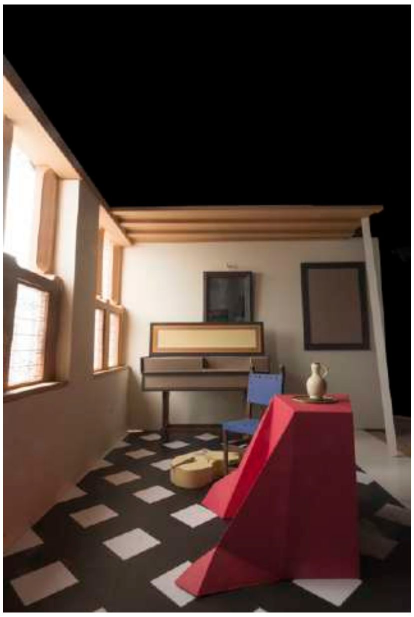
Si l'on déplace l'appareil par rapport à l'objet photographié en le reculant ou en l'avançant, la perspective change. À cadrage équivalent, une vision proche aura tendance à accentuer les fuyantes et à faire se détacher les plans, grossissant les premiers et rapetissant les éléments en arrière plan. À l'inverse, une vision éloignée produira une perspective qui ressemblera de plus en plus à une axonométrie ou une projection orthogonale, aplatissant les plans et rendant presque parallèles les fuyantes.

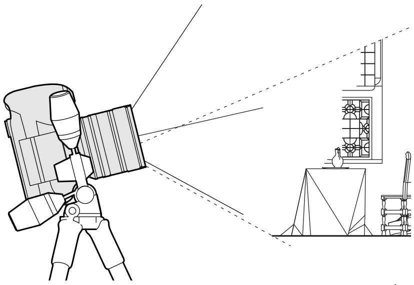


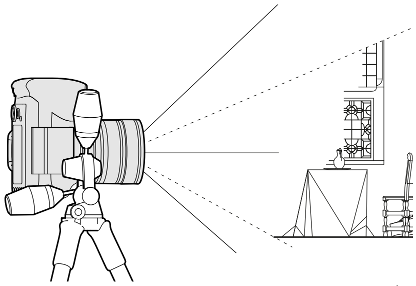


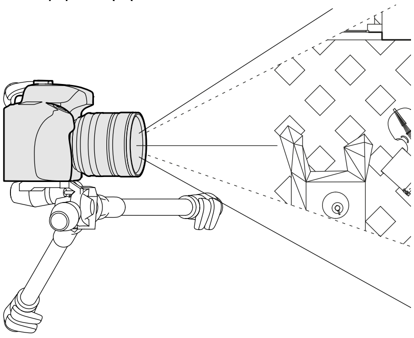
Effets des rotations de l'appareil photo

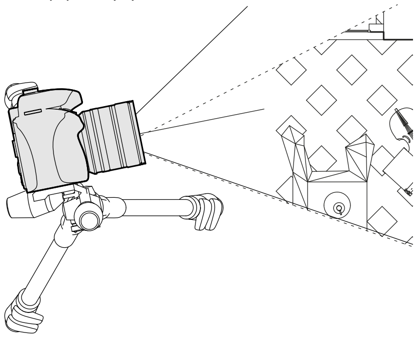
Tout déplacement de l'appareil relatif à l'objet photographié produit un changement de la perspective. Les mouvements dits panoramiques ne font pas exception. Si l'on veut produire une image avec une perspective centrale (frontale), ces positionnements de l'appareil sont à proscrire* car seule une visée parfaitement horizontale et perpendiculaire aux objets photographiés maintient les lignes horizontales et verticales dans l'image.











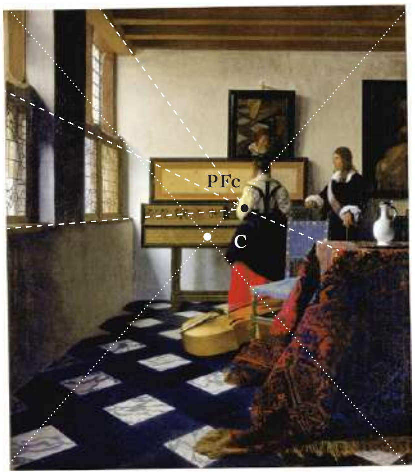
Lorsque la visée est dirigée vers le haut on parle de vue plafonnante (ou vers le bas de vue plongeante). Les arrêtes verticales dans la maquette apparaissent alors inclinées sur l'image, convergentes en un point de fuite en haut (ou respectivement en bas dans le cas d'une vue plongeante).

Lorsque la visée est dirigée latéralement (à gauche ou à droite), on parle de mouvement panoramique au cinéma. Dans la perspective qui en résulte (une vue oblique), aucune arrête horizontale de la maquette n'apparaît plus horizontalement. Tous les éléments horizontaux (parallèles ou orthogonaux entre eux) convergent à deux points de fuites latéraux.

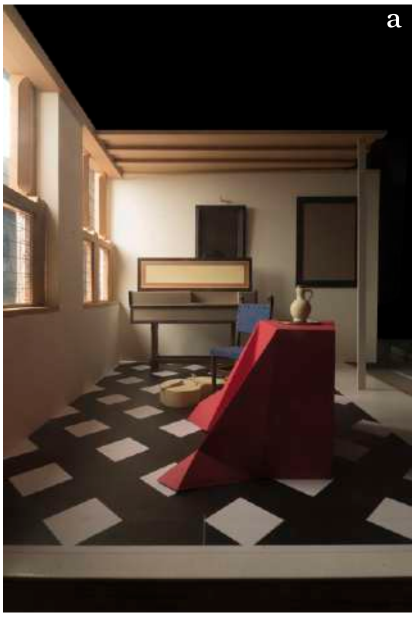
* sauf à utiliser une méthode de redressement de la perspective expliquée ci-contre.

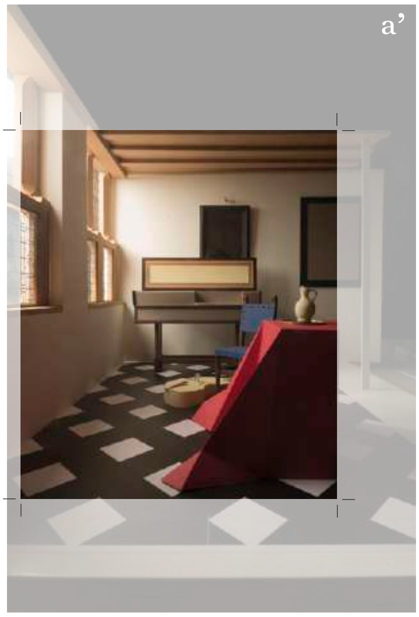
Simulation du décentrement

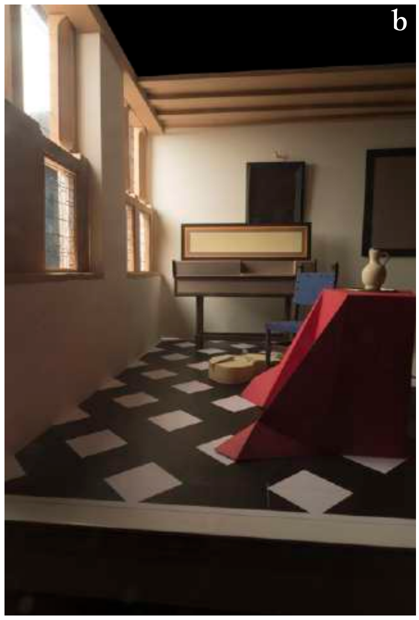
Si la *Leçon de musique* de Vermeer (et beaucoup de tableaux de l'âge d'or Hollandais) présente une perspective centrale, son point de fuite dit central (PFc) ne se trouve pas au centre géométrique de l'image (C). Ce type de vue résulte de ce qui serait, en technique photographique, un *décentrement* si on utilisait une chambre photographique (ou un objectif à décentrement). Pour produire ce type d'image, on peut utiliser deux méthodes.

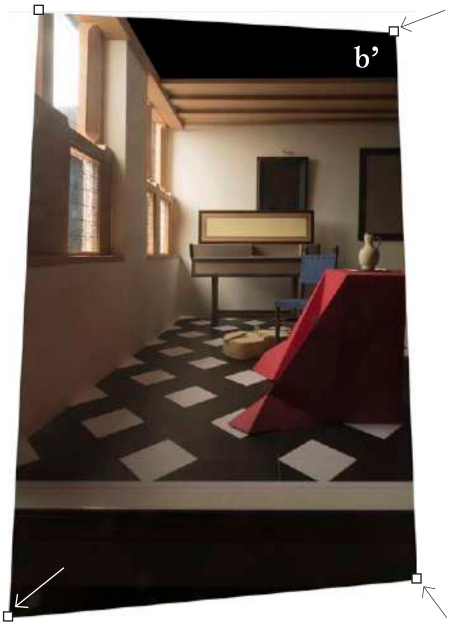


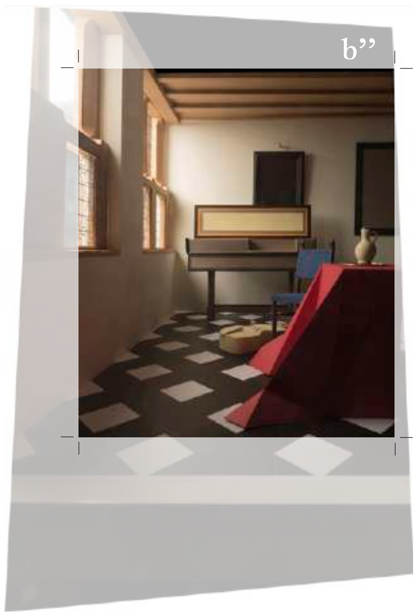
La première (a) est de recadrer une photographie produite avec un objectif offrant un champ de vision plus grand que celui du tableau (une distance focale plus courte).
Le seconde (b), si un objectif avec un grand-angle suffisant fait défaut, est de viser dans la direction de décentrement et de cette manière produire une photographie non frontale et plongeante (ou plafonnante) puis de redresser la perspective en déformant la photographie ainsi produite.
Les deux techniques produisent des résultats identiques (a' et b'') (bien que la seconde soit moins précise et s'accompagne d'une légère perte de qualité).





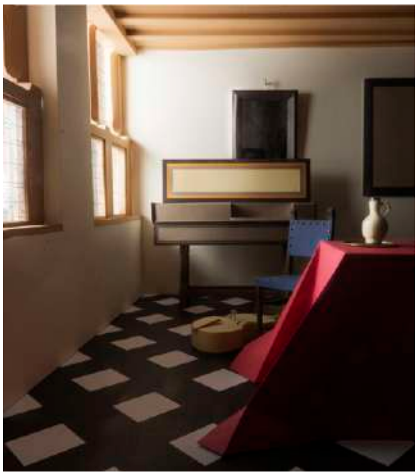




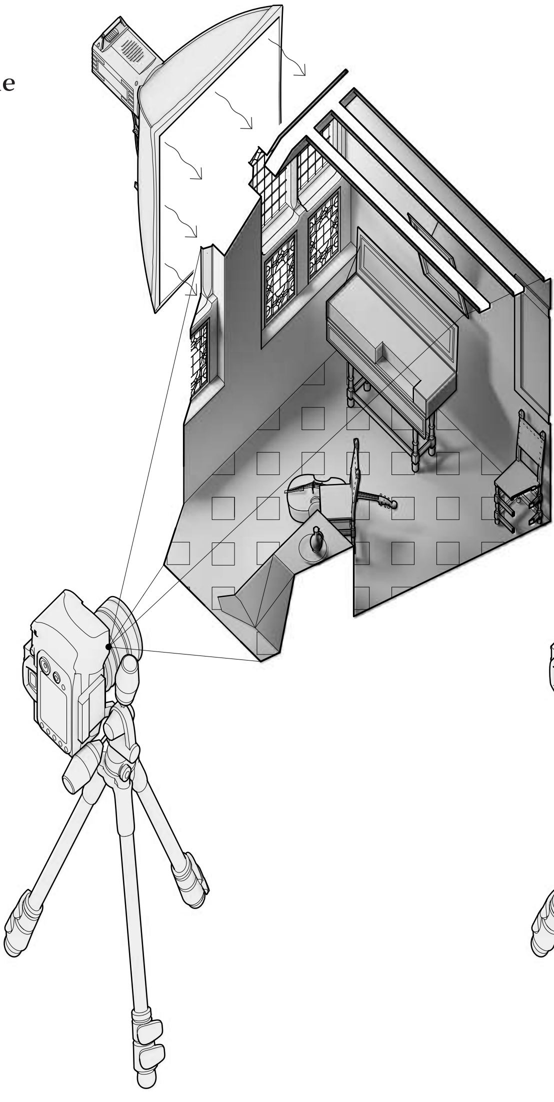


Éclairage diffus

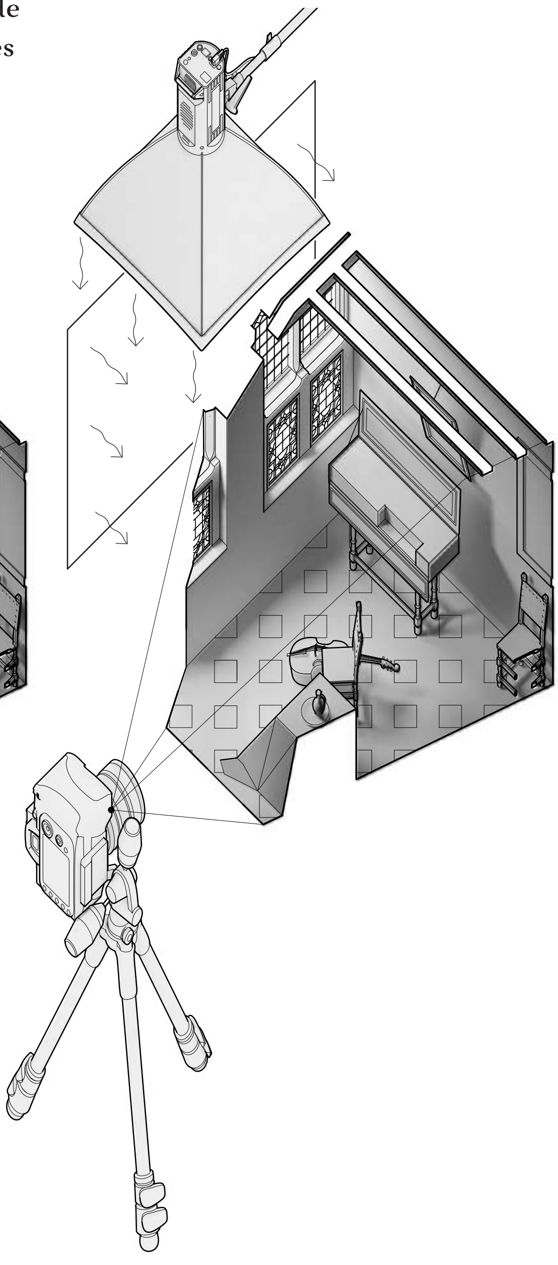
Pour simuler une lumière diffuse, produite par un ciel couvert ou un lumière du nord, un grand nombre de solutions techniques existe.
La première est de placer la maquette à l'extérieur, dans les conditions lumineuses recherchées. Le défi est alors de s'assurer que la lumière ne pénètre dans la maquette qu'aux endroits désirés (ici les fenêtres). Il faut donc calfeutré tous les autres côtés en incluant l'appareil photographique (le plus simple à l'aide des textiles noirs non transparents).
La seconde possibilité, plus confortable, est de se mettre dans des conditions de studio (pièce fermée et coupée de toute lumière extérieure). La source de lumière peut alors être de toutes natures: lampe de bureau avec diffuseur en papier calque, écran d'ordinateur affichant une page entièrement blanche, flash professionnel avec boîte à lumière, etc. Si ces options varient beaucoup en intensité et en température de couleur de lumière, elles produisent toutes des résultats très semblables, ne requérant que des ajustements en termes de temps de pose et balance des blancs.



Une source diffuse directement plaquée horizontalement aux fenêtres produit un contraste trop grand entre la zone proche de la façade et la profondeur de la pièce à droite. La qualité des ombres portées n'est pas non plus celle attendue.

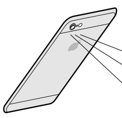


Une source diffuse venant du haut couplée à un diffuseur blanc produit un résultat meilleur.



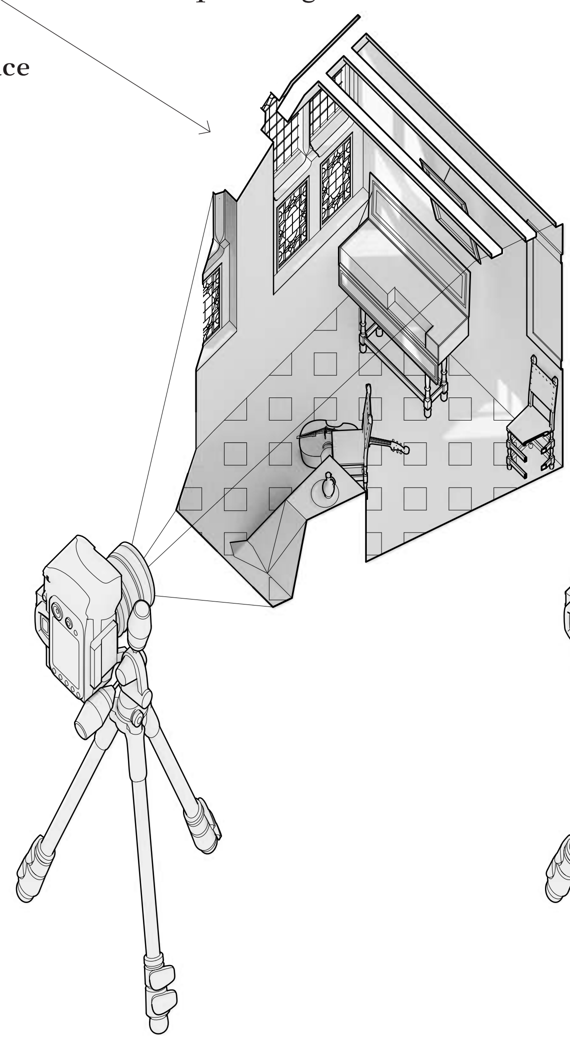
Éclairage ponctuel

Un éclairage ponctuel est requit lorsque l'on veut simuler soit la lumière directe du soleil, soit une source de lumière non diffuse telle qu'une bougie ou une ampoule.
Les mêmes remarques peuvent être faites ici concernant la prise de vue en extérieur.

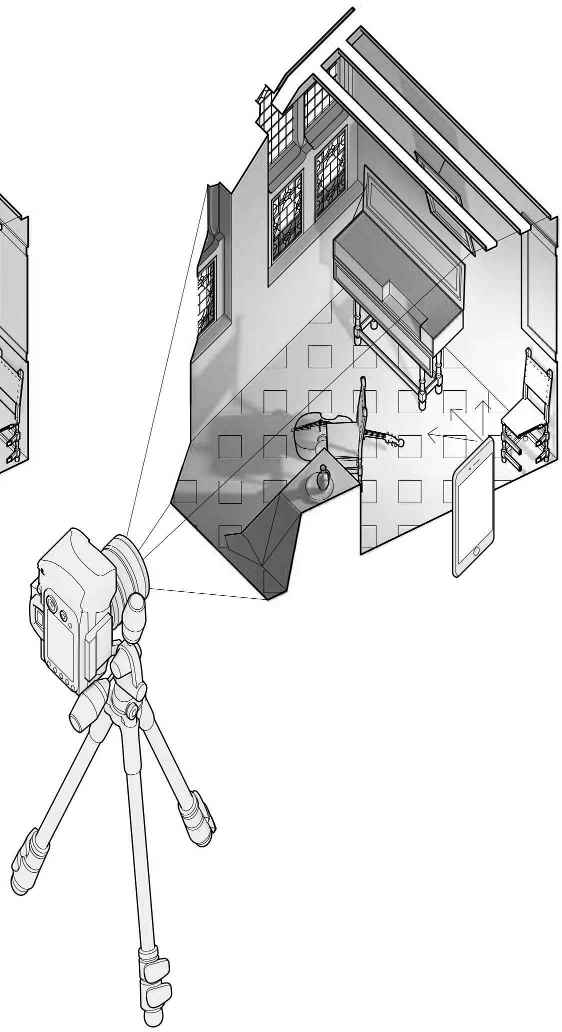


En particulier en ce qui concerne la lumière du soleil, cette option est à envisager car rien ne remplace la vraie source lumineuse du soleil pour produire des projections d'ombres véritablement parallèles.

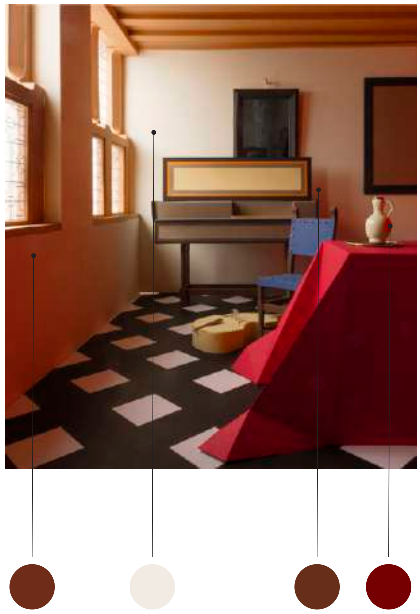
À défaut de lumière du soleil, on peut utiliser un lampe de faible diamètre (la lampe d'un téléphone portable est idéale) et la placer le plus loin possible de la maquette. La lumière de faible intensité ainsi projetée sur la maquette sera compensée par un temps de pose long.



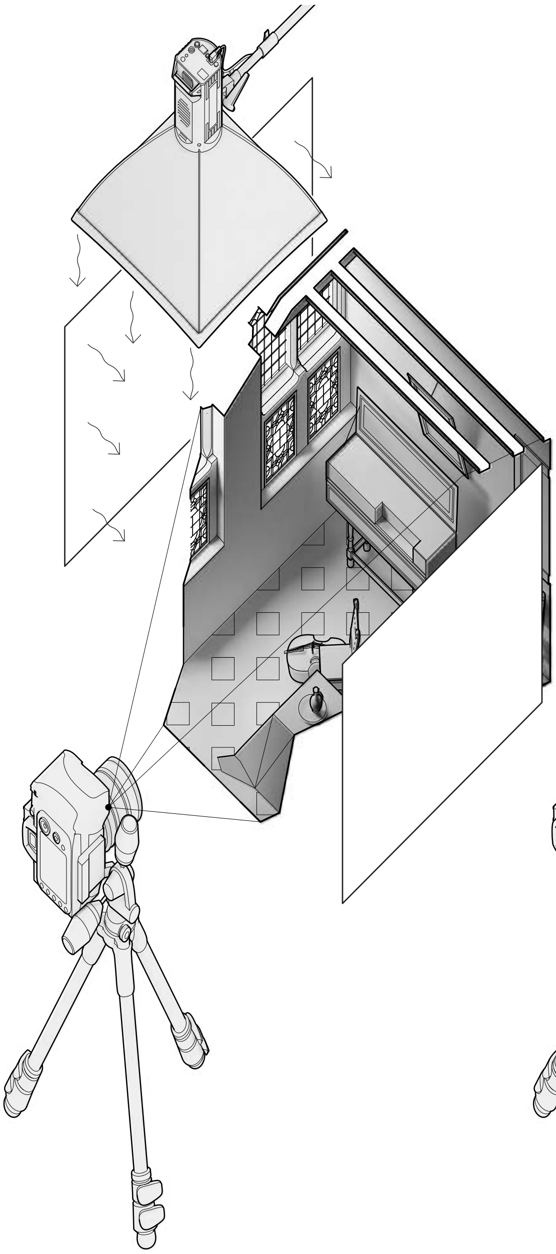
La lampe de téléphone portable convient aussi très bien pour simuler une source de lumière ponctuelle intérieure. On prendra garde ici d'ajuster la balance des blancs pour rendre la dominante jaune-orangée d'une flamme de bougie ou d'une ampoule à filament.

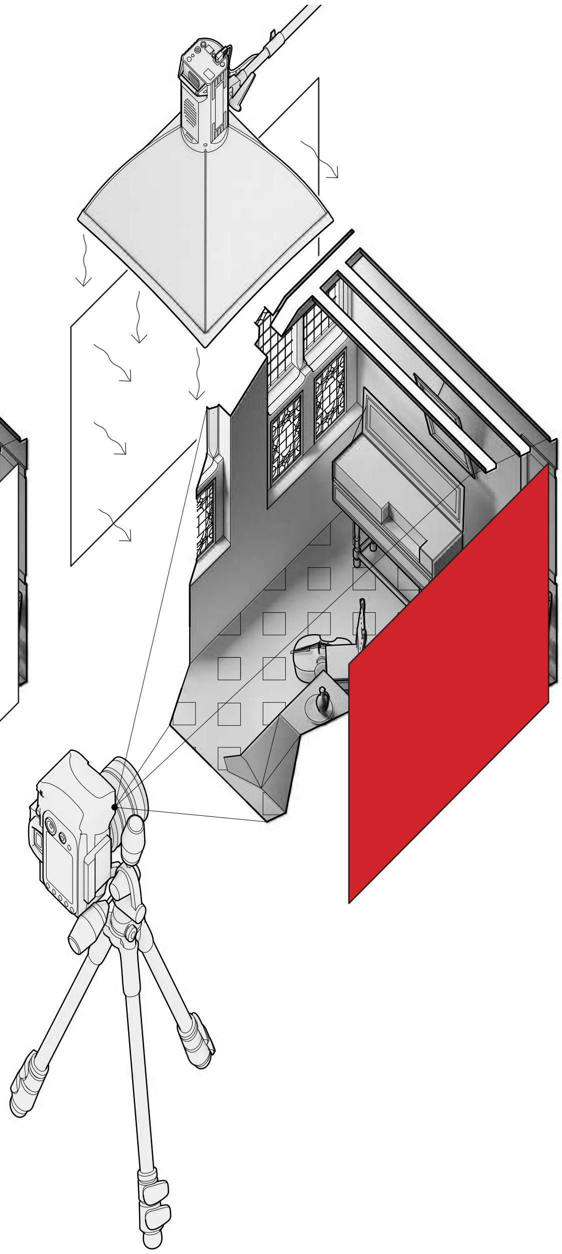


Effets de la réflexion de diffuseurs



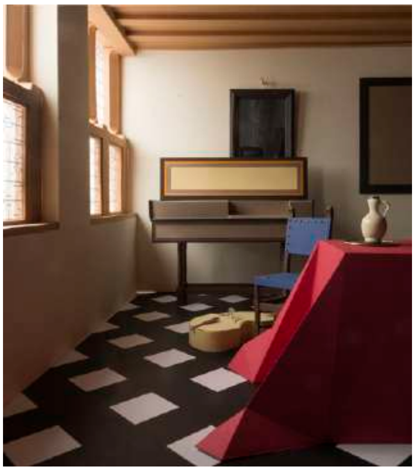
On a tendance à sous-estimer la lumière indirecte réfléchie sur les surfaces en présence dans la maquette. La prendre en compte dans la mise en place de l'éclairage du modèle permet d'en améliorer beaucoup la précision et la qualité.
Un diffuseur blanc fonctionnera comme une source de lumière secondaire diffuse.
Une large surface colorée teintera toute la scène de la même couleur.



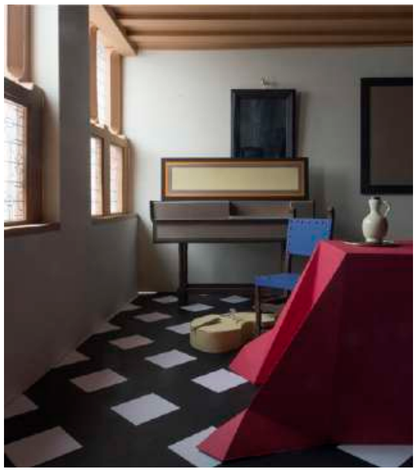


Réglage de la balance des blancs

Une fois l’éclairage de la scène calé, on peut entreprendre les réglages sur l’appareil photographique. Celui du la réponse du capteur à la température de couleur de la lumière se fait parmi les premiers. Il a comme effet de définir la teinte générale de l’image. On peut utiliser les réglages prédéfinis par l’appareil (lumière du jour, ombre, lumière incandescente, flash, etc.), faire confiance au mode Auto, ou encore le régler manuellement (en définissant la température de couleur en °K). Toutes ces options sont valables à conditions que le résultat soit maîtrisé et corresponde à l’effet requis.



Ici un réglage manuel a permis de garder une lumière à dominante chaude.



Le réglage Auto neutralise trop la température de couleur de la scène, en la rendant grisaille.

Un degré Kelvin trop élevé produit une image tirant vers le bleu.

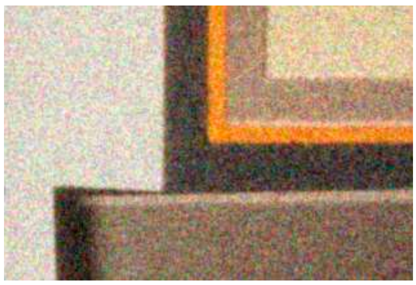
Un degré Kelvin trop bas produit une image tirant vers le jaune-orangé.

Réglage de la sensibilité du capteur (iso)

Pour assurer une image avec le moins de gain (grain numérique) possible, toujours préférer la valeur d’iso la plus petite, du moment que la vitesse d’obturation (temps de pose) n’est pas un problème ici.

50 iso

3’600 iso



Réglage de l'ouverture du diaphragme de l'objectif (profondeur de champ)

Le réglage de l'ouverture du diaphragme (le numéro précédé d'un F/ sur les appareils photo) permet de contrôler la profondeur de champs, c'est-à-dire la profondeur de la zone qui apparaît nette sur l'image. En avant et en arrière du plan de netteté (au niveau où l'on a fait le point, où l'on a mis au point) les éléments photographiés deviennent progressivement de plus en plus flous. Ouvrir ou fermer le diaphragme permet de jouer sur le degré de flou de part et d'autre du plan de netteté.
L'enjeu est particulièrement important en photographie de maquette car, dû à la taille réduite de l'objet photographié et de la proximité de l'appareil photo, la profondeur de champ est proportionnellement réduite. Pour éviter le typique «effet maquette» où le premier plan et l'arrière plan sont flous, il convient de choisir le mode de priorité à l'ouverture (indiqué A, pour *aperture*) ou manuel (indiqué M) et ensuite l'ouverture de diaphragme la plus petite, c'est-à-dire le chiffre, précédé d'un F/, le plus grand. Dans la plupart des appareils, cette valeur est à F/22 ou F/32.

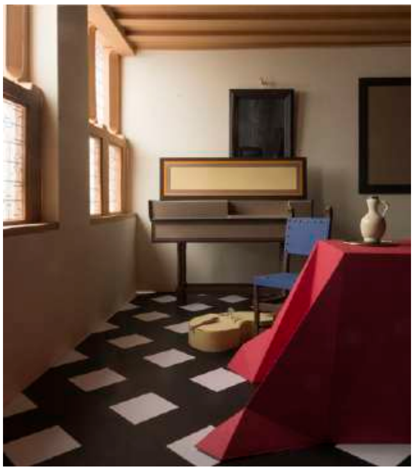
À F/22, le flou de la profondeur de champ n'est presque pas perceptible. Toute l'image semble nette.

À F/1.8, le flou de la profondeur de champ est très visible. Ici seuls les éléments dans le plan de netteté sont nets (bord de la table), le reste devenant très vite très flou.

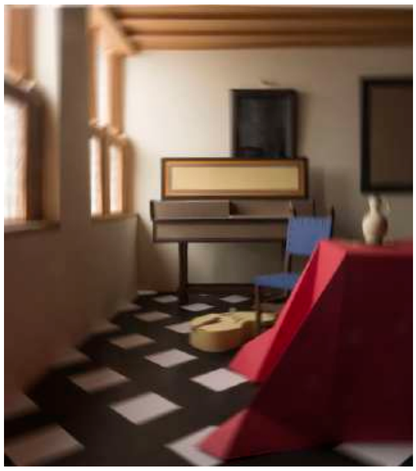
Conseils pour éviter le flou de bougé

D’origine très différente que le flou de profondeur de champ, le flou de bougé est à éviter dans le cadre de la photographie de maquette. Ce défaut est provoqué par le mouvement de l’appareil photographique (et/ou de l’objet photographié) pendant le temps de pose.
Il suffit d’appuyer sur le déclencheur de l’appareil, même bien installé sur trépied, pour le provoquer.

Pour y remédier, il est bon d’utiliser le retardateur de déclenchement (ou un déclencheur souple, ou encore une télécommande). Fixé de 10 à 30 secondes, il permet que l’appareil se stabilise avant le déclenchement effectif.
Un autre mouvement que l’on peut éviter sur la plupart des boîtiers, est celui du miroir du système de visée reflex qui se lève et s’abaisse à chaque prise de vue. La fonction «temporisation miroir levé» (Nikon) ou «verrouillage du miroir» (Canon) permet d’éviter un flou de bougé dû au miroir.



Prise de vue réalisée avec le miroir relevé et le retardateur. La netteté est optimale.



Flou de bougé provoqué par un mouvement involontaire de l’appareil photographique.

Format d’enregistrement des fichiers

Il est conseillé d’enregistrer les photographie en format RAW, seul format qui permette d’exploiter au maximum les fichiers en postproduction.

THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

IV

SINTHÈSE

¤

Olivier Meystre

MANUEL DE SYNTHÈSE NUMÉRIQUE D'IMAGE

Olivier Meystre

La production d'une image vraisemblable (et ici la plus fidèle possible à la référence picturale), basée sur des photographies de maquettes, requiert la maitrise des outils de retouche et de collage numériques. Car au-delà des ajustements appliqués à la photographie principale, il s'agira d'intégrer et de faire fusionner des éléments issus d'autres photographies (textures, éléments modélisés à une autre échelles, ressources photographiques diverses). L'image ainsi produite pourra être dite de synthèse car elle synthétisera, mettra ensemble, un certain nombre d'éléments hétérogènes. La réussite d'une telle entreprise se jugera à la qualité d'homogénéité de l'image finale et à l'imperceptibilité des collages. Les pages suivantes exposent les outils requis pour tout collage numérique et détaillent les différentes couches et étapes que la production d'une image telle qu'implique celle ci-dessous.

Johannes Vermeer, *La Leçon de musique*, 1662-1665.

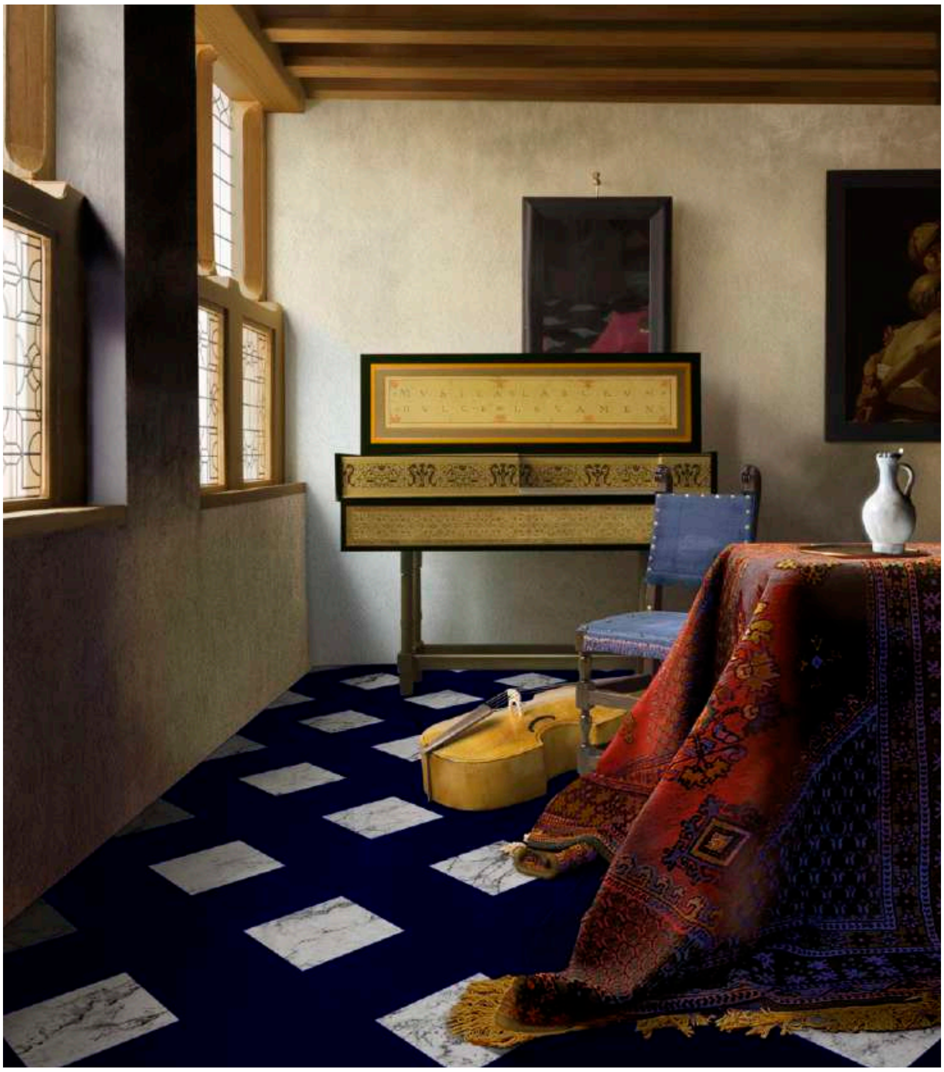


Image issue de la synthèse numérique de plusieurs photographies de maquette, d'après *La Leçon de musique* de Vermeer

LAPIS

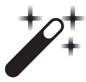
Principaux outils

Lasso et lasso polygonal

Comme dans un collage physique (papier), la qualité de la découpe des éléments est primordial. L'équivalent numérique au cutter ou à la paire de ciseaux sont les outils de sélection (les deux lassos ou le menu *sélection> plage de couleur*.) Leur maîtrise est la clef d'une image composite de qualité, car quelque soit la modification appliquée, c'est la précision de la zone où elle s'applique qui importe le plus.

Baguette magique



L'outil baguette magique permet de sélectionner une zone de couleur et de luminosité relativement homogène. Dans certain cas particulier, il peut être un complément intéressant à l'outil lasso, même si son utilisation est parfois malaisée ou réserve des surprises. C'est pourquoi il est conseillé de ne l'utiliser qu'en deuxième choix, quand l'outil lasso est trop difficile d'usage.

Tampon de duplication

Quand il s'agit d'enlever des imprécisions de la maquette ou des éléments tels que des poussières, le tampon de duplication est un outil performant. Il implique que l'on clique sur une zone de référence (celle qui va être dupliquée) avant de l'utiliser sur la zone à modifier. (n. b.: cet outil produit un clonage simple, contrairement à l'outil correcteur ci-dessous.)

Correcteur

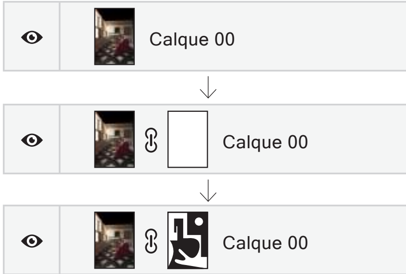
Similaire à l'outil tempon, le correcteur a la caractéristique de non seulement dupliquer une zone indiquée préalablement mais aussi de fondre le duplicata dans son contexte immédiat dans l'image, tant en luminosité qu'en texture. La correction ainsi réalisée n'est donc pas visible dans ses contours.

Pinceau

Le pinceau, dans le cadre d'une image composite, est utilisé principalement pour modifier les masques. Le fait que l'on puisse en faire varier la taille et la netteté en fait un outil très performant pour modifier ou affiner une zone de sélection sur un masque. (cf. ci-contre)

Masque

En bas de la palette des calques se trouve un certain nombre d’icônes dont celle-ci qui permet la création de masque. Un masque est une image en niveau de gris associée à un calque qui définit quelles zones du calque sont laissées visibles, respectivement masquées. Le blanc à 100% code pour la visibilité complète, le noir masque complètement et les gris produisent tous les degrés intermédiaires de transparences. En sélectionnant le masque (en cliquant dessus), on peut le modifier comme n’importe quelle image. Pour le visualiser directement dans la fenêtre principale, il suffit de cliquer sur l’icône du calque en même temps que la touche option/alt.



Calque de réglage

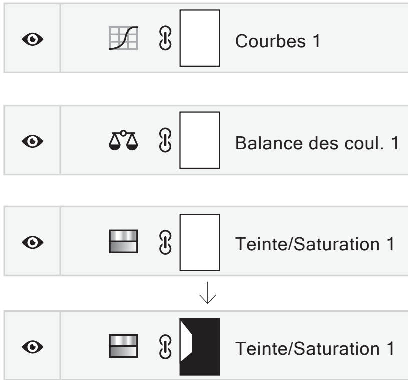
À côté de l’icône des masques se trouve celle des calques de réglage, donnant sur un menu déroulant contextuel. On y retrouve les mêmes paramètres que dans le menu *image>réglages*, mais ici la sélection d’un de ces paramètre produit un calque qui se place en dessus du calque actif. Ce calque de réglage permet de modifier le paramètre choisi, d’y revenir, de le rendre visible ou pas par l’intermédiaire de . Comme il est associé à un masque, le paramètre peut être appliqué qu’à une zone seulement de l’image.
On peut relever ici trois principaux outils incontournables, les autres paramètres étant moins indispensables:

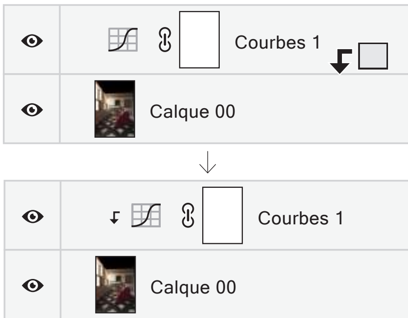
Courbes : elles permettent un réglage de la luminosité et du contraste plus précis que l’outil *luminosité/contraste*, tout en offrant les possibilités de l’outil *niveaux*.

Balance des couleurs : ce paramètre permet d’ajuster la couleur d’un calque, typiquement dans le cadre de l’intégration d’un élément exogène dans l’image du fond.

Teinte/saturation : cet outils complexe qui intègre teinte, saturation et luminosité se révèle très performant dans l’ajustement d’éléments devant se fondre dans leur contexte.

Si l’on veut faire porter la modification du calque de réglage seulement sur le calque immédiatement en dessous, on peut cliquer sur la ligne entre le calque d’ajustement et le calque sur lequel il s’applique en maintenant la touche option/alt : le pointeur se change en et permet la redéfinition d’affectation du calque d’ajustement.





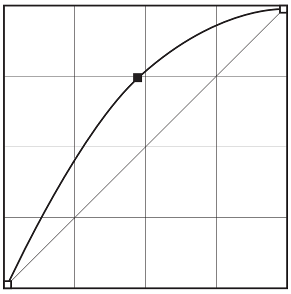
Une image brute, telle qu'à la prise de vue, convient rarement comme base d'un travail de collage. Les déformations liées à toute optique sont à corriger et la perspective (surtout dans le cas présent de perspective centrale avec décentrement) mérite très souvent qu'on la rectifie légèrement. Enfin, même avec une exposition bien réglée à la prise de vue, il n'est pas rare que l'on doive ajuster la luminosité et le contraste général de l'image.
Ces réglages de bases peuvent se faire soit dans l'application de retouche d'image, soit, dans le cas d'une photographie en format RAW, dans le plug-in dédié au traitement de ce type de fichier (Camera Raw).

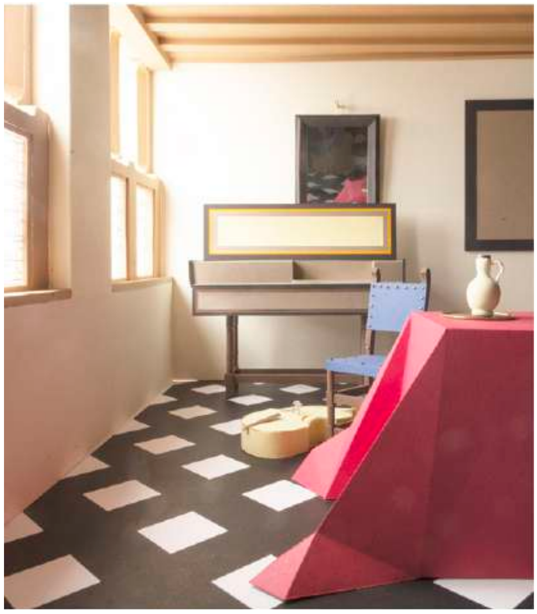
Pour ce qui est des déformations de l'objectif, on peut utiliser les réglages par défaut des profils pré-enregistrés dans Camera Raw en cochant la case *Activer le profil de correction* ainsi que *Supprimer l'aberration chromatique*.

La perspective s'ajuste aisément grâce aux différents paramètres de l'onglet *Transformation* de Camera Raw.

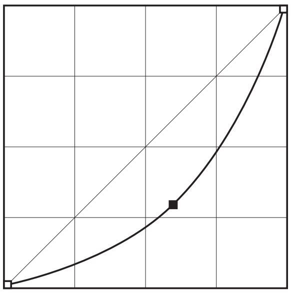
Les réglages de base de Camera Raw offrent le plus grand nombre de paramètres et sont très performants. On peut cependant les retrouver presque tous dans le logiciel principal. Dans ce cas, l'outil *courbes* (en masque de réglage) est celui à privilégier.

En montant la courbe, l'image s'éclaire sans perdre d'information dans les hautes et basses lumières.

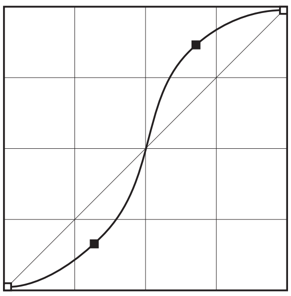




En baissant la courbe, l'image s'assombrit sans perdre d'information dans les hautes et basses lumières.

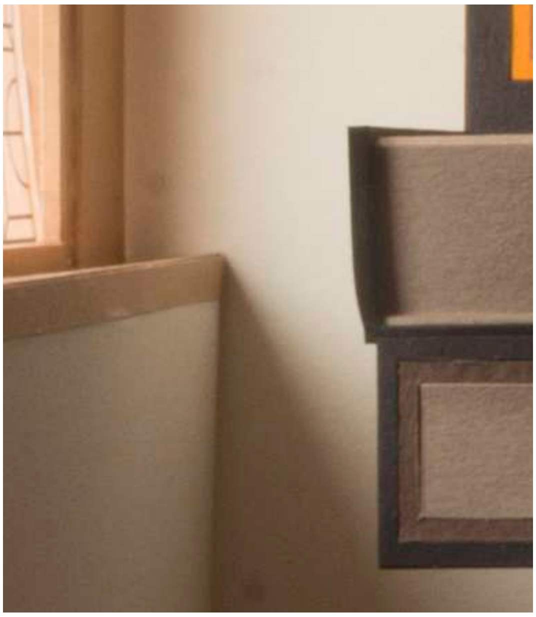


Une position en S augmente le contraste (et le diminue en S inversé.)



Une fois les réglages de base effectués sur l'ensemble de l'image, il s'agit d'ajuster pour chacune des zones ou des surfaces la luminosité et la teinte. On utilise alors les calques de réglages, principalement l'outil *courbe* et l'outil *teinte/saturation* . Pour ce faire, on sélectionne la zone à modifier avec les outils de sélection ( ) puis on crée un calque de réglage . Un masque se crée alors automatiquement reprenant la sélection. Dans un deuxième temps, on peut ajuster l'effet en jouant sur la transparence du calque de réglage et ajuster le zone sur laquelle il s'applique en modifiant le masque à l'aide, par exemple, du *pinceau* ou en appliquant un flou pour en adoucir les limites.

Calques et calques de réglages isolés montrant les ajustements appliqués.



↓

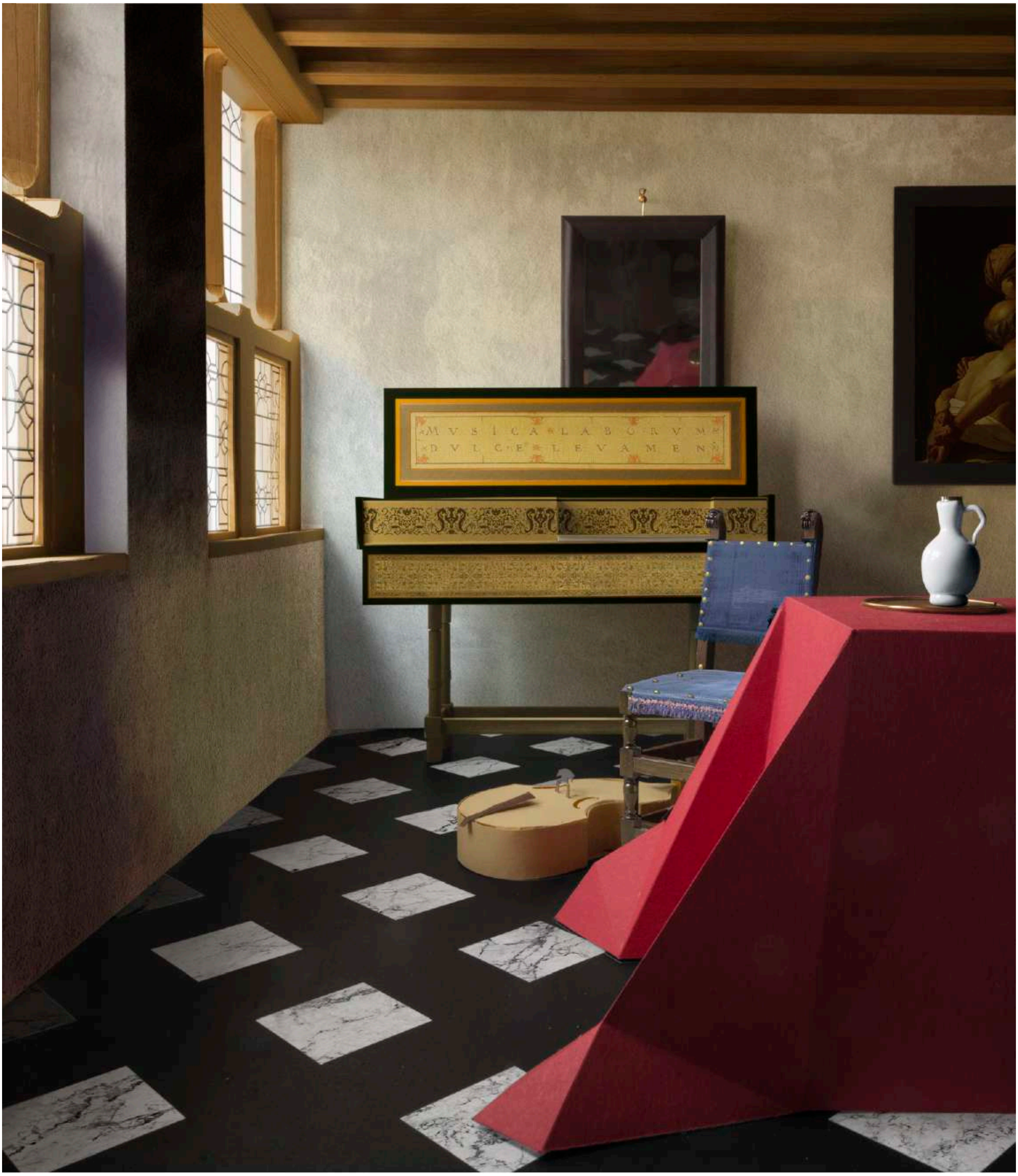
L'ajout de texture se fait par l'importation de photographies qui comporte les caractéristiques voulues, leur déformation avec l'outil *édition* > *transformation* > *torsion*, puis leur délimitation (à l'aide d'un masque ◘) et enfin leur incrustation dans l'image de base par le réglage du niveau de transparence (opacité) et le type de transparence. Le plus efficace pour appliquer une texture est le type d'opacité appelé *produit* dans le menu déroulant contextuel.

Calques et calques de réglages isolés montrant les textures appliquées.

Photographies de textures et leur application sur l'image

↓

Ajout d'éléments issus de sources photographiques

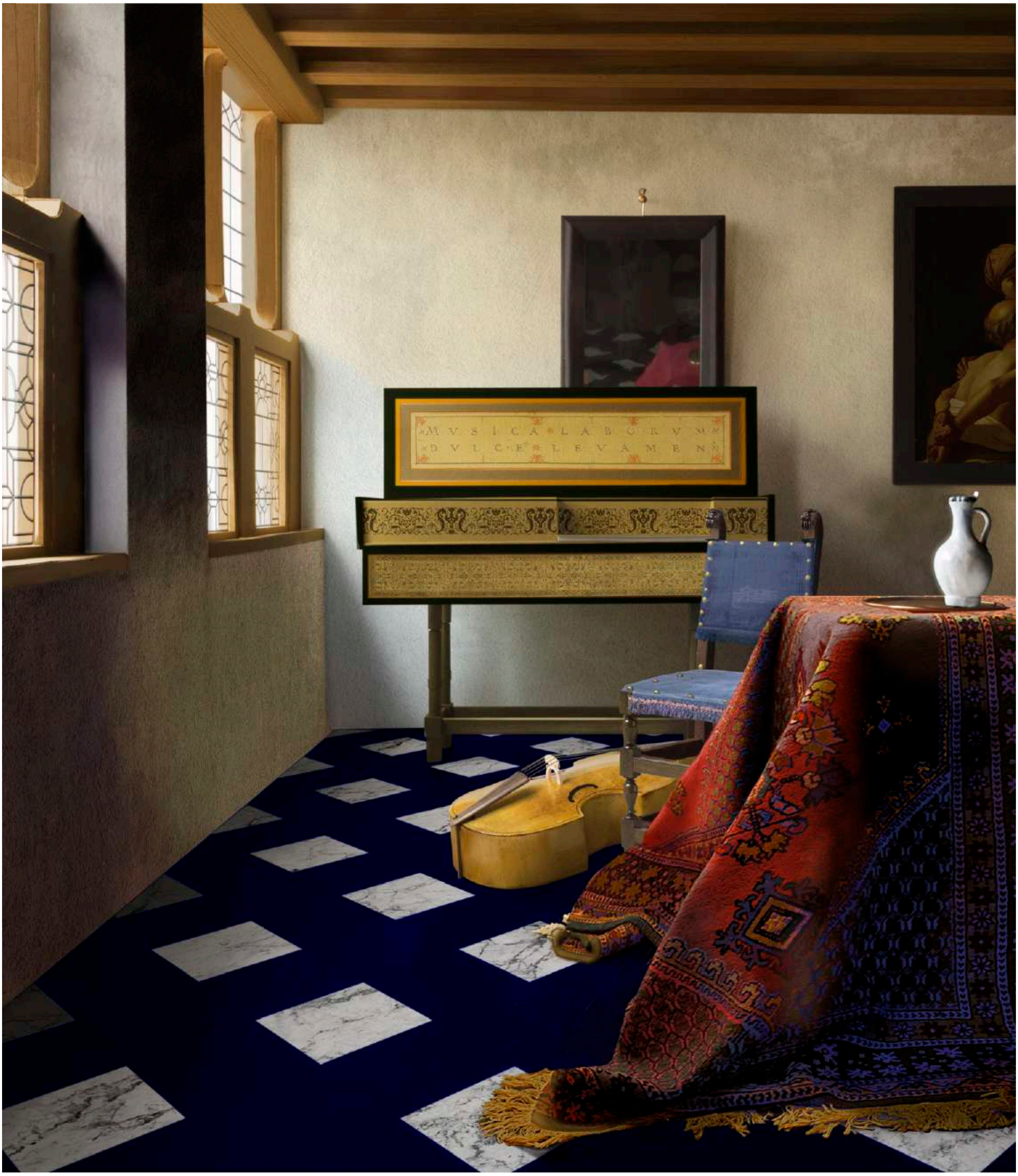


On peut être amené à compléter l'image par le collage d'éléments photographiques de sources diverses: reproduction de tableau, éléments de mobilier, inscriptions, dessins, etc. Les outils utilisés ici sont les mêmes que pour l'application de texture, avec des réglages d'opacité un peu différents.

Calques isolés montrant les éléments ajoutés.

Dirck van Baburen, *Cimon et Péro* (Charité romaine), 1618–1624

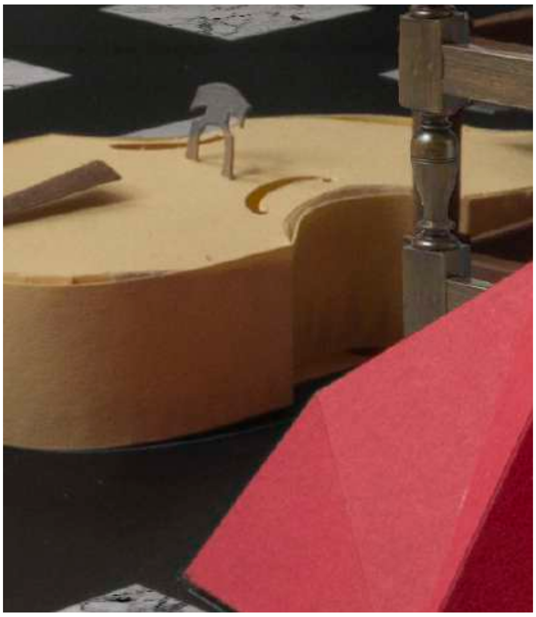
Ioannes Ruckers, Virginal, 1598


MVSICA LABORVM
DVLCE LEVAMEN

La synthèse d'images prend tout son sens au moment où l'on intègre les éléments de maquette produits à une échelle plus grande que celle qui a fourni la base de l'image. Ici la cruche et la viole de gambe sont des maquettes à l'échelle 1/3e et le tapis qui est utilisé comme nappe est issu d'une photographie d'un vrai tapis. Si la lumière a été réglée avec soins lors de la prise de vue, les réglages numériques porteront principalement sur les teintes et les luminosités.

Calques isolés montrant les éléments ajoutés.

Photographies de maquettes à l'échelle 1/3e et 1/1 et leur application sur l'image



THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

V

MODEL

¤

Filippo Fanciotti

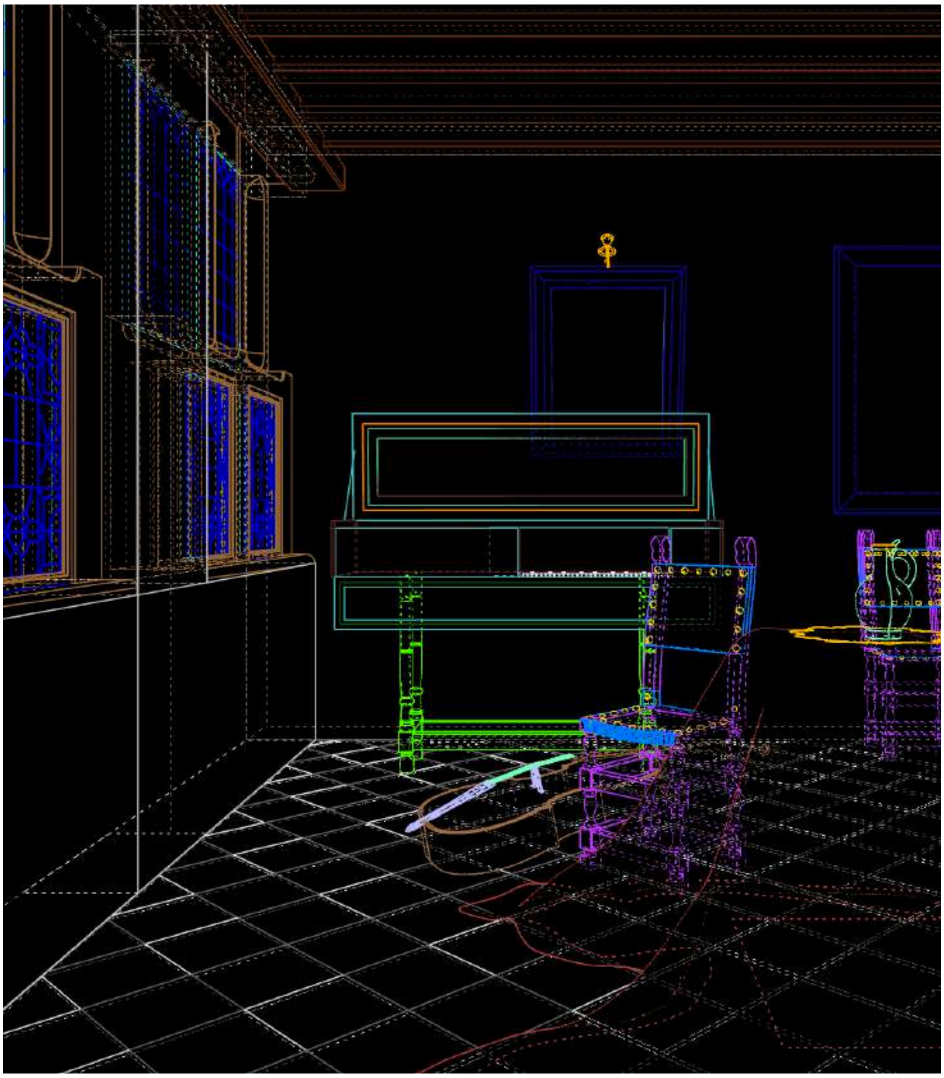
A MODELING HANDBOOK

Filippo Fanciotti

This handbook is divided in two parts: the first one is a collection of general advices, based on my personal experience, aimed to help you in building a working method which is efficient in terms of not losing informations and time during the modeling process. The second part is more about modeling and includes some tips more or less specific, still with the will of helping you to be more effective.

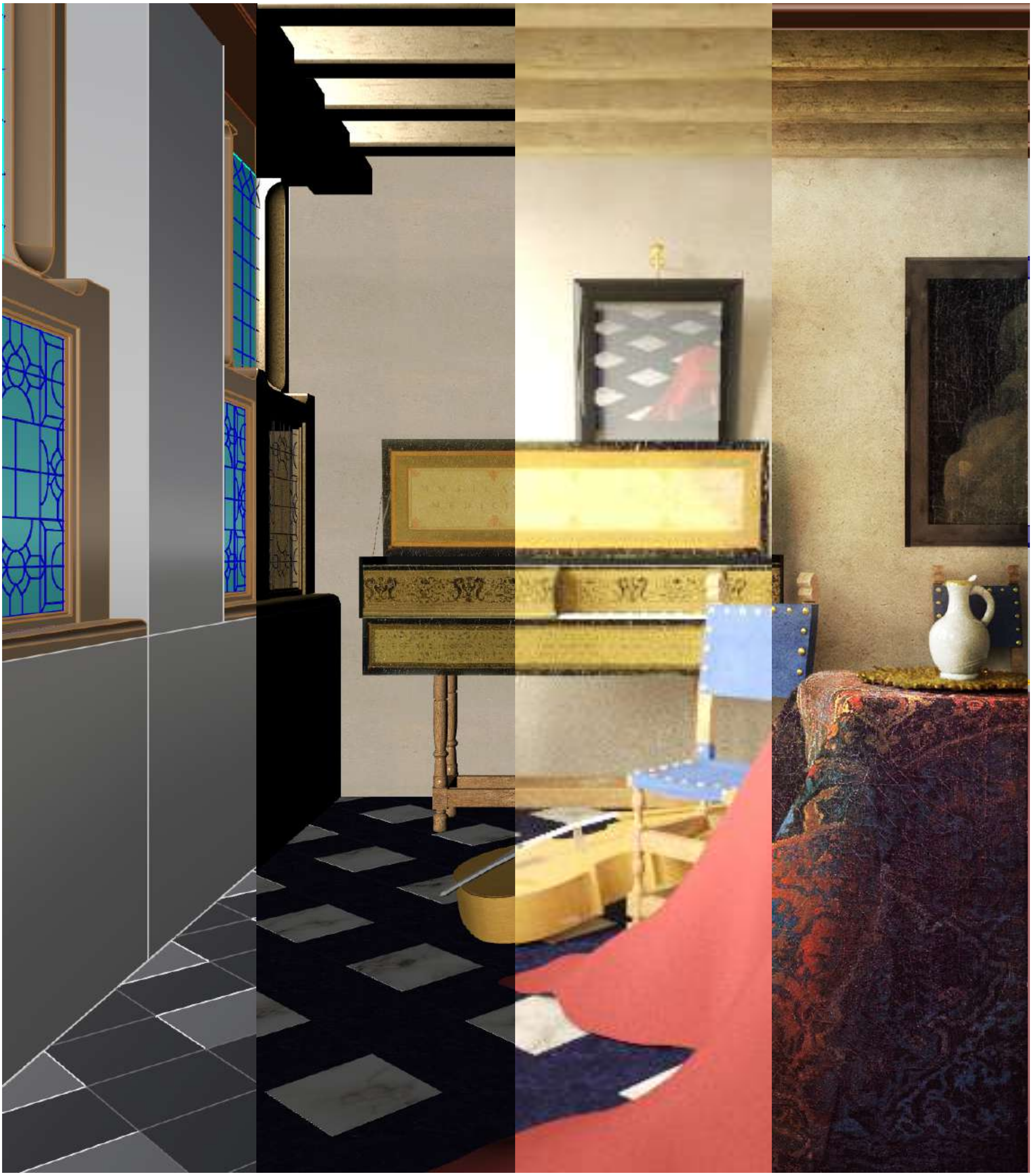
According to this task, there are several aspects that normally people take for granted but which are, in my opinion, perhaps the most important part of the visualization process; therefore the aim of this paper is to give you, as much as possible, a global overview of the visualization methods without getting in detail through the peculiar parameters of a specific software, a task that belongs to the specific literature on the subject.

The Music Lesson
Johannes Vermeer
1662-1665
oil on canvas
74.6 cm × 64.1 cm
Royal Collection, St. James's Palace, London



The Vermeer's Music Lesson, numerical model
Filippo Fanciotti
august 2016
Rhinoceros
1465 x 1465 pixels
EPFL, ENAC, LAPIS

PART I
GENERAL TIPS



1. What to model, what not

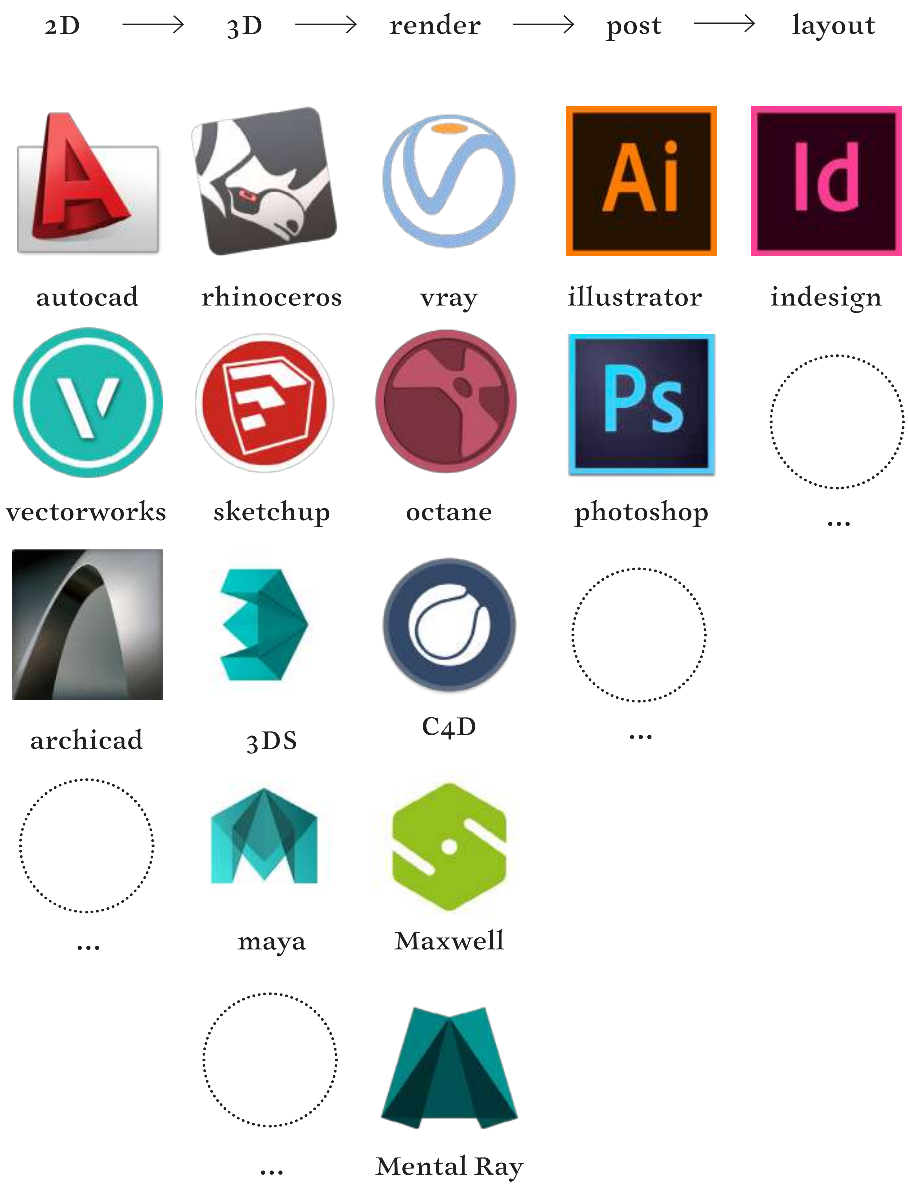
People normally waste a lot of time in modeling things nobody will ever be able to see: too small details according to the representation scale, items not visible from the selected point of view and so on. It's extremely important to decide what to show before starting modeling everything in detail. Both whether you're making a presentation, whether designing for a competition, think of your slides, panels or -as here- your final image before starting modeling like a crazy. Beyond the obvious waste of time this bad habit involves, mind that adding details burden your model a lot with all the consequences you have surely found out the hard way.

In addition, although it's something which only comes through experience, it's fundamental to identify what is better to do through modeling, what can be resolved by mapping, and what to leave out for post-production; in the following diagram I made a list of some of the most common softwares used by architects (I surely left out some important products, eg Revit and the like, but it doesn't change the point), with the aim of linking the main steps of the visualization process to specific sources.

Since almost everything can be done in every way, it's fundamental to understand that there are certain properties of each software which shouldn't be taken for granted or forgotten: if on the one hand some products are better developed to perform some steps of the iter, on the other some are particualrly bad if forced in a direction they haven't been designed for (eg sketchup for technical drawings, Rhino internal renderer for professional renders, Photoshop for making layouts and so on).

Anyway, this list is of course a simplification (you can safely model with autocad, if you feel comfortable, while the post production I mean for illustrator has to be intended for a better visualization of technical drawings); what matters is that you have to be aware of what you are doing, why you are doing it and, as consequence, find your very personal best way to do it.

in the previous page,
the process behind the reconstruction of the Music Lesson, from the left: 3D model (Rhino), applications of textures and materials (Vray), light management and rendering (Vray), post-production (Photoshop).



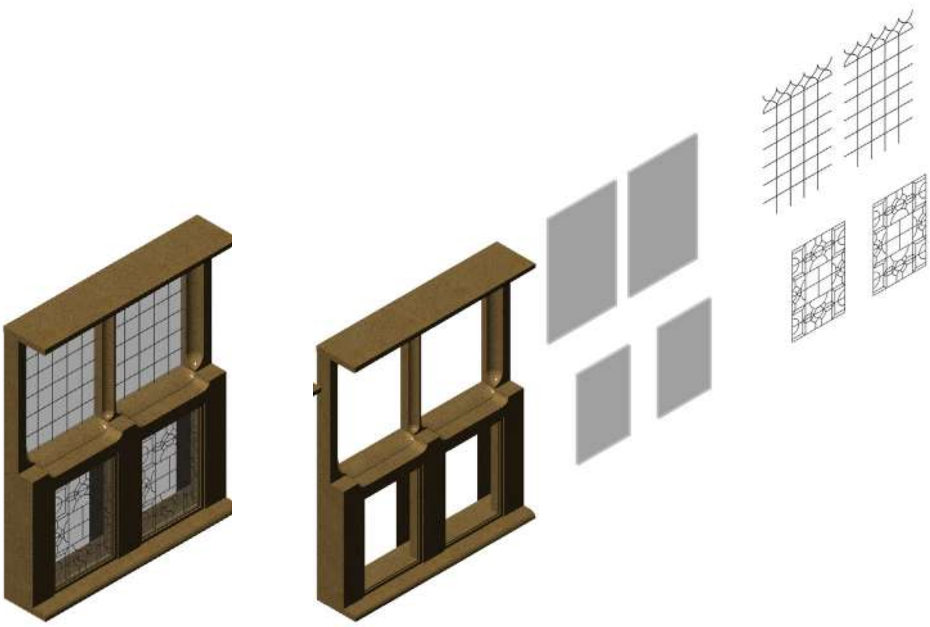
2. Divide your model by topics

Although it can sound pretty obvious, it's very important to keep the architecture of your file clean and clear from the very beginning. This can be easily achieved by organizing its structure through the basic principles of the set theory; Layers and sub-layers (i.e. working with Rhino), classes and sub-classes (Vectorworks), Groups and layers (Photoshop) and so on: the *families* (i.e. a chair, a wall) turn into the bigger set (i.e. Layers), while the single *components* (i.e. the pillow, the backrest) become, for example, the sub-layers.

I find particularly efficient to divide the sublayers by the materials an object is made of, so it will be long easier to assign and manage materials through the material editor (another task we'll see more in detail later on). Here you have a screenshot of the structure of my *Vermeer music Lesson* file; the advantage of dividing the file by materials (= sub-layers) is that when you have to change one, you don't need to do it for every single item; furthermore, when you'll open this file after some time, you will be able to quickly recognize the parts without wasting time. You always have to imagine yourself involved in a team work; as consequence the best way to verify if the structure of your work is tide enough, is to imagine that everything you do has to be readable by anyone else without saying a word.

Layers

Sub-layers



above a screenshot of the sctructure of layers and sublayers organization in my Rhino model.

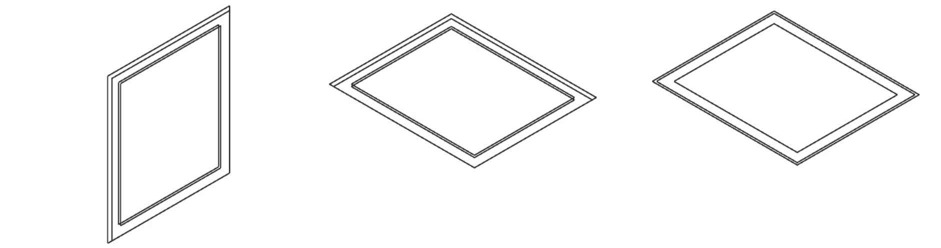
on the left a scheme of the division between elements and sub-elements composing an item according to its materials:
layer : chair
sub-layers : glass, wood, leads

3. Keep trace of what you do

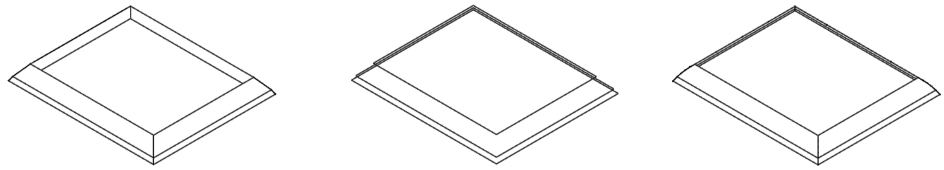
In a way similar to what discussed above, to keep trace of your steps will save you from losing important informations along the process. Saving incremental copies of your work and storying the steps behind a result are the best weapons you own.

As shown in the screenshots in the current page - although it may look particularly pedantic because it was specifically made to explain the modeling tools in a class - it's a very good habit, when modeling objects which contain a certain degree of complexity (like I did for the carpet-second image on the right-check the appendix) to make a grid containing all the steps of the process behind the final result; this way you'll be able to go back to a whatever "frozen step" and create a new form if you aren't completely satisfied with the first result achieved. Keep in mind that most of the modifications are irreversible.

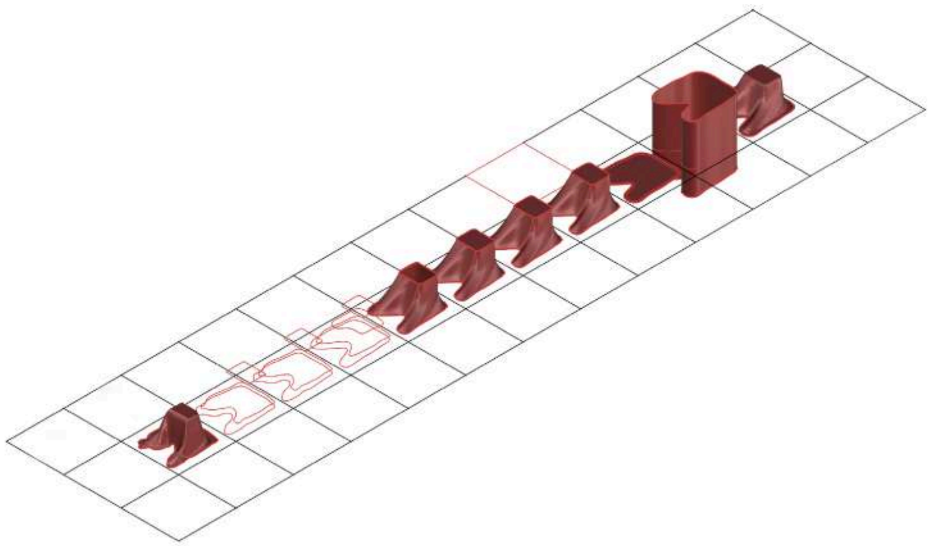
Looking at the screenshot on the right, I want to show you how this attitude will turn particularly useful during the rendering process, whereby a very little change can significantly alter a result; by keeping trace of every single step plus saving a copy of your render named by the last edit made, will make you able to get back to a previous solution without any trouble.

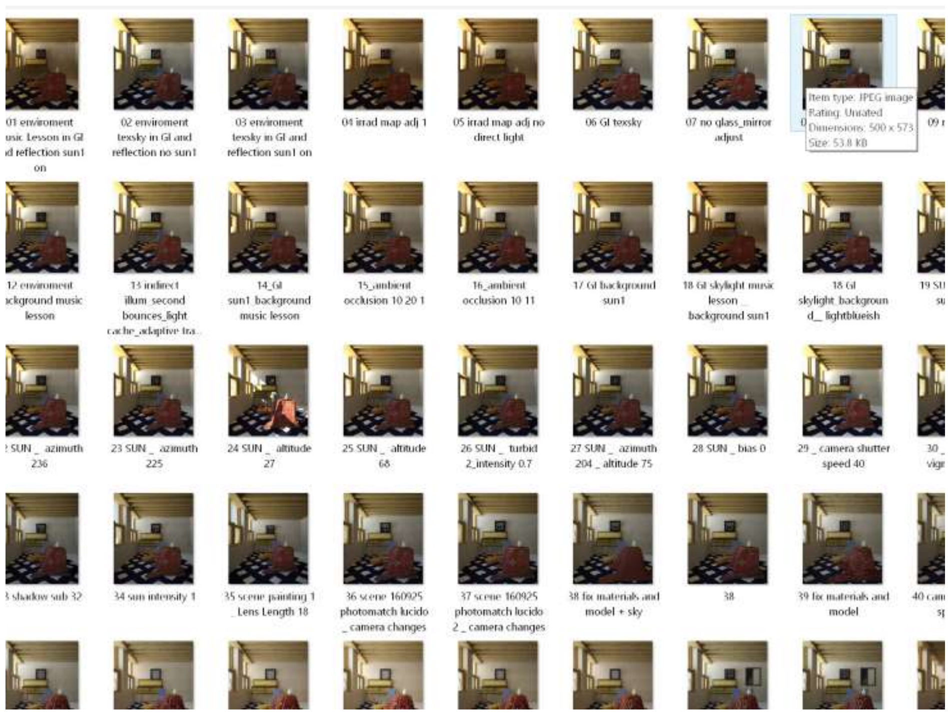


rectangle rotate3D projectToCplane

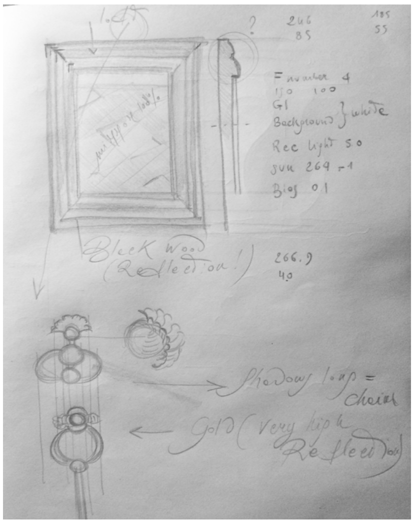


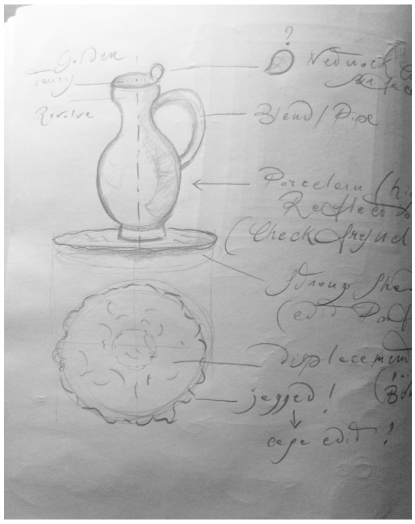
blend crv move vertical loft





PART II
MODELING TIPS

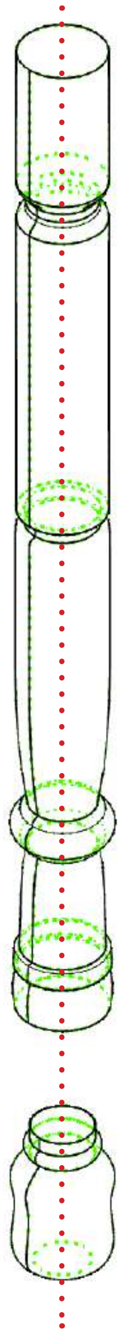


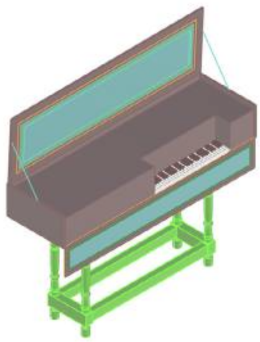


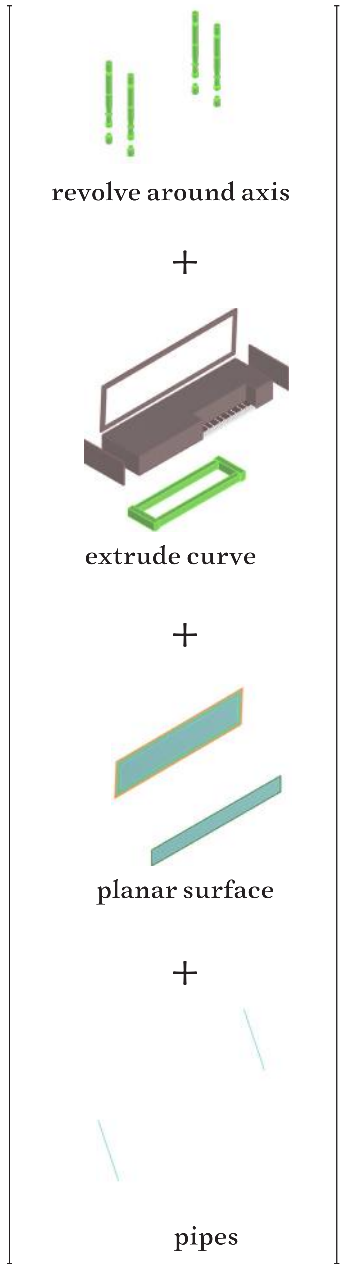
1. Make a sketch

This obsolete tool is still very useful: it's very common to jump into modeling wasting a lot of time in search of a result, when studying the shape and the geometrical rules behind it - even before opening the software - is the most effective and fastest solution.

Through skecthes you automatically simplify a reality, inscribing components within regular shapes or grids, spontanously identifying axes and other useful rules that, once you'll have figured them out, you will be able to completely manage a form, and so it will turn extremely simple even to draw it with whatever software you've chosen to work with.







2. Keep it simple

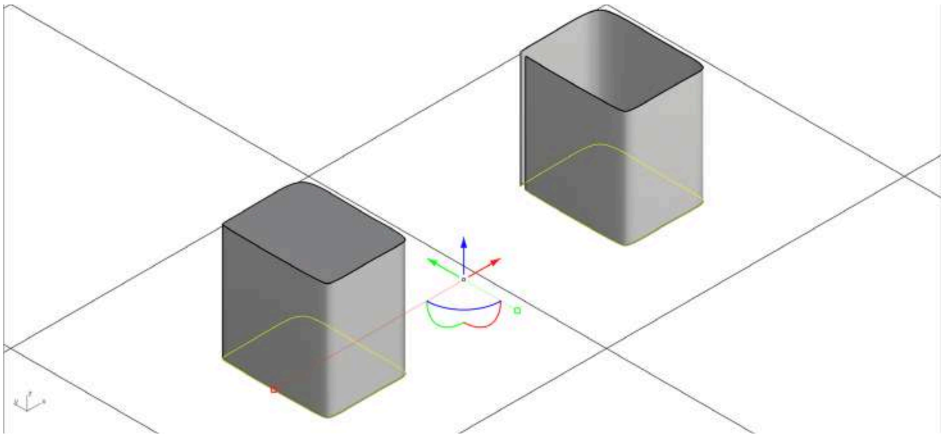
Complexity is written in simple terms: look for axis, symmetries, repetitions, revolutions, etc. is the first act to do between a sketch and the model.

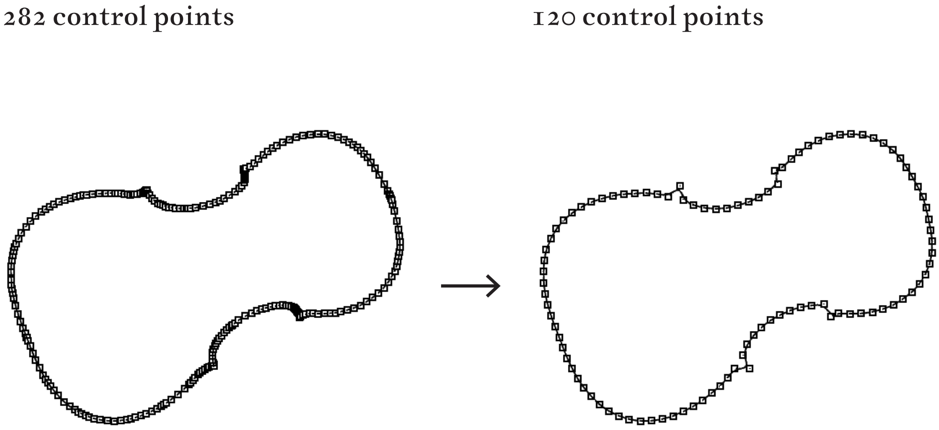
Just to give you an example the virginals - which can look a bit complex at a first sight - is actually nothing more but a set of revolutions (the one shown aside), linear extrusions of curves and a pair of planar surfaces; later on I'll show you that anything else has been resolved through mapping.

3. Draw in (clean) curves

Don't start off building solids and primitives; get used to fix and pre-filletize curves before generating surfaces. It's a common habit to hurry up a lot, getting into extrusions and then merging, making boolean unions and so on. This is the fastest way to stumble on troubles that, sooner or later, will eventually emerge (a common situation pops out when putting a texture on an object which is the result of an union between several solids, where the pattern doesn't match from one face to another). By fixing the curves from the beginning (which means to have continuous curves, without any control point in excess) and extruding or revolving them in a second time, will avoid this kind of situation.

With the same logic, when an object gets too "dirty" - due to a certain amount of operations made on it, such as holes, booleans etc. - get used to extract borders, edges and rebuild that surface or polysurface through cleaner curves.

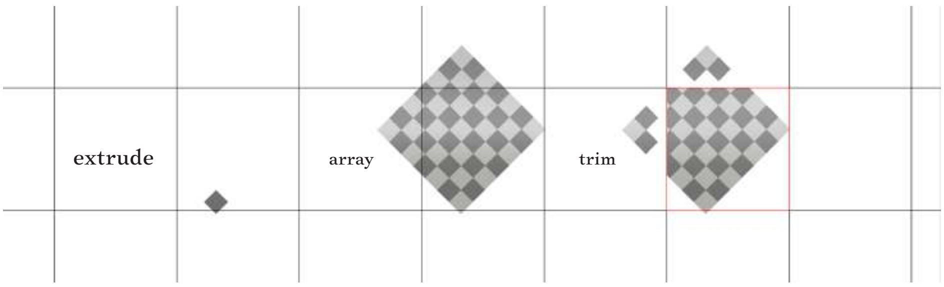




The first image shows how an open polysurface brings to bad extrusions, while the second one shows how the same polygon, with only the necessary control points, doesn't change in shape.

4. Make things bigger,then trim

It's always easier and long more precise to cut out a part rather than adding small parts. Therefore my advice is to make always things bigger than what they actually are - being them surfaces, solids or curves - then trim or split them using defined geometries (whether they are curves, surfaces or solids).



for the Music Lesson pavement I made an array of tiles, then trimmed them according to their encounter with the room's walls.

5. Details can wait

Details come later. The modeling process is similar to the act of sketching or, if you prefere, of sculpting: finishes, holes, bumps, etc. can wait.

Adding details makes your file heavier plus, once certain operations are done, it’s impossible to go back to a previous solution or even to do some basic operations without losing the control over the interested item (i.e. once you chamfer two faces with a defined radius, it’s impossible to scale the object without scaling the radius of the chamfer too.)

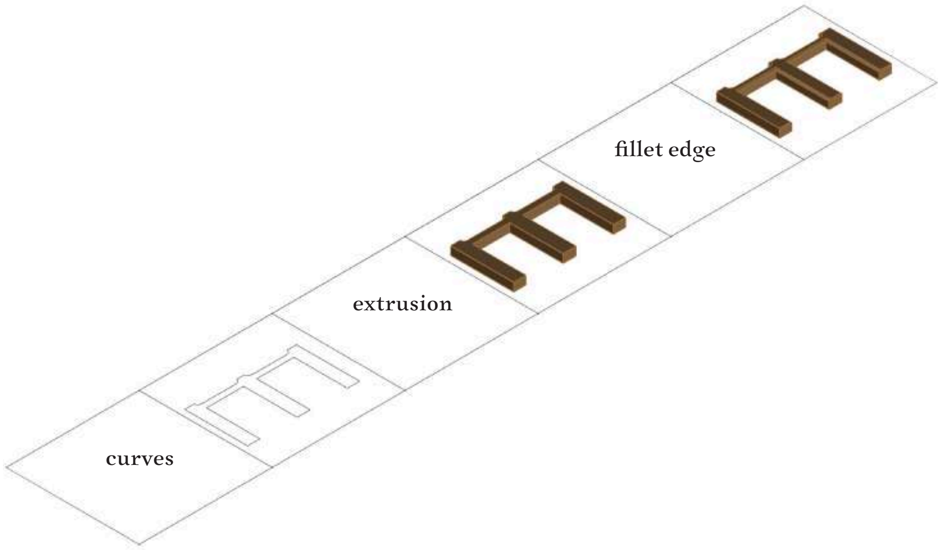
6. Use nurbs rather than meshes

This advice is in particular addressed to some softwares (i.e. Rhino), since other ones only work with meshes (i.e. Sketchup).

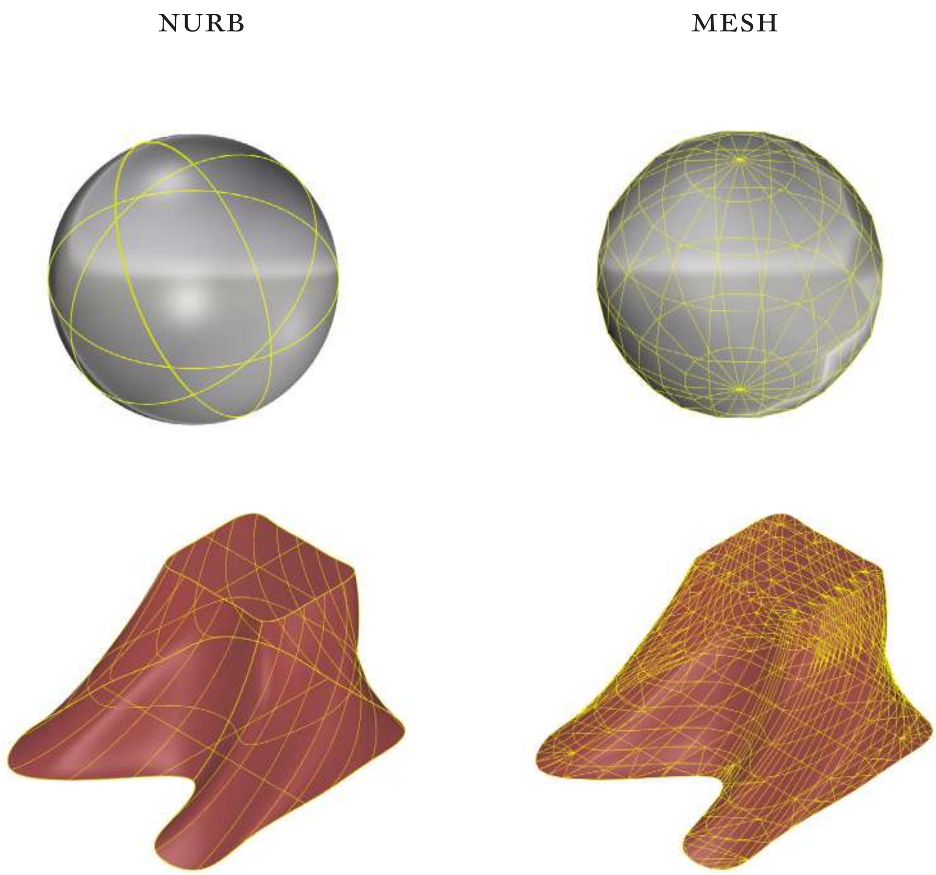
• A *mesh* is a complex of triangulated polygons approximating the geometry (the more dense the triangles, the closer to the actual geometry).

• A *surface* is the actual mathematical expression of the geometry (NURBS and the like) and what you’re seeing in the viewport is a translation of that expression.

[Although from a technical point of you it doesn't have anything to do with the intrinsic differences occurring between meshes and nurbs, think of the lost of information when passing from a vector file to a raster image .]



after extruding the lines obtained through the reverse perspective, the windows' frames edges have been fillet only at the very end, in order to leave the door open to any editing.



comparison between a simple sphere and the Vermeer Music Lesson's carpet built as a nurbs (left) and as meshes: you can easily appreciate the difference between the clean isocurves describing the first geometry and the triangulated faces approximating the models on the right.

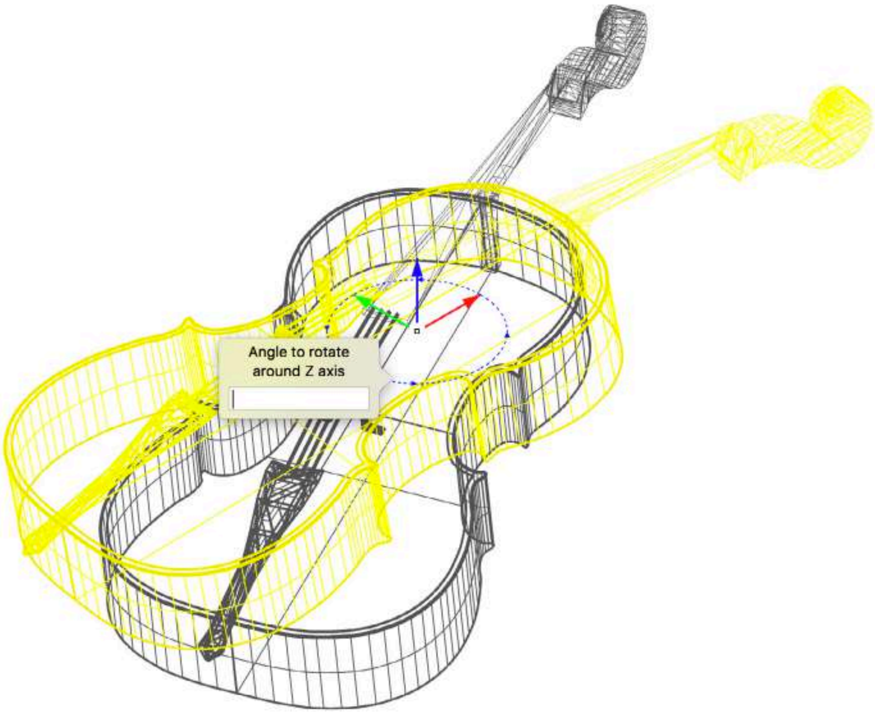
7. Exploit modeling aids

Each software has its owns, because each software has its own logic. By exploring the modeling aids you will better understand the logic behind the software you are using, therefore figuring out some operations must be done in a certain way if using, for example, whether autocad, 3DS, cinema or Rhino. (i.e., using Rhino, once you get confident with the selection filter, the gumball and the c-planes, your working method will significantly get improved).

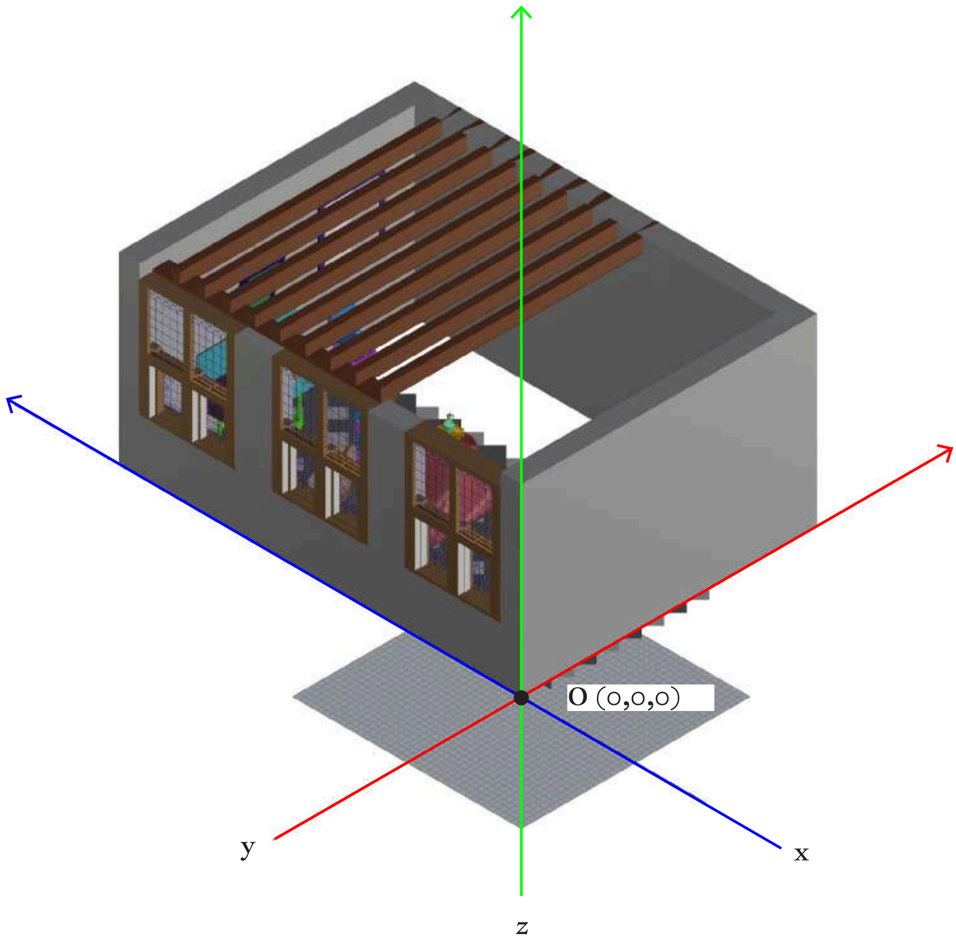
8. Define drawing Unit & Origin

Get used to work with a meaningful unit of measure according to the type of objects you are modeling. Normally industrial designers work in millimiters, while the centimeter is more appropriate for architectural drawings.

Avoid visualization troubles: by drawing close to the origin you'll save your RAM from hard calculations. Mind that once you'll start putting textures, or working with discretely complex geometries, you'll easily appreciate the improvement given by simply centering the drawing on the Internal Origin. It's also an important task to define the origin (0,0,0) on a stronghold point and, hopefully, don't change it anymore; remember that you normally storage a lot of copies of your file (plus you're often working in a team), therefore is highly desirable to benefit from the paste in place from different files.



application example of a rotation through Rhino's Gumball.



the drawing's origin has been fixed on a stronghold point.

09. Make everything editable

You can change any number of copies of an object if they are block instances by making changes to the geometry that defines the block; repeated instances of a single definition do not increase the file size much since there is only one actual definition for the block held in the file. Objects can also be updated from external files and used as libraries.

10. Sweeten up!

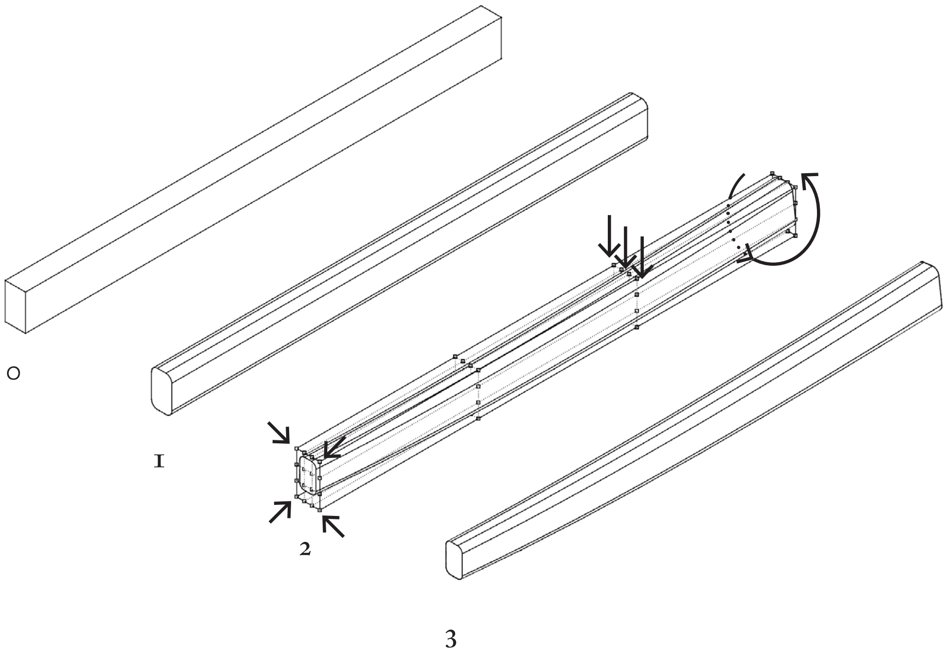
Just before rendering, you can finally start making your scene looking more natural: walls' and furnitures' edges are not as straight and perfect as the results of extrusion are; actions like fillet, chamfer and the like are very welcome to increase realism.

11. Add irregularities

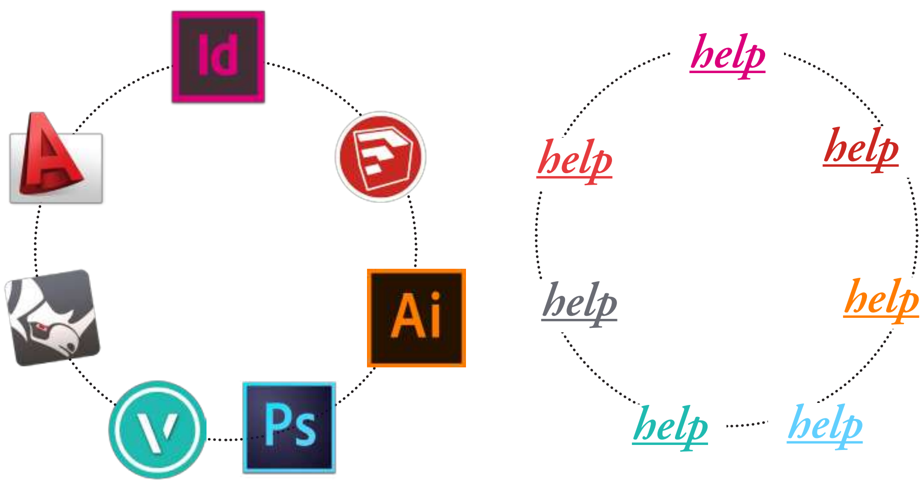
Like what just discussed, adding imperfections and treating volumes as if you wish to include mechanical wears, or the passage of time, are other small tricks which will help to add a lot of verisimilitude to your scene.

12. Ask for help

Softwares constantly evolve, sometimes the way you're doing some operations from a while can become outdated. Furthermore, don't forget that nowadays sotwares are daily implemented to talk more to each other; figuring out how they do it can be extremely useful and save you a lot of extra work of editing.

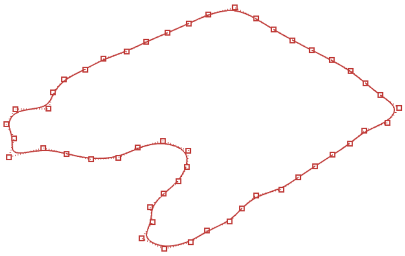


in the image above, two sets of transformations have been applied to the beams to make them more natural. First of all the edges have been fillet with a radius of 4 cm to make them look smoother (step 1).
A second set of operations (step 2) has been performed by using the [CageEdit] tool (Rhino): a virtual cage is built around an object, making the user able to apply a soft deformation to parts of it (i.e. here the beam has been smoothly scaled at the beginning, moved down in the middle and rotated at the end).

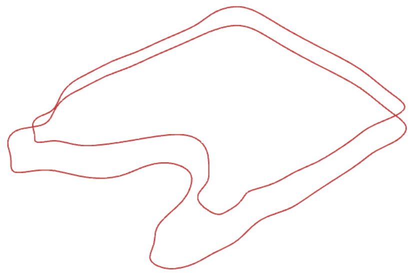


click on the colorful helps above to explore your software guidelines

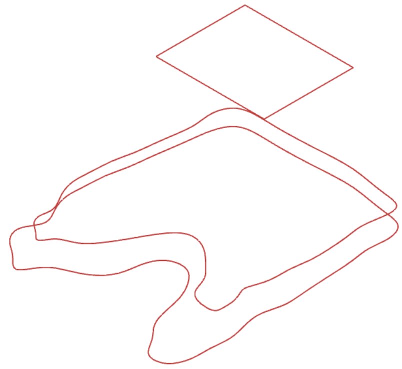
APPENDIX
modeling a carpet in Rhino



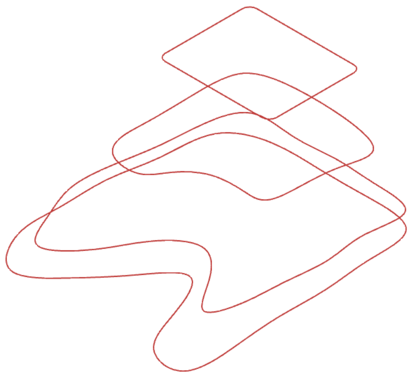
01. InterpCrv : a smooth curve (similar to a spline) to join the points extracted from the reverse perspective.



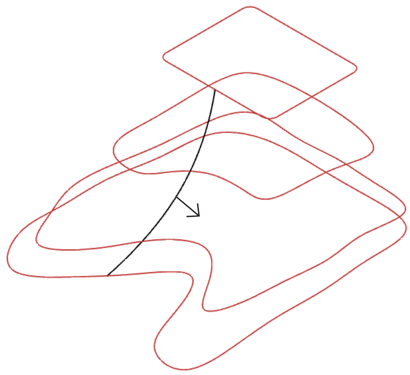
02. Offset : copies of the starting curve, gradually smaller to lay out a path for the developlment of the surface.



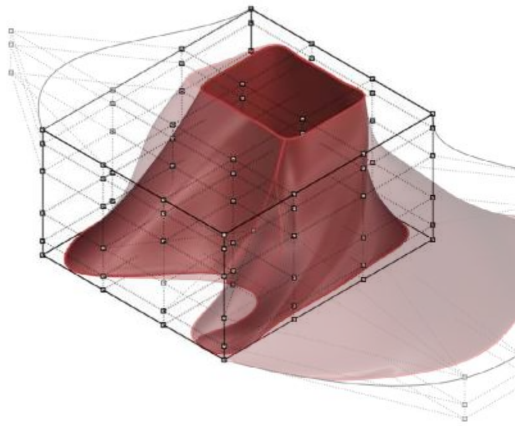
03. Rectangle : the last curve of the future shape is a simple rectangle, in orderto mimic the behaviour of the fabric touching the top of table.



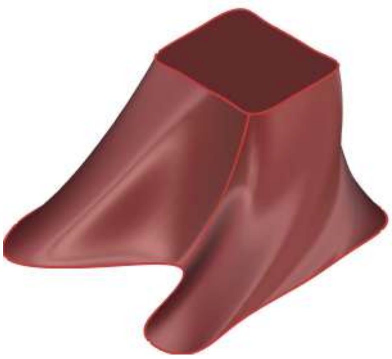
04. Edit Curves : turning on the Points, simplifying and smoothing the geometries get a cleaner surface.



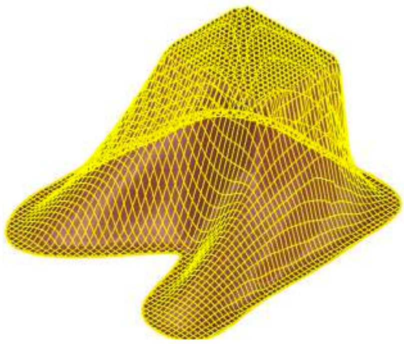
05. Loft : the previous curves become the profile to define the surface of the carpet.



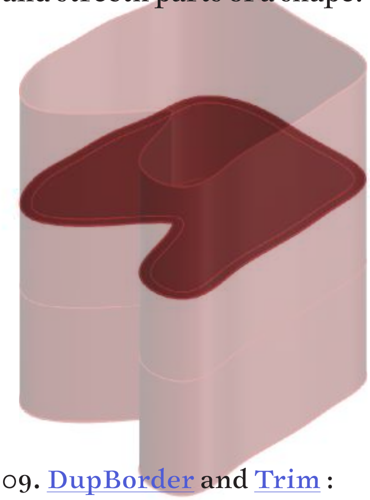
06 . CageEdit : a box of control points to smoothly move, scale and strecth parts of a shape.



07. Patch : another Rhino surface, useful when you need to create a surface out of a curve which is not planar (here to "cover" the "top" of the carpet).

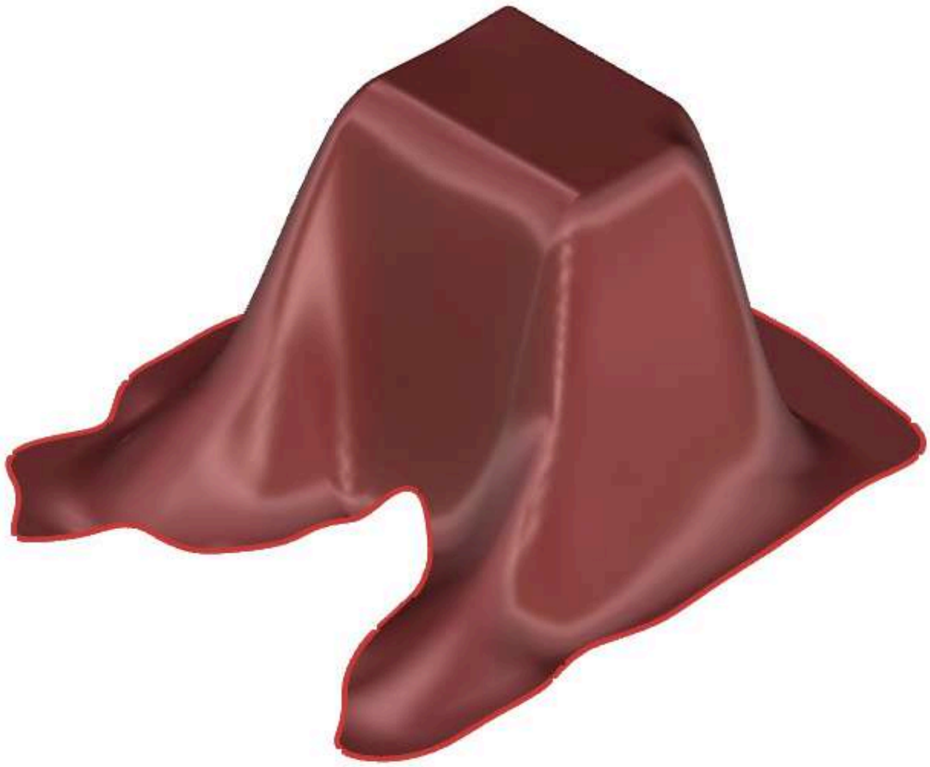


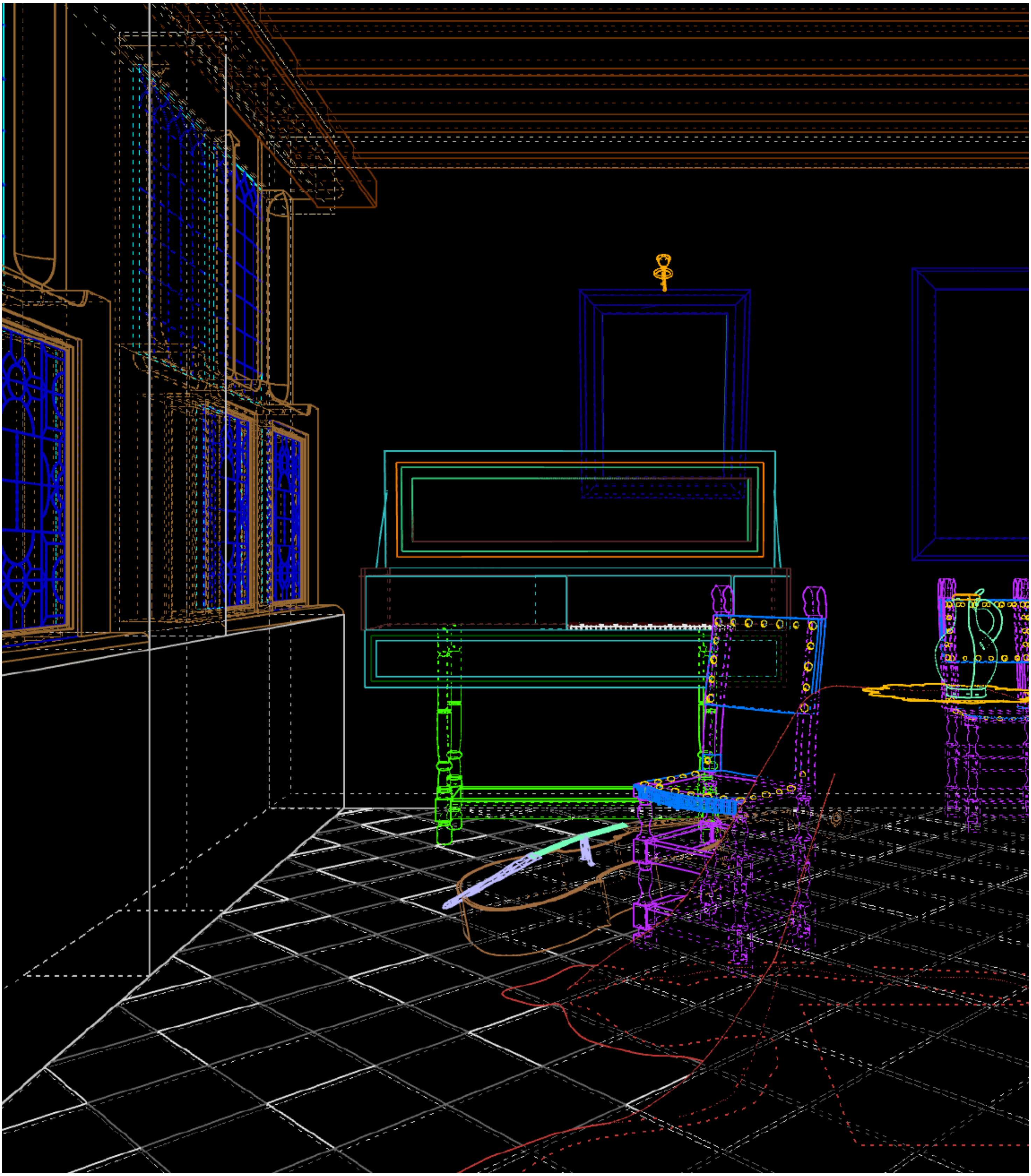
08. Drape : literally drops a drape above a series of objects, so creating a continuos geometry with a defined structure.



09. DupBorder and Trim : drape is always a bit bigger than what needed, so I simply duplicated the border of the starting profile, extruded and used as a trimming geometry.

The operations explained so far are the ones I used to reach the final shape (here on the right); sometimes getting back to a previous step, extracting borders or inserting knots, deforming geometries again and again.
After some trials I decided I was satisfied with this result because, although I knew it was not perfect, it was enough for my purpose, which was to have a good base to apply a texture onto and to inform the surrounding light.
As mentioned before, I really do believe that the act of free modeling is somehow like sculpting in real life, therefore you must find a time for exploring options, a time to push yourself improving your skills for better results, but also a time for putting an end on your work.





THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

VI
CAMERA

¤

Filippo Fanciotti

A CAMERA HANDBOOK

Filippo Fanciotti

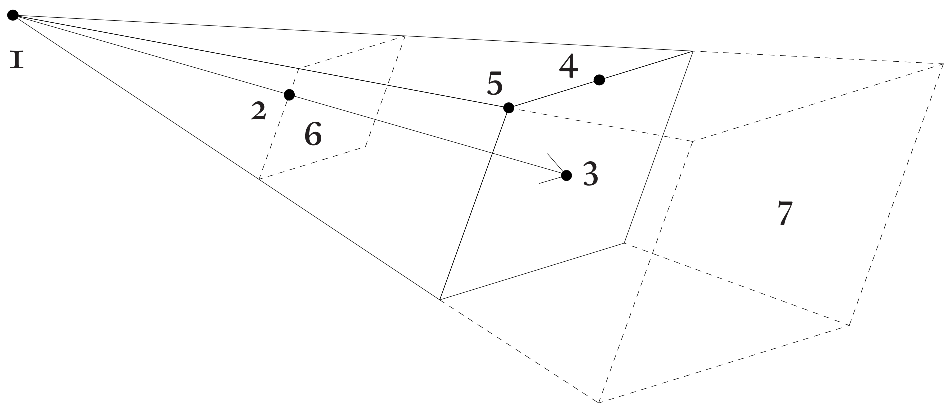
The Music Lesson
Johannes Vermeer
1662-1665
oil on canvas
74.6 cm × 64.1 cm
Royal Collection, St. James's Palace, London

How to frame a scene is as much relevant as the scene itself, including all the choices concerning a certain point of view, a particular focal length, the shape of the layout and so on. This apparatus involves decisions supporting the story told by a painting, enhancing effects linked to a particular artistic genre or movement, a pictorial technique or an expressive intent.

Since these settings are real choices in the real world, it becomes extremely important to be conscious of the available options provided by rendering softwares when shifting to the virtual dimension - from how to chose a layout to how to set up a camera - since not taking any choice is a choice itself, simply taken by the programmers of that engine when called to define the default settings.

The Vermeer's Music Lesson,
camera variation: reverse shot
Filippo Fanciotti
november 2017
Rhino, V-ray, Photoshop
1465 x 1465 pixels
EPFL, ENAC, LAPIS

Camera widget



1. Camera viewpoint.

2. Camera location (can be used to move the whole camera widget).

3. Target point

4. Roll control (to tilt the camera).

5. The field of view/lens angle

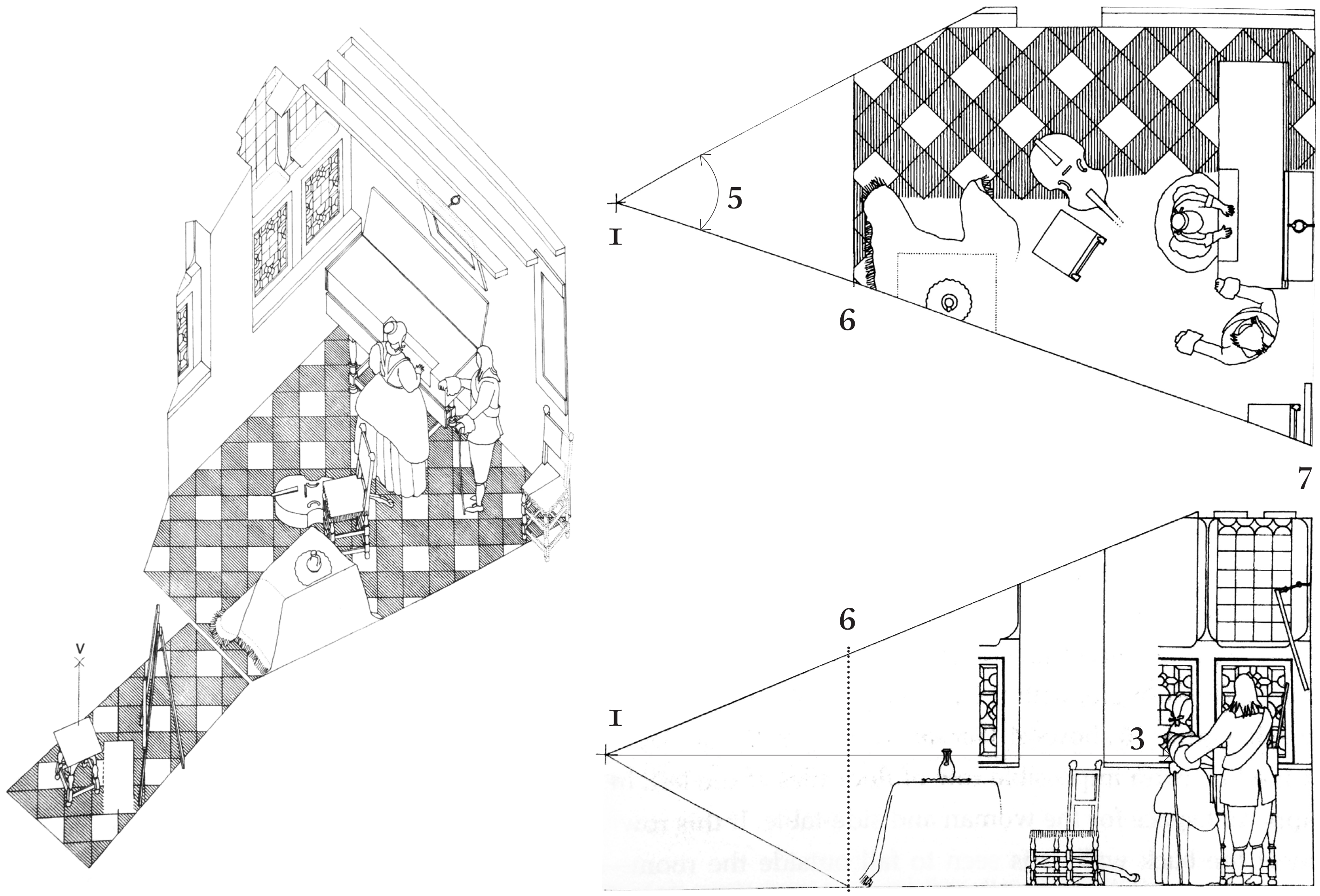
6. Near clipping plane (nothing visible "before")

7. Far clipping plane (nothing visible "after")

Any numerical camera is composed by a series of elements recreated in order to provide a realistic control of it.

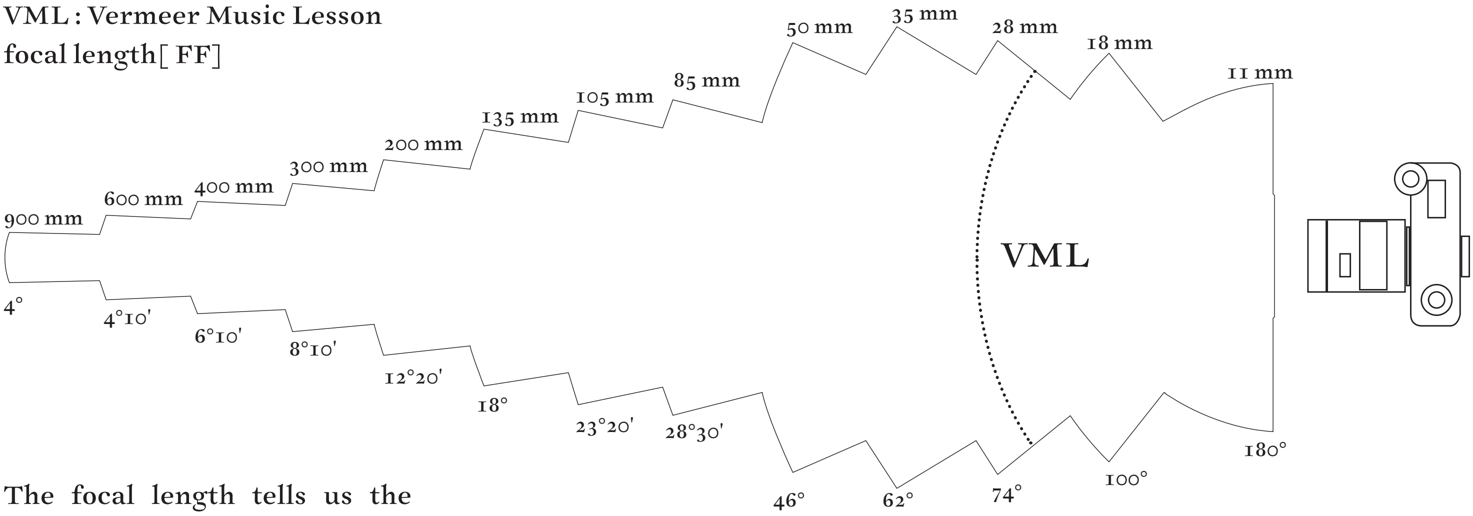
Besides the viewpoint (1. the place where you are looking from) and the target (3. the point you are staring at) there is a widget to control the rotation of the camera -so how to tilt it (4.), another one to open up or decrease the field of view, so manually changing the lens length, as well as a pair of ideal surfaces delimiting the beginning (6.) and the ending (7.) of the visible portion of space captured by the camera.

Mind that the Physical camera - e.g. so named in Vray - is also the tool to control the light exposure of a scene, being the rendering a simulation of the photography act happening in real life [We'll face this topic in the lighting handbook].



drawings from "Vermeer's camera, uncovering the Truth Behind the Materpiece", Philip Steadman lens length

VML : Vermeer Music Lesson
focal length[FF]



The focal length tells us the angle of view - how much of the scene will be captured - and the magnification - how large individual elements will be -.

A proper management of the lens length is necessary not only to include portions of space otherwise not visible with, for example, a lower angle, but also to enphasize a personal expressive intent (i.e. if used in an interior, by radically enhancing depth and distorting nearby objects, a very short focal normally gives a sense of anxiety, almost of vertigo, to the viewer).

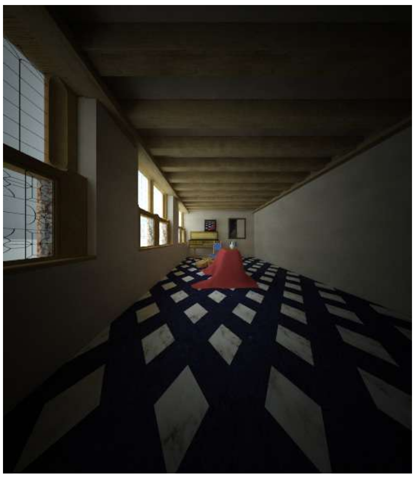
22.5 mm (original)

30 mm

40 mm

18 mm

10 mm



5 mm (previous page)

camera rotation

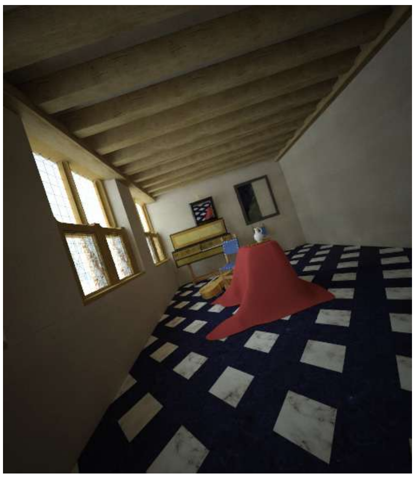
A camera rotation can add a lot of dynamism to your scene, specially if combined with a proper lens length (see previous chapter).

Although this kind of shot has been long more used in the cinematography environment - i.e. the *Dutch Angle*, a shot in which the camera angle is deliberately slanted to one side, used for dramatic effect to portray unease, disorientation, madness, etc. - it is not unusual in the history of art as well, in fact you may notice that the Vermeer Music Lesson is already a camera rotation case, which we straightened only for educational purposes.

Inception, Christopher Nolan, 2010, Warner Bros (US, UK)

0° | lens legth 22.5 [mm]

25° | lens legth 22.5 [mm]



341°| lens legth 10 [mm]

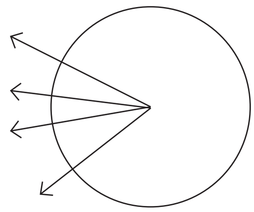
Basically, in a rendering engine the type of camera determines how the scene (what you see, the model) is projected onto the screen (once you render it to get a bidimensional projection). The behavior of the rays cast into the scene can change according to the type of camera used.

Besides the standard camera (usually a pinhole), there are other types of camera, each one working with different lenses and, therefore, rendering a different projection of the scene. The most common are:

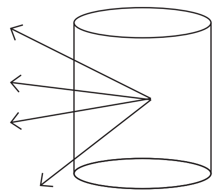
- Spherical camera (1): the lenses has spherical form. As shown in the following examples, with override FOV setting the renderer overrides the Field of View angle. (because some camera types can take FOV ranges from 0° to 360°.) This kind of camera can be useful to make HDRI like images.

- Cylindrical (point) (2) all rays cast from the center of a cylinder;
- *z* axis (vertical direction):the camera acts as a pinhole camera
- x,y axis (horizontal direction): spherical camera.

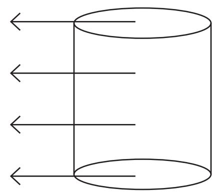
- Cylindrical (ortho) (3) – Like the previous one, but with the camera acting as an ortho view in the vertical direction.



1



2



3

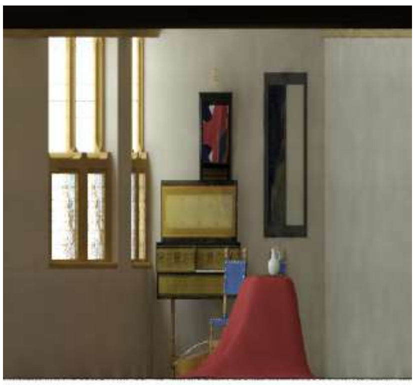
spherical camera ov. FOV 45°

spherical camera ov. FOV 90°

spherical camera ov. FOV 180°

cylindrical camera ov. FOV 20°

cylindrical camera ov. FOV 60°



cylindrical camera ov. FOV 100°

Fisheye lens

Fisheye lenses are exasperated wide-angle lenses able to produce strong visual distortion to create wide panoramics or hemispherical images. "Instead of producing images with straight lines of perspective (rectilinear images), fisheye lenses use a special mapping (for example: equisolid angle), which gives images a characteristic convex non-rectilinear appearance."

source

Fisheye captures the scene as if it is normal pinhole camera pointed at an absolutely reflective sphere which reflects the scene into the camera's shutter.

curve - fisheye main parameter - contorts the way the rendered image is warped. A value of 1.0 corresponds to a real world Fish-eye camera. As the value approaches 0.0 the warping is increased.

2001 A Space Odyssey, Stanley Kubrick, 1968, MGM (US, UK)

fisheye ov.FOV 20,dis.t 2.0, crv 1.0

fisheye ov.FOV 20,dist. 2.0, crv 0.5

fisheye ov FOV 20, dist 2.0, crv 0.1

Box camera

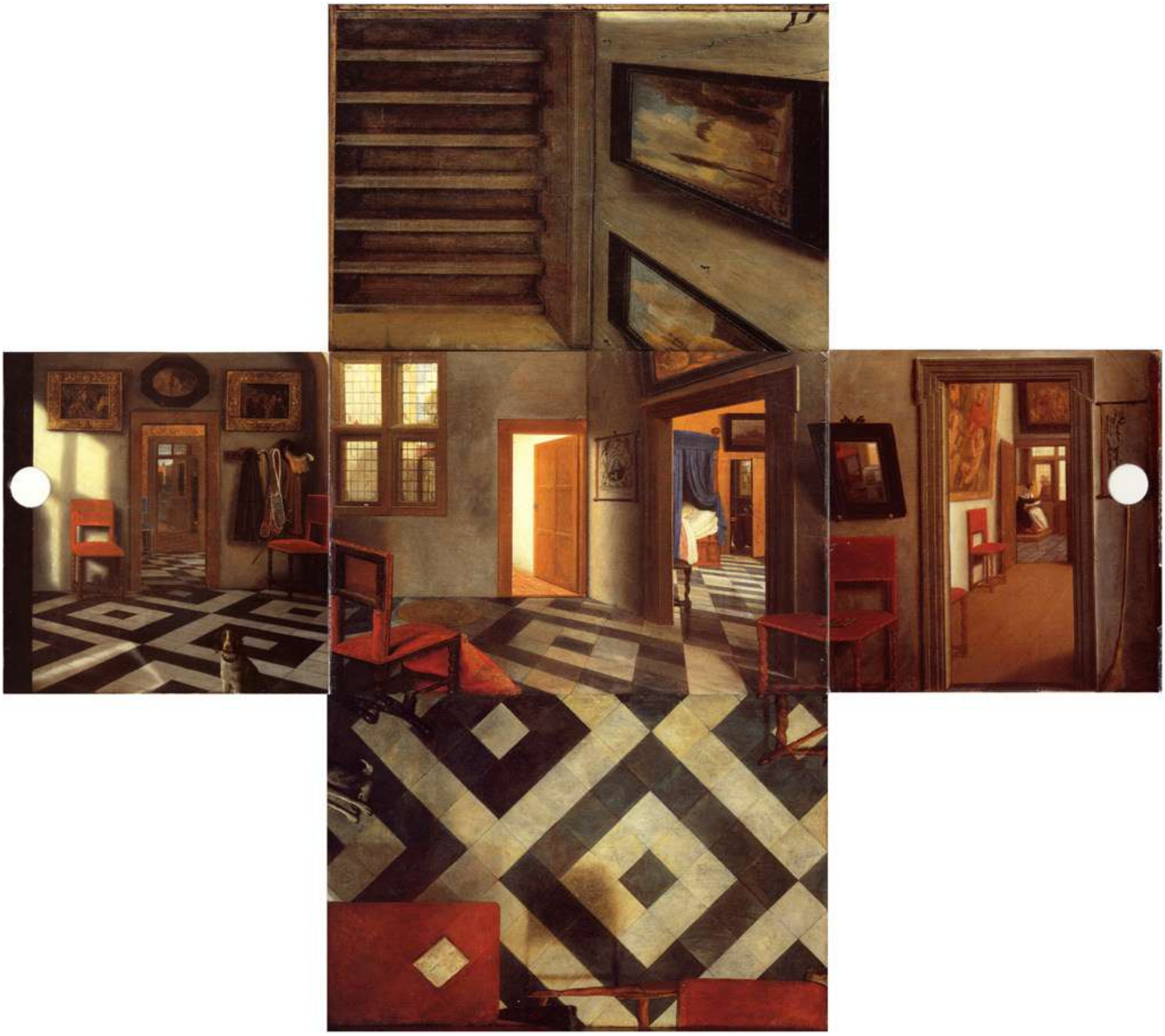
"Box – Six standard cameras placed on the sides of a box, generating a vertical cross format image.

This type of camera is excellent for generation of environment maps for cube mapping. The Box camera can also be used for generating irradiance maps for GI: First you would calculate the irradiance map with a Box camera, then save it to a file and finally reuse it with a Default camera that can be pointed in any direction."

source (chaosgroup.com)

Although it is a very specific feature of sotware like Vray, the Box camera turns into something extremely interesting looking at the notorious Peepshow by Samuel Van Hoogstraten and imagine than that complex process can be obtained just turning on this option...

Peepshow faces with Views of the interor of a Dutch house
Samuel Van Hoogstraten
1655-60
National Gallery, London



camera location and target

In the representation of architecture it is customary that the position of the eyes and the gaze coincide, so that the vertical lines do not go toward a vanishing point and, consequently, are straight as in an orthogonal projection.

Although this is really a good norm, it should not be taken as an incontestable principle, since moving around the scene and changing the target can lead to other narrative lines, otherwise excluded in a more classical representation.

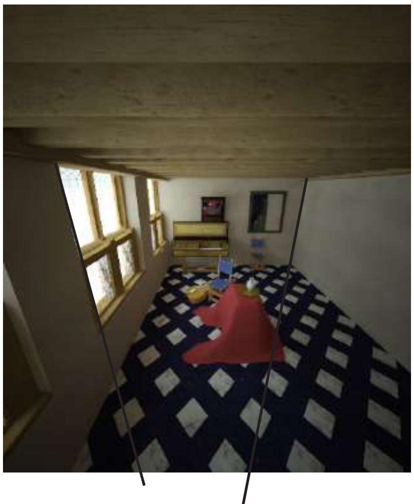
We can find an exceptional example of combined management of point of view, zoom (thus focal length change) and camera position in the dolly zoom (or vertigo effect), invented by Alfred Hitchcock in his notorious Vertigo.

Vertigo, Alfred Hitchcock ,1958, Paramount (US)

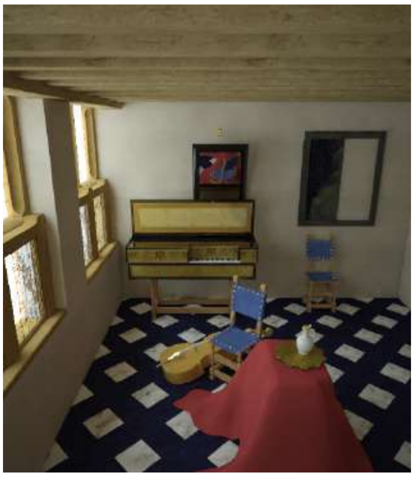
z loc. 5 | *z* target 5 | lens 22.5

z loc. 5 | *z* target 250 | lens 22.5

z loc. 5 | *z* target 25 | lens 10



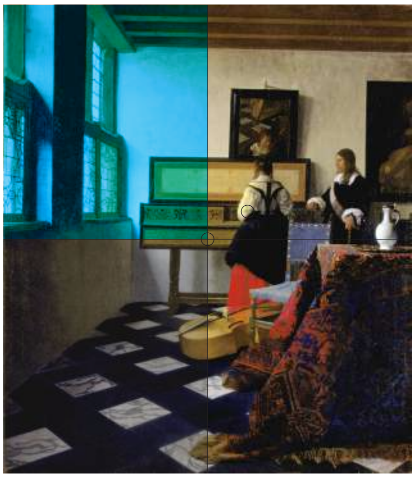
z loc. 270 | lens 10



z loc. 270 | lens 22.5

reverse shot

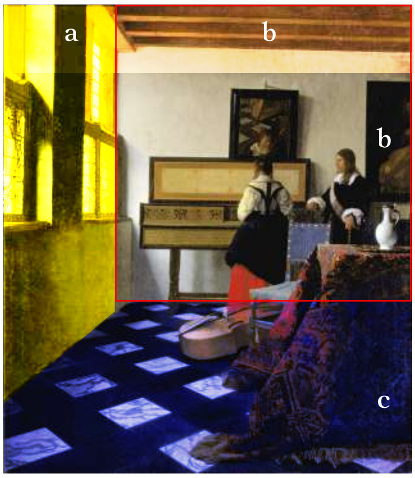

a
b
b
a
a



The center of the canvas is neither coinciding with the vanishing point neither with any relevant geometrical element -....

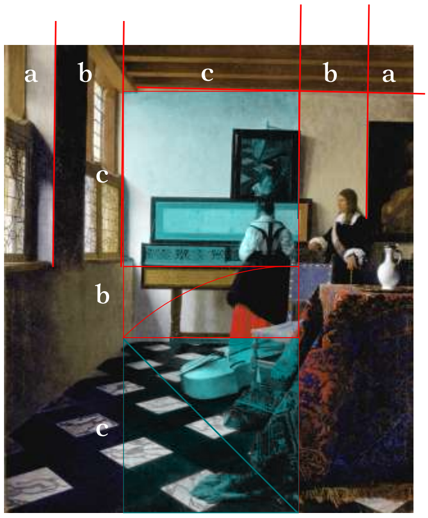
The vanishing point is displaced from the center of the canvas, focusing the apix of the drama on the arm of the lady, intented to play at the virginals.

The vanishing point is displaced from the center of the canvas, I decided to let it coincide with the edge between the wall and the window on the right, therefore enpoweing that line.



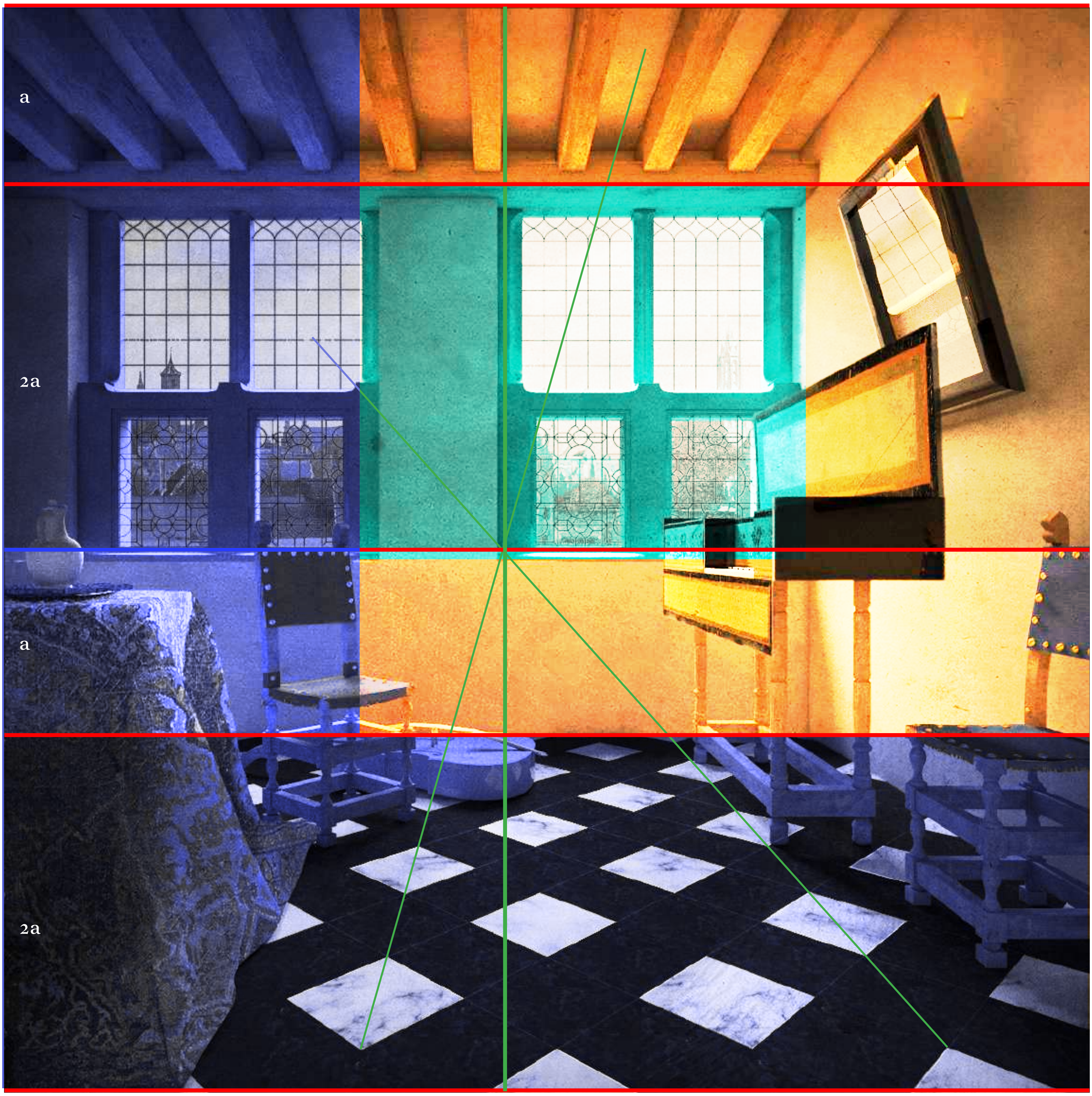
the front wall occupies the space between the pavement and the left wall, inscribing the core of the scene in a perfect sqaure.

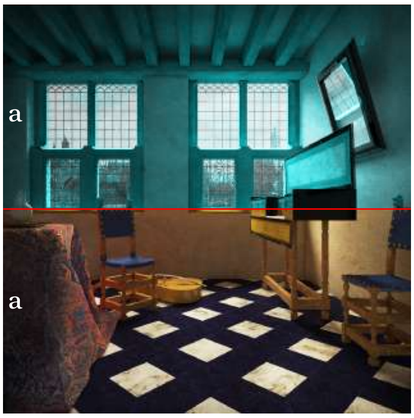
as in a scenic stage, three lines have the function of framing the scene, so letting the observer gradually approach the representation: on the left the edge of the window, on the right the border of the Caritas Romana painting, the last wooden beam of the ceiling above.

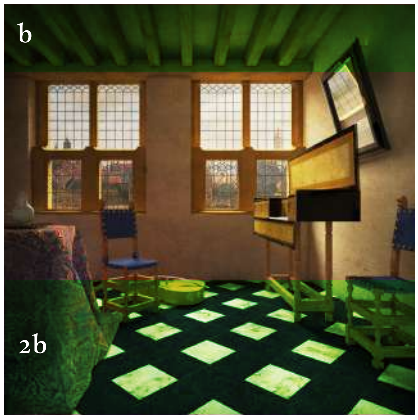


as in a scenic stage, three lines have the function of framing the scene, so letting the observer gradually approach the representation: on the left the edge of the window, on the right the border of the Caritas Romana painting, the last wooden beam of the ceiling above.

Gestaltic proportions



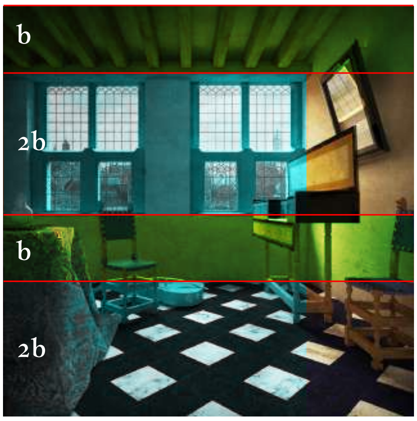


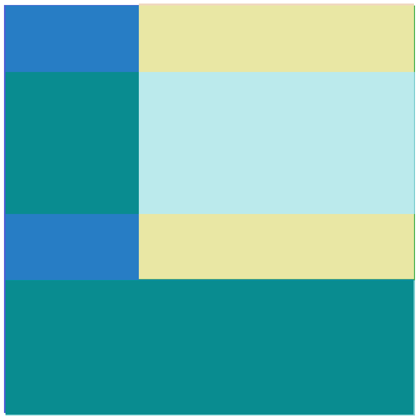


The vanishing point is - like in Vermeer's Music lesson - not at the centre of the scene, but a bit shifted. I decided to let it coincide with the edge between the wall and the window on the right, therefore enpoweing that line.

The other edge of the window divides the image in two equal parts, so ...

The proportion between the visible parts of ceiling and pavement is central in the composition : here the floor is twice the ceiling.





the "b+2b" proportion is repeated twice, theredore generating a rhythm between ceiling, windows, wall and pavement.

lhe limit of the pavement and the beginning of the other window are equally distant from the border of the drwing, thus generating a square including the core of the scene.

main areas/lines of the composition

THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

VII

MATERIAL

¤

Filippo Fanciotti

MATERIALS HANDOBOOK

Filippo Fanciotti

This handout is aimed to help you in creating any kind of material to visualize your model.

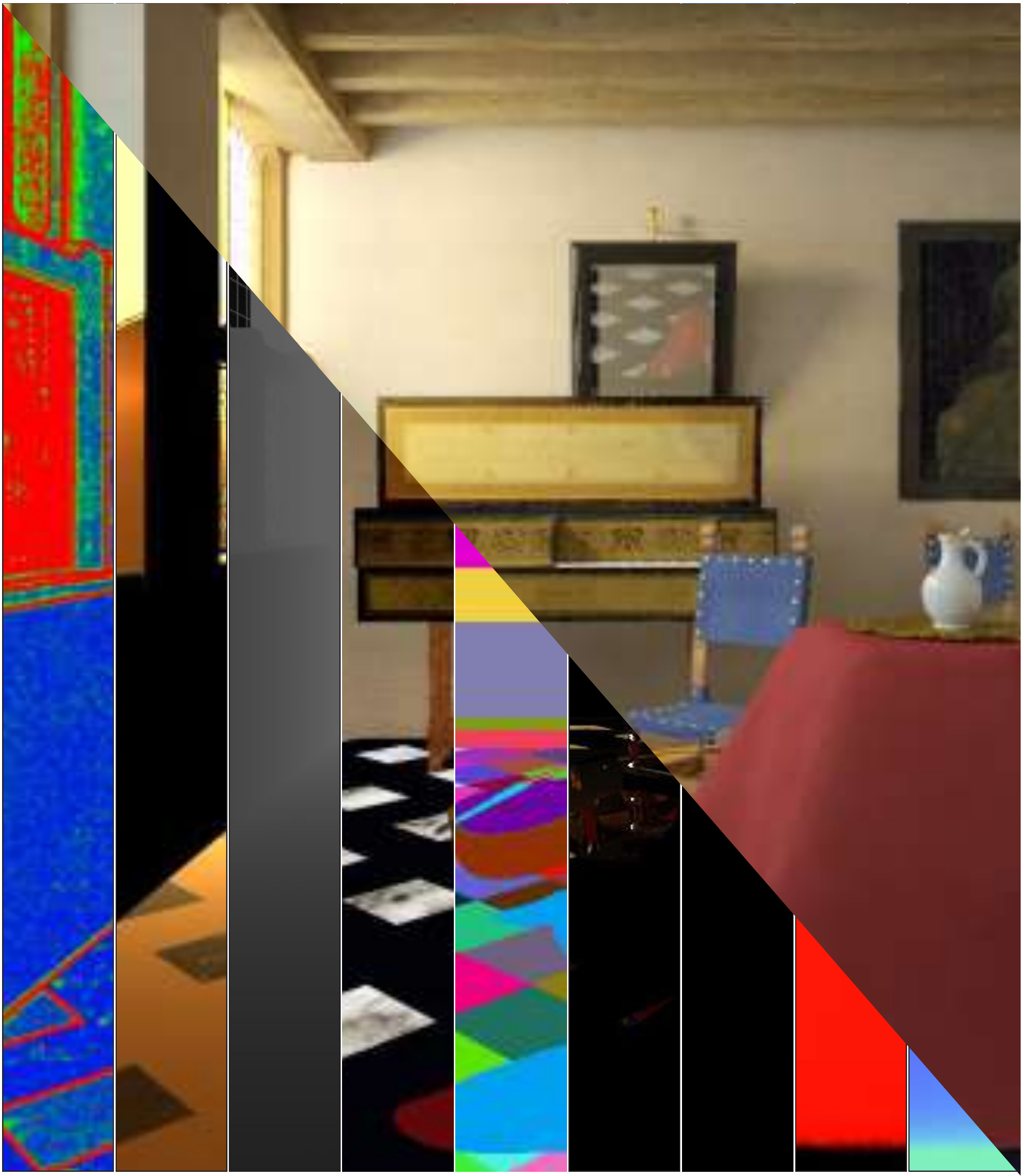
Getting back to what anticipated in the previous preface, in some cases I'll use *Vray* as example, in order to give you a direct response to words which, otherwise, could sound a way too abstract. The point is that, more or less, the packages of algorithms which describe each material's behavior are, almost in any case, the same for any software.

Adding characteristics to a material is like adding layers on a canvas: so, when creating a new one, start with the diffuse color (or map), then add reflection, refraction or any other feature that material owns.

Here I'll explain you how to properly manage those features.

The Music Lesson
Johannes Vermeer
1662-1665
oil on canvas
74.6 cm × 64.1 cm
Royal Collection, St. James's Palace, London

The Music Lesson #64 azimuth 4° (no Lady at the Virginals , no Gentleman)
FF



Before going into detail on the necessary parameters to give a good level of verisimilitude to any kind of material, it's important to understand how visualization softwares translate those inputs into outputs.

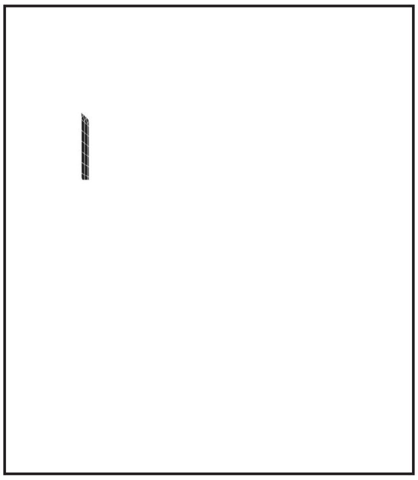
Any rendering produced by whatever visualization software - like Cinema4D, Vray and the most - are images generated by a computational process, where the rendering engine overlaps informations through a system of layers as a series of visual effects, including lighting, shadows, textures, reflections and so on.

These effectes are computed separetly and overlapped to the basic textures through a precise blending mode, thus returning the final image as an indivisible sum.

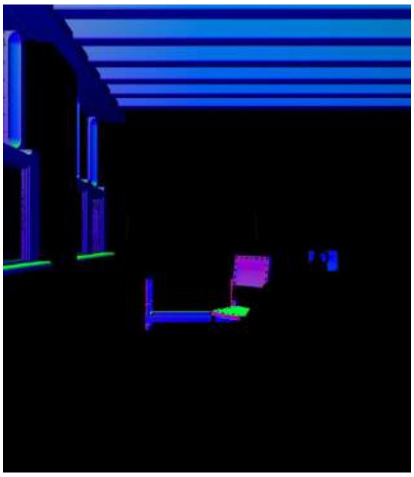
Through the Multipass function, it is possible to extract all the single channels contributing to the creation of the final image as separate layers. There are at least two advantages behind such operation:

- every layer can be personally managed in post production, therefore giving the user the possibility to handle the image in a more personal way;

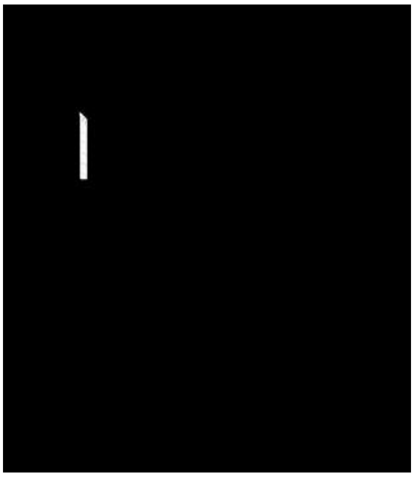
- users can isolate and check the behaviour of lighting and materials, so understanding what parameters to change in order to obtain the desired results before re-rendering.



alpha



bump



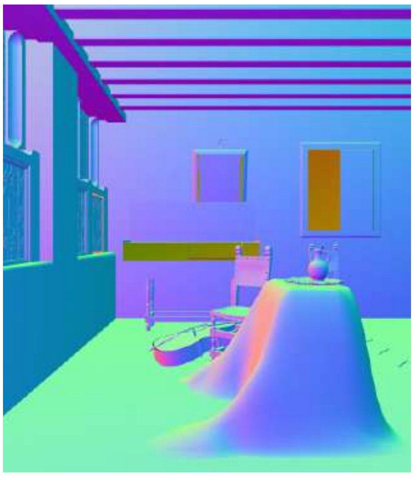
background

diffuse

Global Illumination

lighting

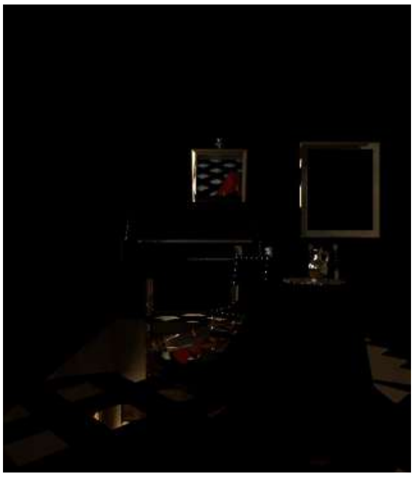
matte shadow



normals

raw GI

raw light

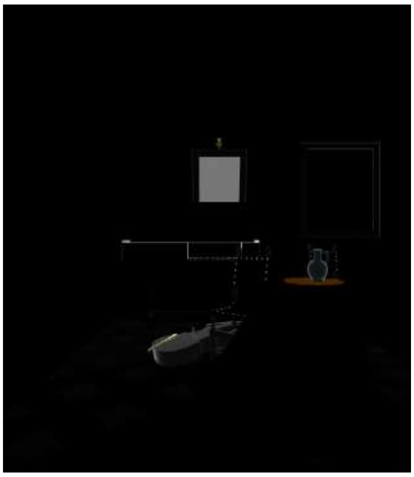


raw reflection

raw shadow

sample of channels

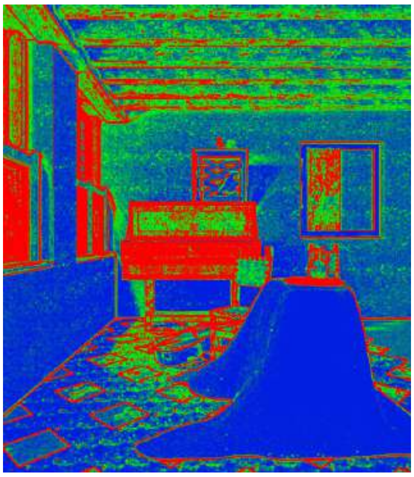
raw total light



reflection filter

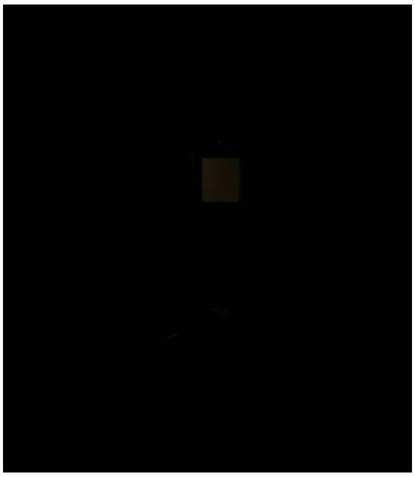
reflection

render ID



sample rate

shadow



specular

total light

Zdepth

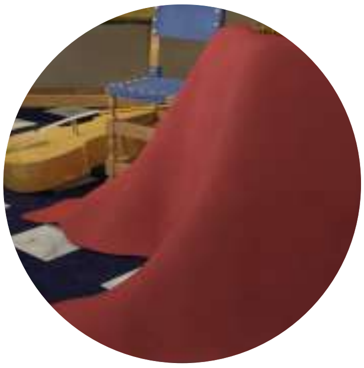
diffuse color, transparency

a basic, diffuse material means it only contains the *diffuse layer*, so it's not able to reflect, refract or emit light.

If you want to quickly test a color on an item in your scene, you can easily select the color of the diffuse layer. Normally, the settings provided for the diffuse layer are :

- *Color* : to attribute the base color of the material;
- *Mapping* : to select a texture or any other type of procedural mapping (we'll see this feature in the next pages);
- *Multiplier* : to increase or decrease the brightness of the mapping (personally I don't recommend this action: if you want your color to be brighter, pick a brighter tone of it instead);
- *Transparency*: to add transparency to the diffuse layer.

Even if my personal intent was to prepare this scene the way I had not to post-produce almost anything, after several trials, I decided not to give a texture to the carpet, leaving out this task for the post production instead. The rendering phase is an exhausting trial and error process: you'll figure out that, in some cases, there are situations, limits which is long more convenient - specially in fact of time wasted - to bypass and face in another moment.

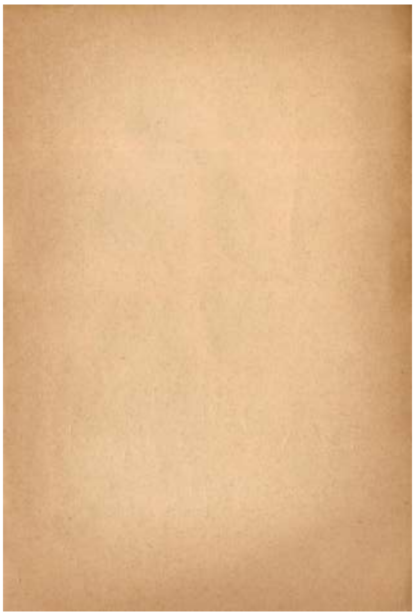


The *Transparency Swatch* works on a grey scale: when this color is 100% black (RGB value 0), it's 100% opaque. When it's 100% white (RGB 255), it's 100% transparent [i.e. If you want the material to be 50% transparent, change the transparency swatch to be medium grey (RGB value 128)].

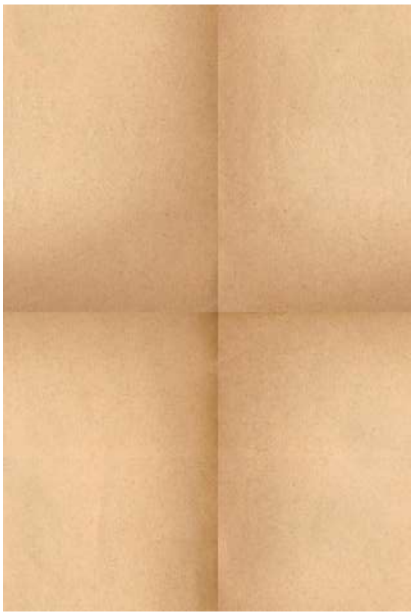
N.B. In *Max* transparency white is opaque, black is transparent. In *Rhino*, black is opaque and white is transparent.

In the example which follows (the *Metal.net.Bunny*), I took advantage of applying a mapping to the transparency channel; by using a black&white version of the same image of the *mapping channel* applied to the diffuse layer, you can convert any item into a new one with only some parts of it set to transparent, according to the nature of its material or components.

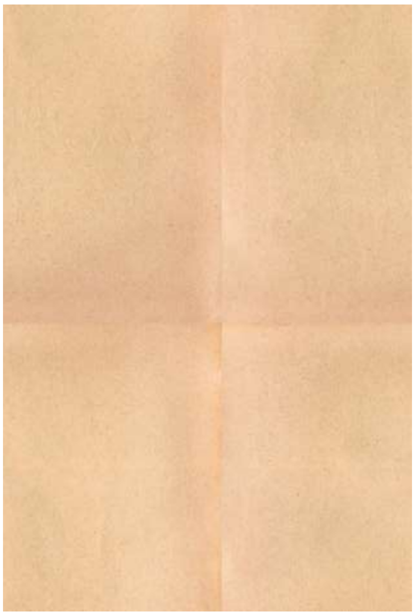
Textures, seamless



to create a seamless texture in Photoshop open the desired image and choose: *Filter > Other > Offset*



Check the *Wrap Around* method. As you can see, the tonal values change significantly from side to side in the original image, therefore the pattern will harly become seamless unless you decrease this shift before offseting.



Adjustments before offset *Camera Raw filter*: *Graduated Filter*, *Spot Removal* and *Adjustment Brush*; applying the *offset filter* to the evenly lit image, the seams are much less noticeable.

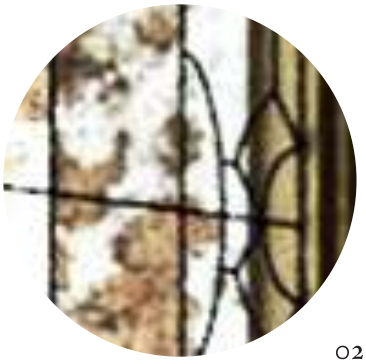
Healing Brush + clone stamp (round brush 30%hardness) tools to remove any noticeable seams.

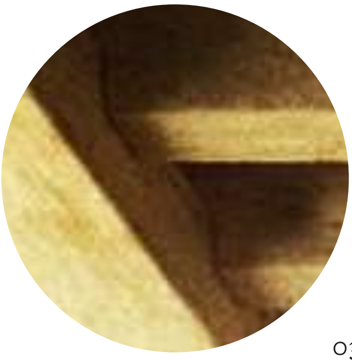
To verify that the pattern is actually seamless, run the filter again and again until you don't see any more seams.

Once the file is seamless, choose *Select > Select All* and then *Edit > Define Pattern*; this way the Pattern created will be available to fill areas in Photoshop.

More in general, try to avoid obvious items in the texture that will easily be spotted when the pattern is repeated; to achieve it - still using the *Clone* tool - tide up any anomalies in the texture, or distinctive elements that appear more than once and give away the fact that the texture has been duplicated. To restore some of the texture's original quality and mask the Cloning, apply a *Sharpen filter* 1-2 times until desired effect is achieved.


01


02


03


04


05

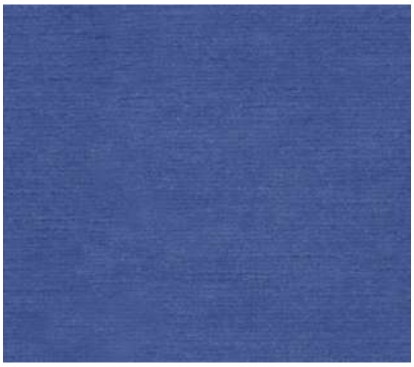
The choice of using different kinds of wood textures - although some of them might look the same at first sight - helps a lot to add realism to the image.

For the ceiling beams and the windows frames (fig. 01, 03) I used seamless textures with some roughness, avoiding any reflection in order to mimic the conditions of the painting.

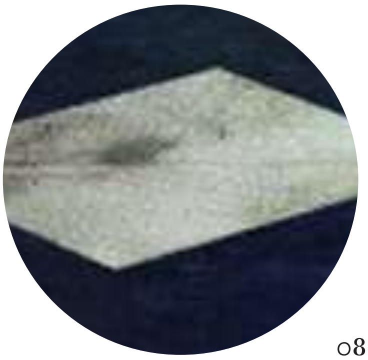
Notice that when a texture contains many imperfections with a high contrast (03 in particular), displeasing clones of those imperfections will happen because of the repetition of the texture; here I decided to let them happen, just moving the position of the texture - in order to make them less evident - and fixing anything later on in post production.


06

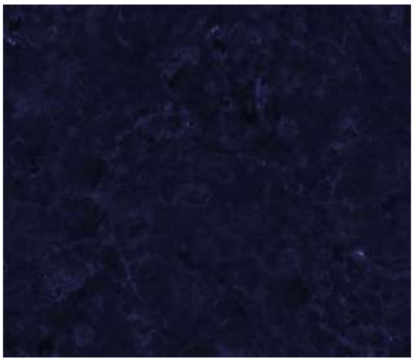

06. When it's about the *walls*, specially for interiors, I normally use an *old paper* sheet and directly stick it to the wall as it was a real wallpaper. This way you can avoid the excessive brightness of a perfectly white surface and make it look less fake.


07


07. the blue fabric covering the chairs is *Eroica Milano Velvet Ocean*, a medium weight poly backed velvet very similar to the one of the painting.


08


08. the Music Lession white marble looks totally fake, making it the weirdest material of the painting. A good compromise between reality and mimicry has been obtained overscaling the texture to the whole floor, as it was just one piece of marble.


09


09. Black marble is one of the hardest to render, since the lighter shades proper of the material tend to be absorbed by its overall darkness; once set up the exposure and lighting of the scene, I gradually augmented its brightness, thus adding a bit of fresnel reflection.


10


10. A golden leaf texture has been applied to the mirror pommer, the pitcher cap and the chair buttons, thus changing mapping in scale and position in order to perceive more gradients from a same texture.

Mapping channel

If on the one hand the creation of whatever textured material is very simple, the mapping process to make it fit to a particular solid may be a slightly more complicated task. Each object in the scene holds its own *mapping channel* (i.e. in Rhino you can check it from the *object properties*) and each mapping channel is identified by a number.

A mapping channel holds a set of texture mapping parameters; an object can have any number of channels and therefore can hold any number of textures mapping types. When the textures are applied to an object, the software is using the *matching channel number* on the object.

UVW mapping

Normally you need to adjust the way in which the mapping (a texture or any *.jpg* image) lies on the plane on which the material is applied. In order to achieve the desired result, you have to adjust the *UVW map* of the surface. UVW map is a coordinate system that is relative to the object that it's applied to, NOT world coordinates.

- as mentioned above, the *XYZ coordinates* refer to the way in which an object is situated in *world space*, hence *UVW* are similar coordinates, but related to the way the material is applied to the object (we may call them local coordinates).

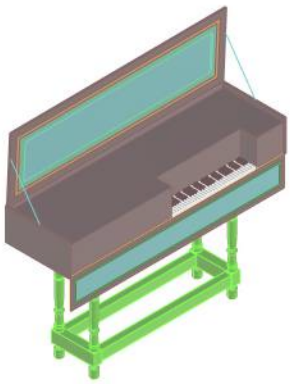
- The *projection* literally manages the projection of the texture (imagine this feature like a video projector casting a frame on an object).

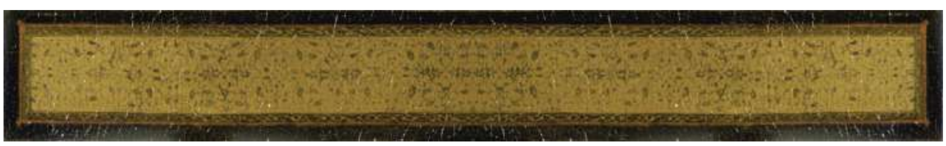
- The *UVW Offset* determines the position of the texture in relation to the position of the origin of the object itself.

- The *UVW Rotation* adjusts the degree of rotation of the mapping.

- The *UVW Repeat* controls how many times a map is repeated within a given space: this is the feature which affects the scale of the texture.

In the virginal, you may notice I built different surfaces (the different colors in the image beside) according to the diverse mappings I was supposed to assign to each one of them. The most efficient way to visualize that item was hence to prepare a collection of images directly extracted from the painting, which means to adjust them in Photoshop, correcting the perspective distortion and saving a precise bi-dimensional (with right dimentions for each side) image to paste in your 3D model.





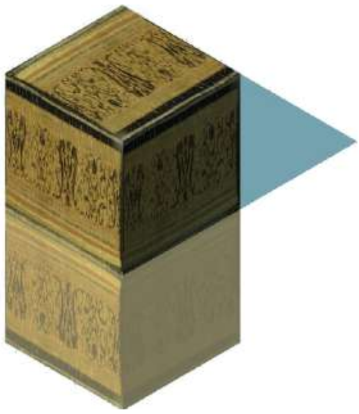
Texture, projections

Projection (Mapping types)

The default behavior for many softwares (i.e. Rhino) is to treat each surface as a separate object, stretching and orienting the assigned texture to fit. Unluckly, this is almost in any situation far from reality.

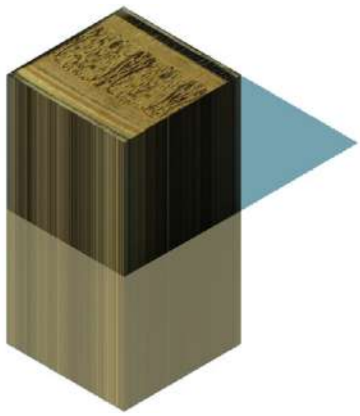
Every engine offers several mapping methods, the most common are the listed below:

- *Surface mapping* stretches the texture over the object.
- *Planar mapping* projects a 2D plane onto the side of an object, useful for planar surfaces, since it extrudes the pixels on the boundaries of the image along the thickness of the item.
- *Box mapping* projects a 3D box onto the sides and top of an object, in many cases it's the most useful method.
- *Box (sides only)* mapping sides of an object only, does not cap the mapping to the top and bottom surfaces.
- *Spherical mapping* wraps the object around a sphere. The top and bottom edges of the texture shrink into the top and bottom poles of the object.
- *Cylindrical mapping* an image around an object like a cylinder the left and the right edge will join each other.



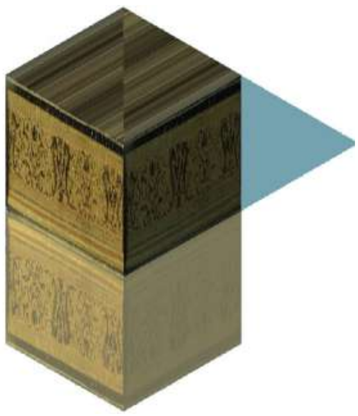
Box

Sphere



Planar

Surface



Box sides only

Cylindrical

Vermeer includes in the Music Lesson a small painting hanging on the wall, so introducing - like in many other paintings - the *painting within a painting* topic.

The painting is a Roman Charity (Latin Caritas romana; Italian Carità Romana), the exemplary story of a woman, Pero, who secretly breastfeeds her father, Cimon, after he is incarcerated and sentenced to death by starvation.

The story - recorded in by the ancient Roman historian Valerius Maximus - was presented as a great act of pietas (i.e., filial piety); therefore it is a valid hypothesis to interpret the whole painting as a masked allegory of an implicit love relationship, where the young man is a secret love prisoner.

The topic of the painting within a painting is very frequent in the work of Vermeer and other authors of the time, as an occasion to introduce parallel plots, lifting scene and characters to a higher level and so transforming genre scenes (and genre art in general) into allegorical, sophisticated masterpieces.

La Carità romana
Bartolomeo Manfredi

Lady Writing a Letter with her Maid, 1670 | J. Vermeer
National Gallery, Dublin

The Allegory of Faith, 1671-74
Johannes Vermeer
MoMa, New York

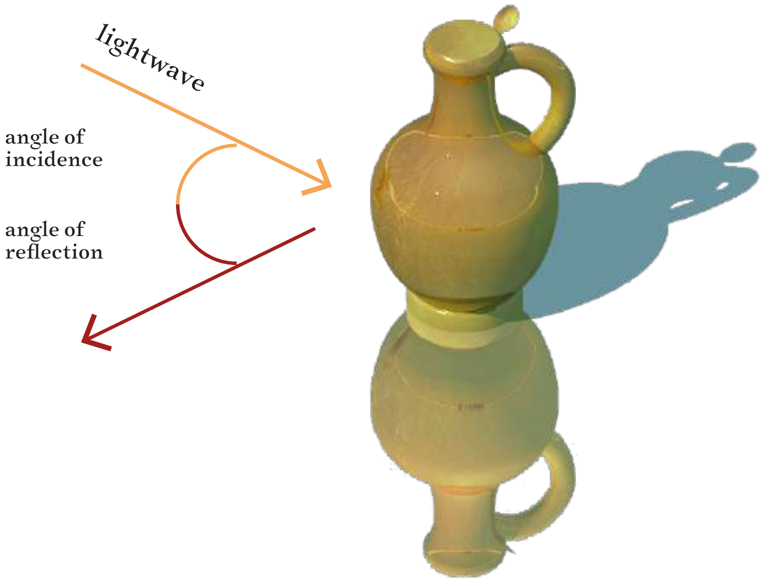
The Guitar Player, 1672
Johannes Vermeer
Kenwood House, London

The love letter, 1669
Johannes Vermeer
Rijksmuseum, Amsterdam

Lady Seated at a Virginal, 1673
Johannes Vermeer
National Gallery, London

The Concert, 1665-66
Johannes Vermeer
theft

The light wave comes from the light source and makes contact with the front face of the material at a given angle. This is known as the angle of incidence. The light wave then bounces off the material at the exact same angle, known as the *angle of reflection.*



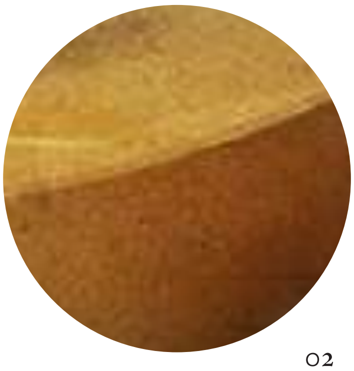
the Reflection map

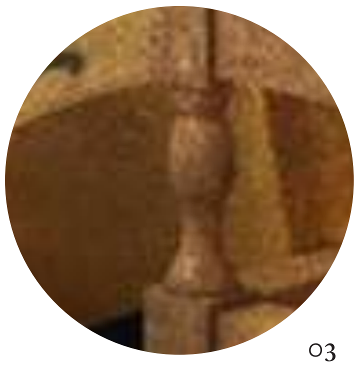
By default the reflection layer has a *fresnel map* which varies the amount of reflection based on the viewing angle (this is why the edges of a sphere seem to give the material a distortion that we come to expect from a reflective sphere) .

If that map is removed (or if the fresnel value is set to 0) then the reflection is constant over the whole material.

The images below show all materials in the scene owning some reflections; a particular situation occures with white marble (05), which normally is long more reflective, as it happens in the first image in the following page. The choice to almost completely avoid reflections has been taken in order to mimic the tiles in the painting, still looking like marble, but more flat, as if the pavement was very dirty and old.


01


02


03


04


05


06

Fresnel IOR (Index Of Reflection)

The *Fresnel IOR* controls the reflection intensity; the *Fresnel reflections* are a naturally occurring phenomenon that states that an object becomes more reflective the greater the angle at which it is seen (i.e. think of how the reflection changes moving around a window).

Each material owns its own *Fresnel value* [High IOR > smaller angle needed > less reflection]. A higher *Fresnel IOR* means that, at a slight angle, you can see reflections, while with a lower IOR at the same angle, you might not see the material as reflective.

A Fresnel IOR value of 1.2. has been given to the *black wood mirror frame* (view pitcher in this page), since my intention was to give a reflection of the light coming from the window and, at the time, not reflecting any item in front of it as the mirror does instead.

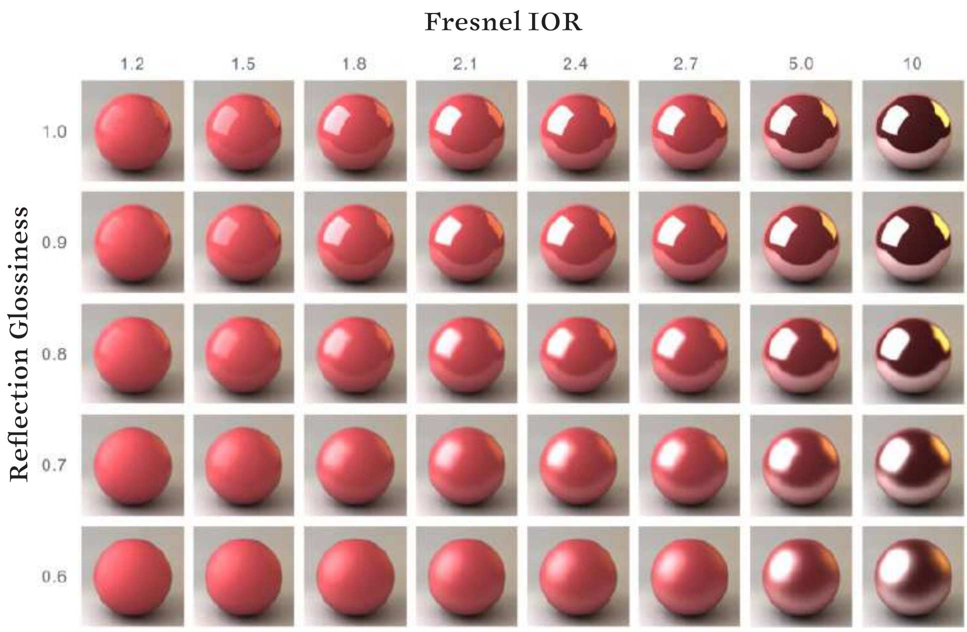
Glossiness

Similarly to the IOR, *Glossiness* is a parameter in both *Reflective* and *Refractive layers*. The difference between the two is that the *Reflective Glossiness* deals strictly with the amount of reflection dealing with the surface, while the *Refraction Glossiness* has an effect on what happens inside the material, therefore influencing its transparency (it's through this parameter that materials can appear frosted, the refraction will become blurrier as the *Refraction Glossiness* decreases).

The control over the uneven nature of a reflective material can be balanced with this parameter; the amount of reflection glossiness is actually a two-part equation that deals with the *Highlight Glossiness number* and the *Reflection Glossiness number*. When these are both set at 1, the material will be mirror like, while as these numbers are reduced, the material's reflections become much blurrier.

>>> Don't reduce these numbers to below 0.5/0.6, or it will cause highly increased render times and almost no reflections. You can increase glossiness subdivision instead, to improve the quality of the glossiness and remove the noise which most of the times occurs. Mind that this option will increase anyway the rendering time on this material. A good value for the subdivision could be something between 22 - 40 (32 is recommended).

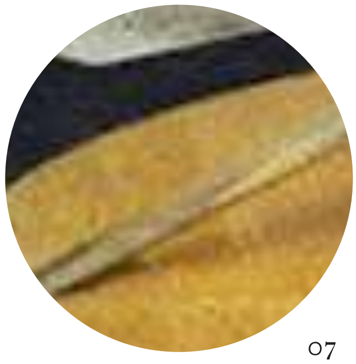
above : Fresnel IOR 1.2
below : Fresnel IOR 10



Reflection Filter

While, by default, the color of the reflection is white, you can tint the reflection using the *Reflection Filter*: this function changes the color of the reflection producing different metallic like tints.

It can be useful when you want to achieve a precise chromatic result only on a given surface without changing the lighting parameters of the whole scene, which would affect the other materials too. (i.e. *Cello Metal* has a yellowish reflection filter.)



07

08

(07) cello metal includes a yellowish reflection filter to achieve that tone of color only in the reflective parts of the item.
(08) on the right a mirror like material: in order to be totally reflective, the fresnel map has been removed. Mind the pitcher: since there is nothing to reflect, it gives a black reflection because of the environnment settings of the scene.

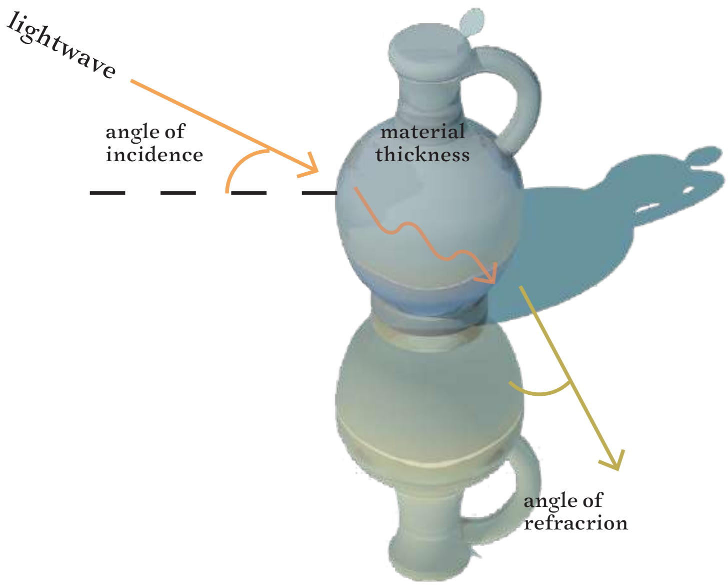
Mirrors

Similarly to what discussed about the painting within a painting, mirrors are another signature of the period; beyond being an expedient to show off the artists' skills, they allow painters to include parts of the space without changing the shot (see pictures below).

The love letter, 1669
Johannes Vermeer
Rijksmuseum, Amsterdam

The Concert, 1665-66
Johannes Vermeer
theft

Refraction is the way that that the light wave travels through the material. Because of specific thickness and density, it is refracted in the thickness of the material as bounces off of the "substance". The angle of the light coming out of the material isn't the same as the angle of the light entering the material. This difference is measured by the *Index of Refraction* (*IOR*).



Refraction Fresnel (IOR)

As in the definition above, the angle of the light coming out of the material isn't the same as the angle of the light entering the material: this difference is measured by the *Index of Refraction (IOR)*.

The *IOR* of air in a ideal vacuum is 1.0 (meaning the angle is the same coming in the material as exiting the material). As the IOR number increases, the more refraction occurs. Many materials have a well-characterized *refractive index*, but these indexes depend strongly upon the frequency of light. By definition, the perfect *vacuum* (you can approximate the air in any interior or exterior scene as it was that) IOR value is set to 1.0.

On the right, a chart sums up the main *IOR values* you can find yourself testing along your visualization process; at this link you can find a more complete description of the chart.

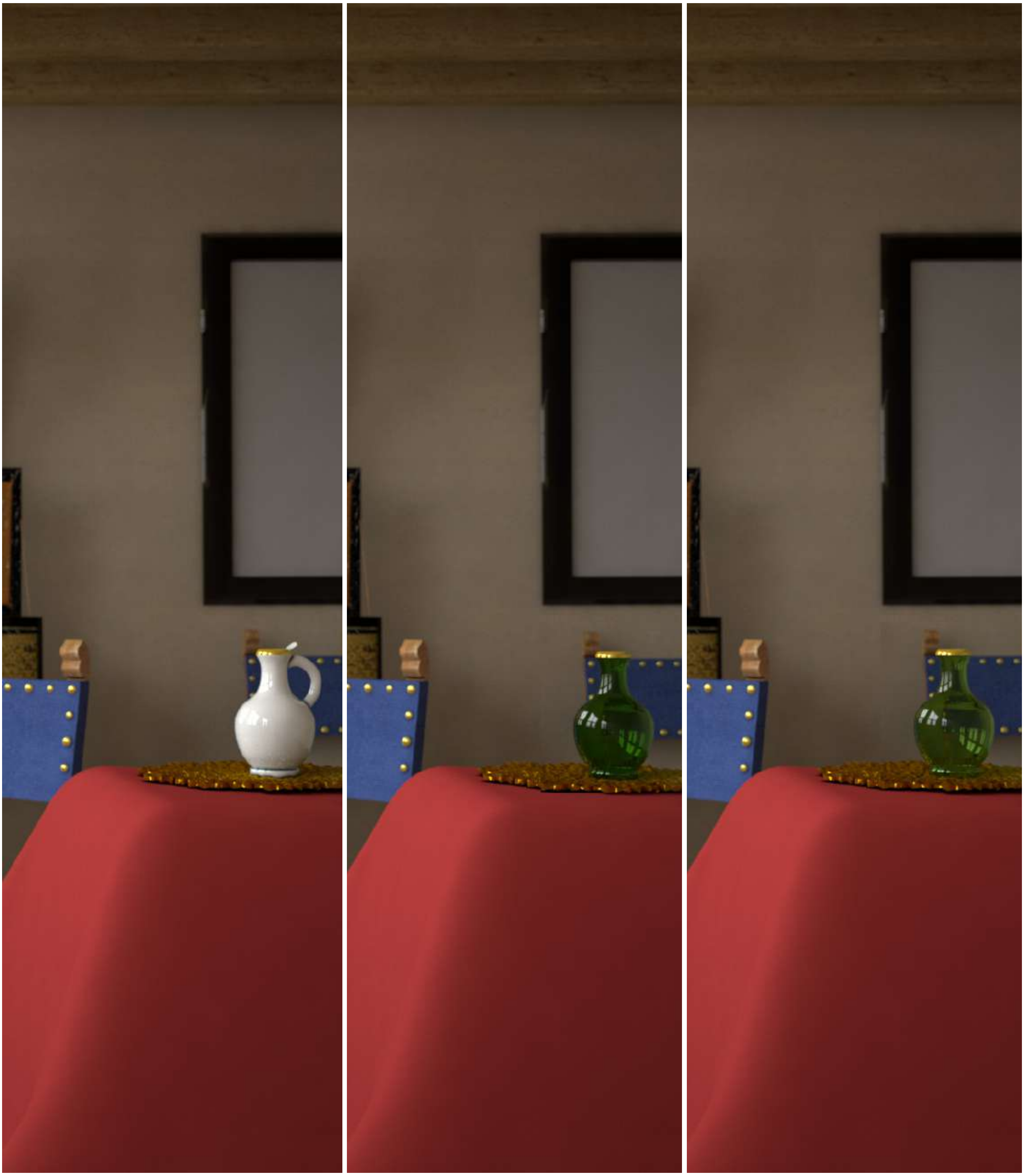
glass without refraction

glass with refraction

IOR VALUE CHART

MATERIAL	IOR	MATERIAL	IOR
Vacuum	1.0	Glass	1.517
Air	1.00029	Glycerin	1.472
Alcohol	1.329	Ice	1.309
Crystal	2.0	Ruby	1.77
Diamond	2.417	Sapphire	1.77
Emerald	1.57	Water	1.33

Refraction, fog



Fog

The *Fog* parameter allows to give any refractive material a tint of color. This can be useful when attempting to create a tinted glass, adding a lot of realism because, despite of giving a simple transparency map to a colored material, it takes care of the smoothing effect of refraction through the thickness of the object in which it is applied.

The chart at the end of this page shows how intense this setting becomes approaching a 2.0 value.

the Fog parameters (Vray)

- *Fog color*

Specifies the attenuation of light as it passes through the material. This option allows the user to simulate the fact that thick objects look less transparent than thin objects.

- *Fog multiplier*

Controls the strength of the fog effect. Smaller values reduce the effect of the fog, making the material more transparent. Larger values increase the fog effect, making the material more opaque.

- *Fog bias*

Changes the way the fog color is applied. Negative values make the thin parts of the objects more transparent and the thicker parts more opaque and vice-versa.

in the previous page, the pitcher materialized in different ways:

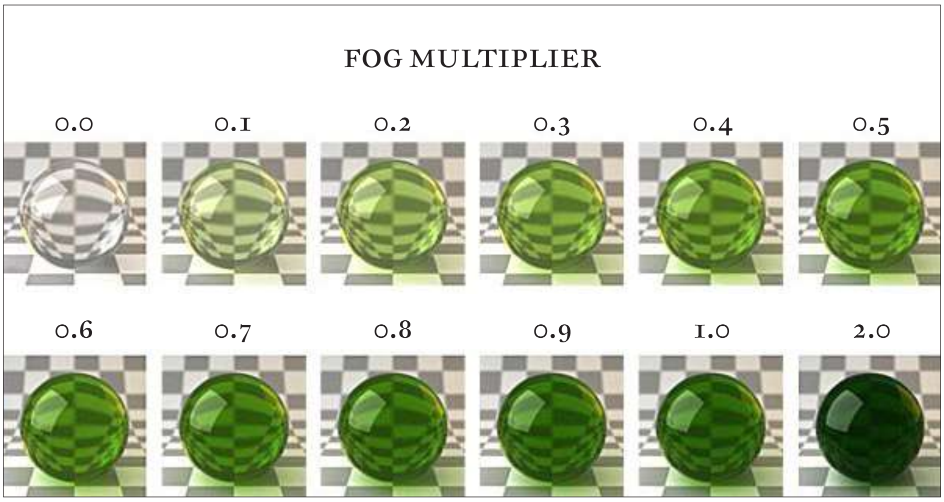
1. painting porcelain like, no refraction (the material has no transparency), fresnel reflection 1.55.

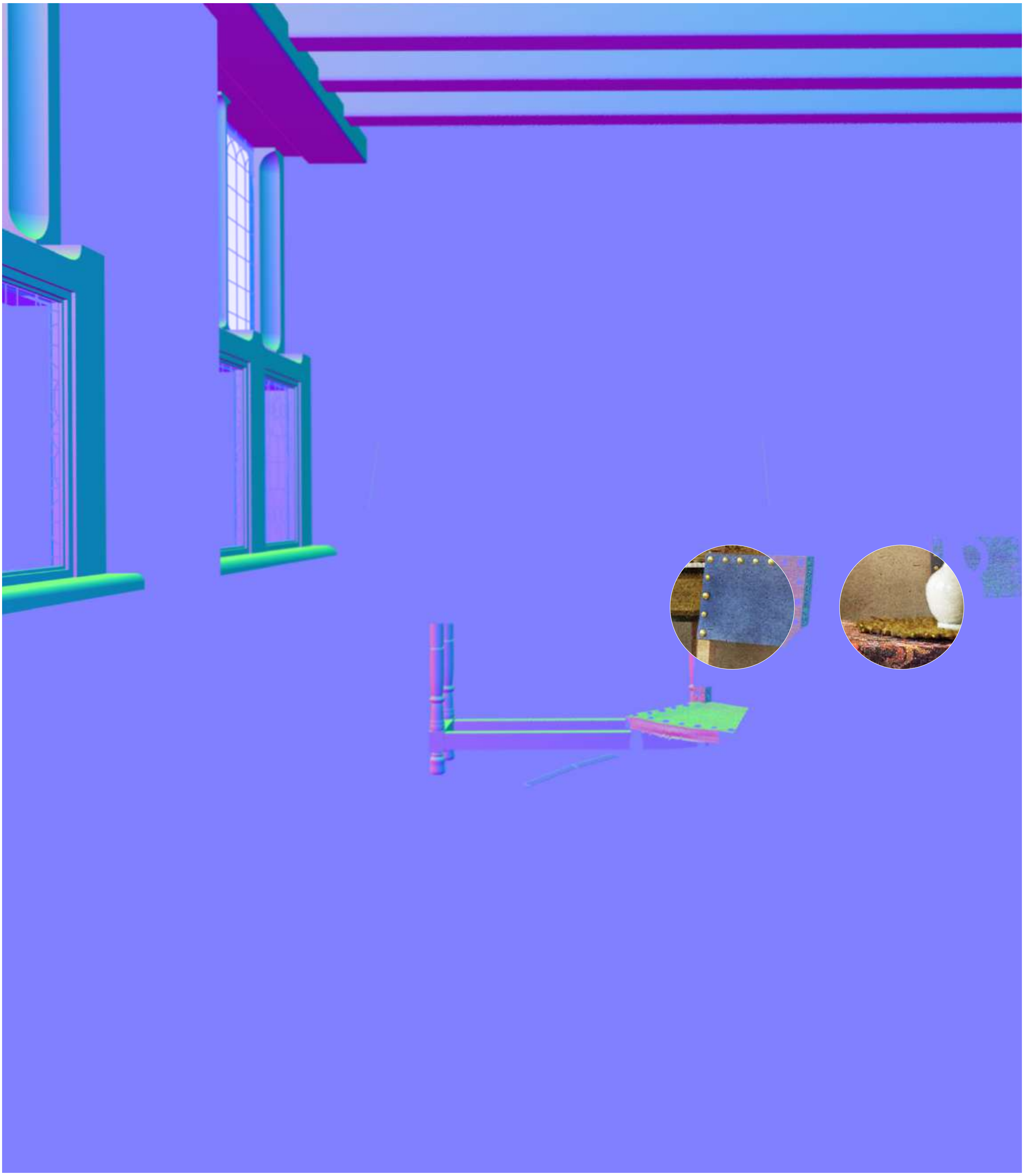
2. the surface has been offsetted of 3 mm, therefore a Fog light green color has been applied with a multiplier of 2.0 (see chart below)

3. the fog multiplier has been decreased to 0.5, same color.

refraction

refraction with cyan fog



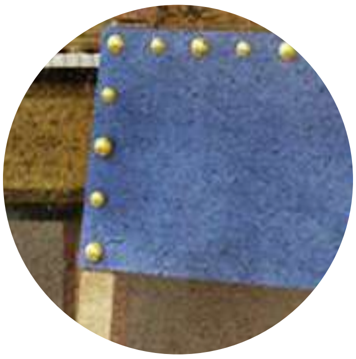


Bump layer

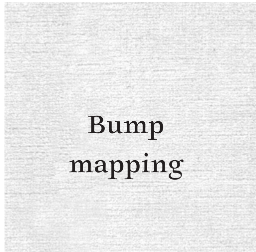
Visually, a *bump* is a part of surface owning a slightly different orientation in space than its neighboring surface. Instead of modeling a bulge in the geometry - which would require a bunch of polygons for each bump, slowing down all related operations - you can reach the same result through the bump layer.

Changing the bump and displacement maps will help you add depth to your materials. *Bump maps* will create the illusion of depth (while displacement will actually create a 3D geometry. *Displacement maps* will take longer to render but will create much better shadows for close up renders).

The *Bump* texture maps are generally black and white, high contrast images you will add as a separate layer to a given material, like in the following example.



blue velvet covering the chair has as bump mapping which is the same texture applied to the material, but black and white.



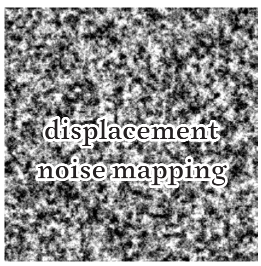
Displacement mapping

Displacement is a technique for adding detail to your scene's geometry without the need to model it first, the concept is very similar to bump mapping. However, bump mapping is a shading effect that only changes the appearance of a surface, while displacement mapping actually modifies the surface. You can use your current bump b/w map as displacement maps. The main parameter which influence the final size of the displacement is the *multiplier*; this will reference the *Amount value* in the Displacement rollout.

[N.B. In the *V-Ray Options* there is a rollout containing the parameters for displacement: these are global controls for all of the displacement throughout the scene. In order to manage each object or material's displacement you must use texture multiplier .

To mimic the frosted effect of the plate, a noise image has been assigned as displacement map in addition to the diffuse golden texture; when not rendered, the plate looks (and it is) absolutely flat.

blue velvet covering the chair has as bump mapping the same texture applied to the material, but black and white.



V-Ray Fur is a very simple procedural fur plugin. The fur is generated only during render time and is not actually present in the scene.[1]

Fur parameters (Vray)

Lenght : length of single hair

Thickness : thickness of the hair

Gravity : value of gravity; negative values will attract hair upwards.

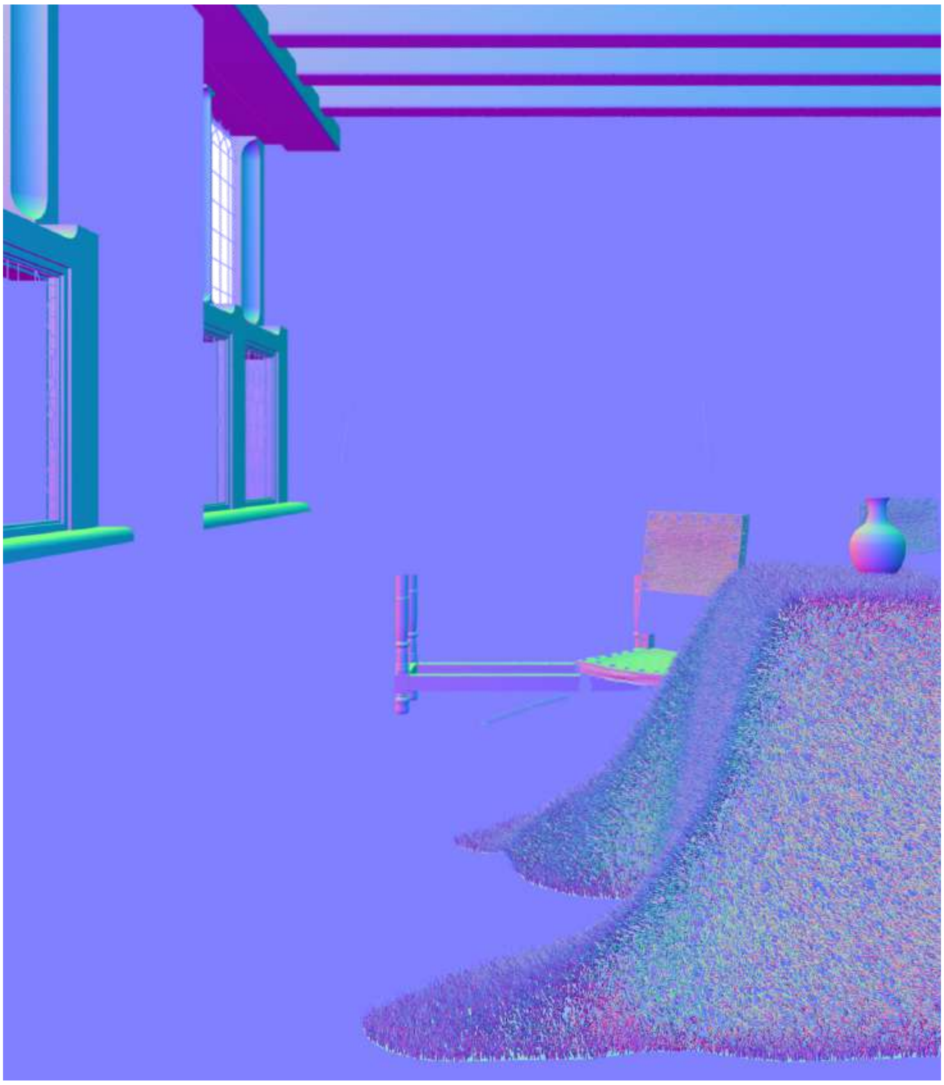
Bend : value that determines the curvature of the hairs

Taper : amount of tapering of hair from root to tip

Sides : indicates the number of sides of the polygon that generates the fur (3 means that the hair has a triangular section, 4 square). Even if you leave this parameter to 3 the results are still good, unless your camera is very close to the hairs.

Knots : determines the number of stitches (and consequently the number of segments) in which the hair is divided; with high values you will obtain hairs with a more rounded curvature, with low hairs with more "angular" curvature.

Moreover, through the *Variation* option group it is possible to set a variation of these parameters to make the final result more irregular and therefore more likely.



as very evident in the *bump normals channel*, the surface on which it has been applied a Fur (here the carpet) generates in the rendering phase a considerable quantity of surfaces - depending on the distribution parameter amount - , each of which has its own orientation and consequent set of normal vectors.

The yield times are slightly shorter when compared this technique to those of the method *Hair + MoGraph + VrayProxy*. In the end, among the available techniques, Vray Fur is without any doubt the most efficient one to create fur/grass like textures in terms of easiness, but also as a matter of memory used by the software in both phases of modeling (the plugin doesn't affect the scene) and rendering.

In the previous page, a fur has been generated with the following parameters:

Length : 3
Thickness : 0.5
distribution : 1
bend : 0.8

Then a seamless grass texture has been applied to the fur item and to the carpet below. No post-production was needed.

....

1. chaosgroup.com

Emissive materials are self-illuminated materials, that is they can emit light across their surface. When an emissive material is used in a scene, it is rendered as a visible light source, and depending on its intensity, its glow can light up the surrounding area. These types of material can be used to create effects such as a neon sign, a glowing lamp shade, a tv/ computer screen or a candle.

These materials belong to the *global illumination* calculation (we'll see this more in detail in the light handbook, anyway, in general when light hits a surface bounces all around and, with *GI* algorithm enabled, these bounces result as an indirect light, which illuminates areas otherwise dark in the scene); emissive materials are part of, meaning they emit indirect light.

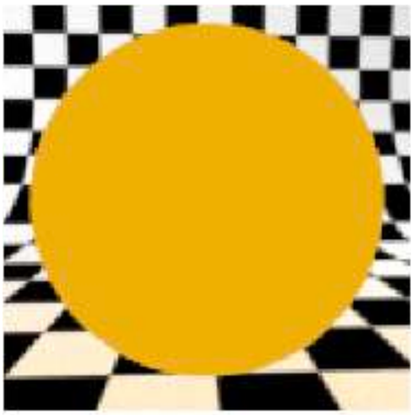
Mind that emissive materials may considerably increase render times, up to extreme amounts (even 100 times); do not use these materials as the sole lighting for a scene. It's suggested instead, for best results, to use an artificial (i.e. point light, we'll see this in the light handbook) and only use emissive materials for the glowing that they're meant for. The changes that you make in the *Emissive layer* will affect the light emitted from the material, not the underlying color itself.

Sometimes emissive materials can be noisy and cause an effect known as *fireflies*; in case you may encounter this problem, decrease the brightness of your emissive surface and increase the point light associated.

how to make a lava lamp

lava lamp is a very fascinating item, specially when it's about finding a good way to visualize it, since its content features phenomena such as reflection, refraction (both with fresnel IOR peculiar properties) and emittivity, therefore combining many aspects analized in the previous pages.

1. lava-like red plasma bubbles of different shape and dimension (although part of the difference between them is a consequence of the glass distortion) with emissive layer to let them glow;



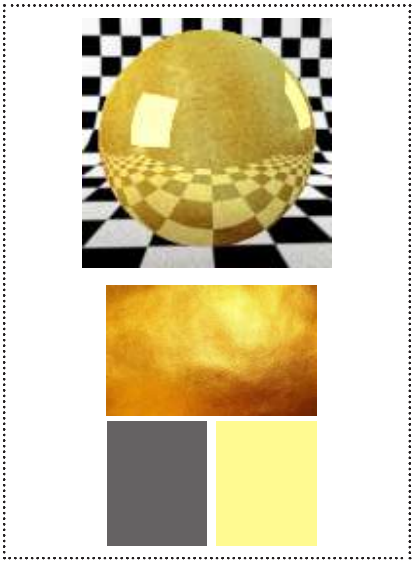
2. an emissive yellow surface has been placed below the magma bubbles, in order to create a gradient of fire-like light within the lamp and play with internal reflecions;

3. a transparent shell to enclose the magma; the glass like material has a reflective layer (with a fresnel IOR 1.55 value like normal glass would be) and a refractive layer tinted with purple fog

the Music Lesson materials

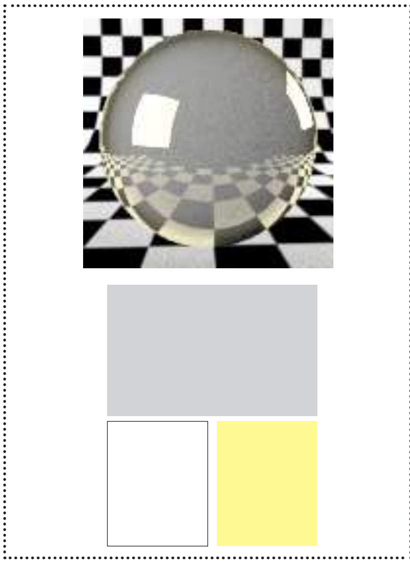
Marble white tiles

- diffuse map white marble texture (scaled to fill the whole pavement, miming the painting)
- reflection 0.1 (white)



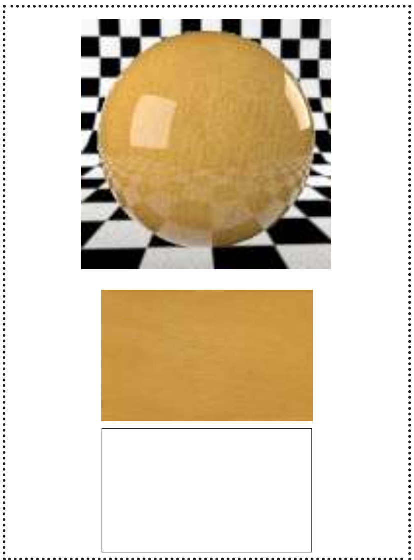
Golden buttons

- diffuse map golden leaf texture
- reflection 0.3 (dark grey)
- reflection filter (RGB 251,251,142)
- reflection glossiness 1.0 (same map of diffuse)



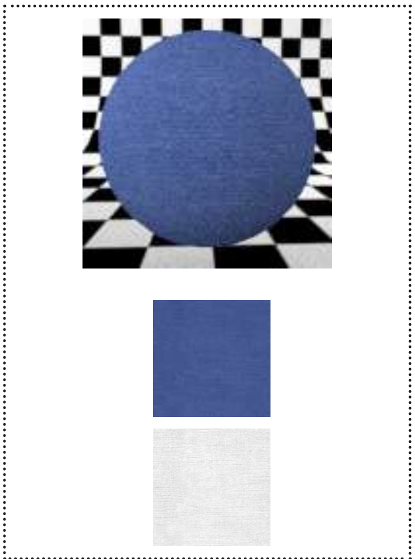
Metal cello component

- diffuse grey
- reflection 5.0 (white)
- reflection filter (255,248,208)
- reflection glossiness 1.0 (Fresnel IOR 1.0)



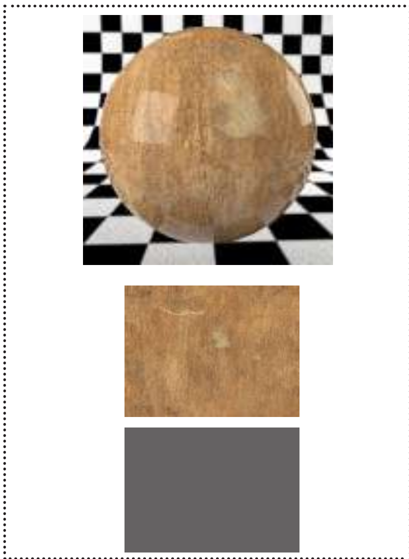
Wooden cello

- diffuse map wood texture 01
- reflection white



Blue velvet chair

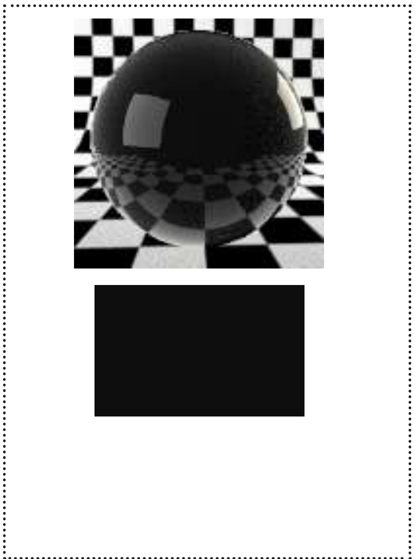
- diffuse map blue velvet texture
- bump map 1 (same texture)



Wooden chair parts

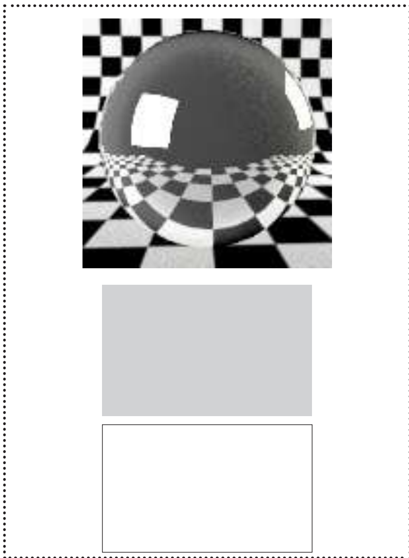
- diffuse map wood 02 texture
- reflection 2.0 (dark grey)
- reflection glossiness 1.0

the Music Lesson materials



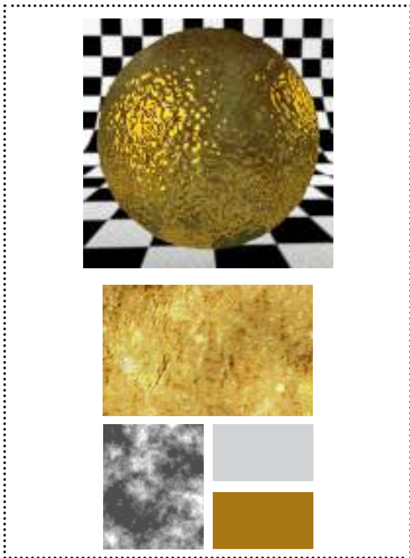
Black mirror frame

- diffuse black (0,0,0)
- reflection 1.5 (fresnel IOR 1.2)
- reflection glossiness (fresnel IOR 1.2)



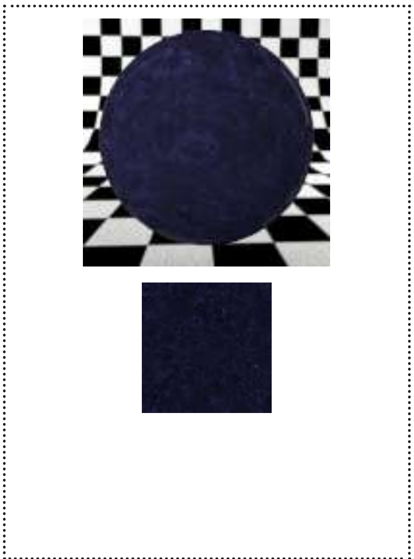
Mirror reflection

- diffuse black (0,0,0,)
- reflection 10 (Fresnel IOR 1.55)
- reflection glossiness 1.0 (Fresnel IOR 1.55)



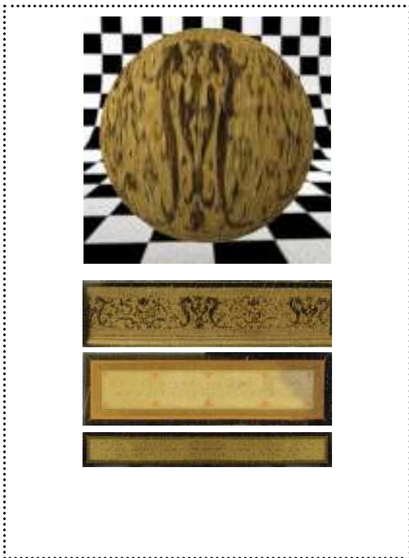
Golden crispy plate

- diffuse map golden leaf texture (box mapping)
- displacement map (TexNoise, size 1.0, ampl. 2.0)
- reflection 1.2 (grey)
- reflection filter (160,121,11)



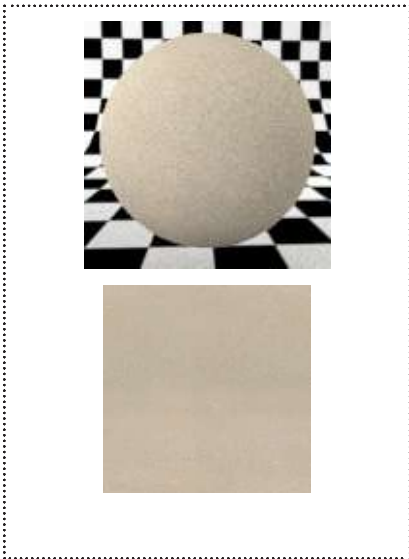
Black marble tiles

- diffuse map dark marble texture
- reflection 0.05 (white 100%)



Virginal Seahorse frieze

- diffuse map set of textures extracted from the painting and applied as surface mapping on the faces of the virginal.

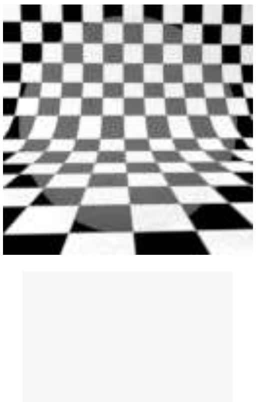


Dirty Plaster Walls

- diffuse map texture dirty plaster

White Porcelain pot

- diffuse color white 100%
- reflection 2.0 (fresnel 1.55)
- reflection filter 1.0 (160,121, 11)
- Fresnel IOR 1.2 on reflection layer

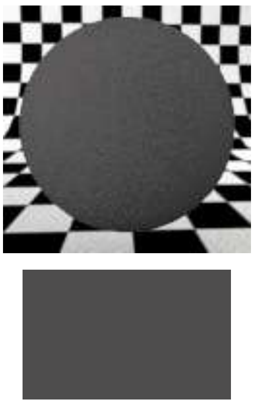


Semi-transparent glass

- diffuse white color.
- transparency 1.0 (light grey 245)
- no reflection, no refraction

Grunge window wood exterior

- diffuse map grunge wood texture



Lead window frames

- diffuse color dark gray

Wooden window

- diffuse map wood texture 03 (mix of box mapping and surface mapping)
- roughness map wood texture 03 (black and white version)
- reflection 0.1 (black 0,0,0)

Beams wood

- diffuse map wood texture 04 box mapping mapping)
- roughness map wood texture 04 (black and white version)

THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

VIII

LIGHT

¤

Filippo Fanciotti

LIGHTING HANDBOOK
Filippo Fanciotti

Before getting into the specific lighting topic, few words must be spent on the subject of rendering, since the light management is strictly connected to this phase.

The image produced by any rendering engine is the result of the combination of many parameters, therefore any result is unique and requires the management of a lot of data; that's why it is mandatory to adopt a systematic workflow from the beginning, that includes incremental saving and a good storage system. In other words, each time you touch something in the render options, take note of that change and save that step, otherwise it will be very hard to get back to a previous solution. A due note musts be addressed to the software you are working with.

The Music Lesson
Johannes Vermeer
1662-1665
oil on canvas
74.6 cm × 64.1 cm
Royal Collection, St. James's Palace, London

The Vermeer's Music Lesson,
Lighting variation: candlelight
Filippo Fanciotti
november 2017
Rhino, Vray, Photoshop
1230 x 1465 pixels
EPFL, ENAC, LAPIS

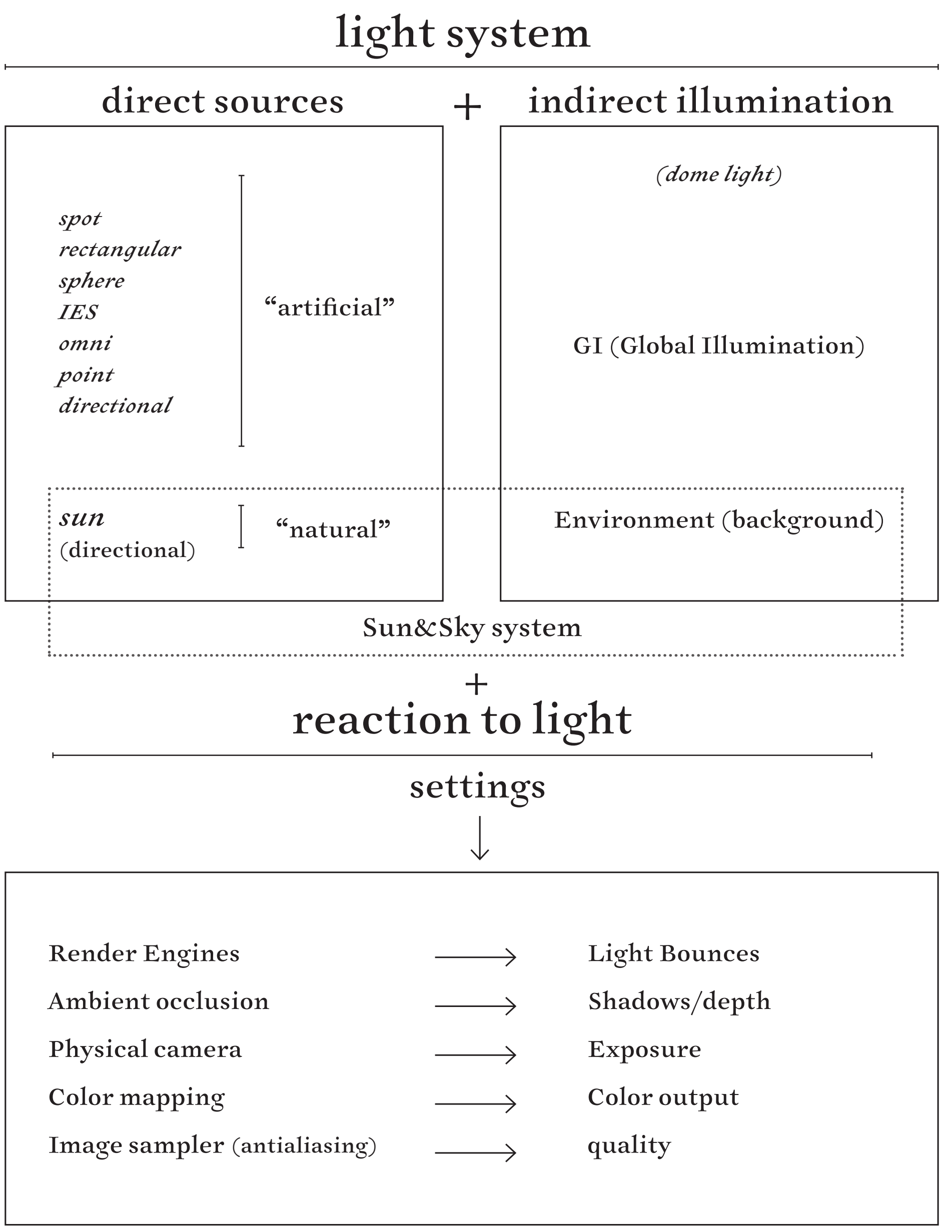
Vray - as you have probably noticed is the one I use the most - is a very complex but complete program, thus giving me the chance to present and discuss a wide fan of topics in this handbook. The following pages will often directly refer to some parameters proper of that software and which perhaps don't even exist in the one you are using; so, as you have already done with the *Matière handbook*, I kindly ask you to abstract the concepts behind those specific instructions and learn how to navigate any other rendering engine. If you are a beginner in the rendering world, at this link you have a list of "*The Most Popular Rendering Software Used by Architects and Designers*".

Any engine has its own its strengths and weaknesses, the important thing is to understand what they are and compensate for any gaps with a good post-production or, possibly, consider using a more complete software in order not to limit yourself in the search for the best result desired.

The diagram on the right shows the package of fields required to manage a lighting environment within a scene. The location of this settings changes, again, from software to software: here I propose a subdivision which is coherent with *Vray* and which - in my opinion - is pretty logical.

Two main sets of tools influence light result: the *light system* (including both *direct sources* and *indirect illumination*) and the settings to balance the *reaction* to those light sources.

Although in many cases it will be more than enough to properly set up a *Sun and Sky System* in cooperation with a *Physical Camera* and the *Global Illumination* algorithm (as explained in the following pages), in other situations you may have to introduce other sources, being them proper artificial lights or "fake lights" to increase some effects, light up small parts of the scene and so on.

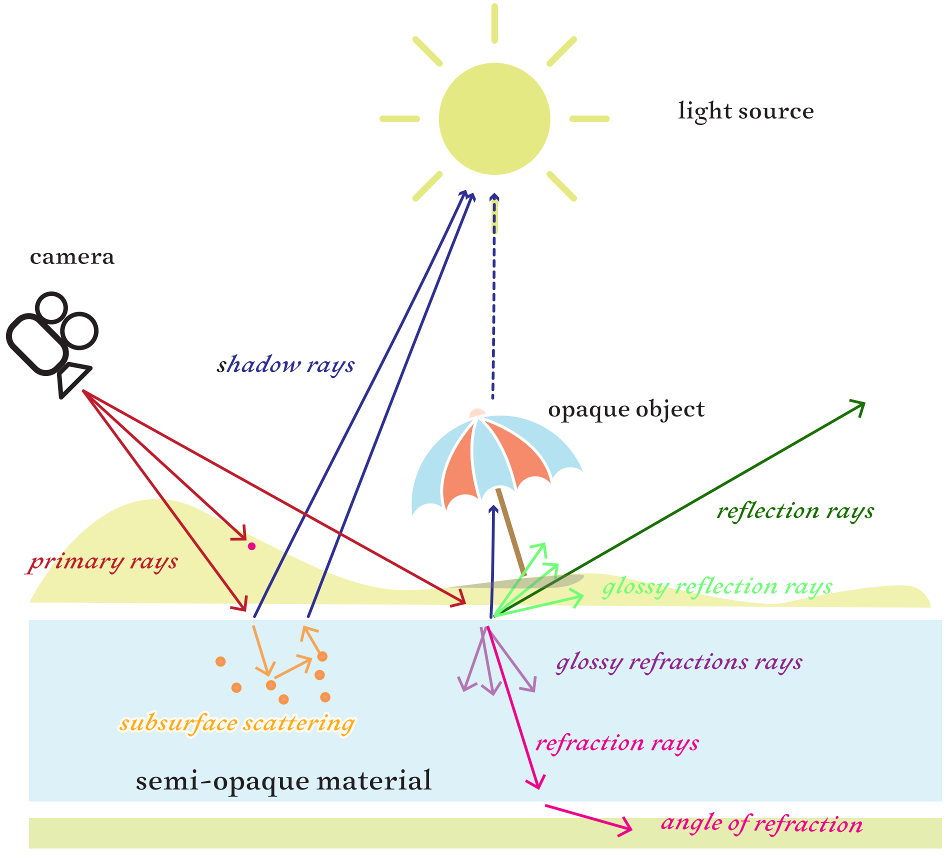


Ray tracing

Have you ever wondered how light works in renderings? *Ray tracing* is a technique for generating an image by tracing the path of light through pixels in an image plane, simulating the effects of its encounters with virtual objects.

The diagram on the right shows how the basic effects are generated. *Primary rays* (red) are always traced from the camera into the scene in order to determine what will be visible in the final image.

To create the direct illumination and shadows «*Shadow rays*» (blue) are traced from each rendered point to each light in the scene. If the rays hit a light, the point is illuminated based on the light's settings. If they hit an object, the point is shaded.

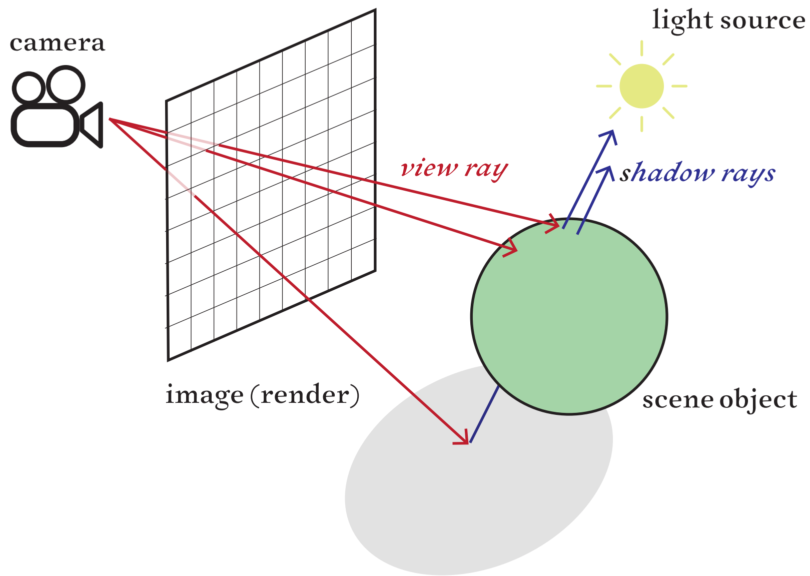


Ray tracing process: light behaviour and interpretation.

Reflection rays (dark green) are traced in the direction of the reflection vector which depends on the type of reflection - *fresnel* or *normal* and the *index of reflection IOR* of the material. The direction of the *Refraction rays* (pink) depends only on the *index of refraction IOR* of the material.

To create *glossy reflections (light green)* or *glossy refractions (purple)*, many rays are traced in a cone (the spread of the cone depends on the glossiness amount.)

Subsurface scattering (orange) and translucency effects are generated by tracing rays inside the geometry.



Ray tracing: translation of info on a bidimensional image.

Indirect illumination
GI (Global Illumination)

To understand the setups of *global illumination* it is worth to find out what is *indirect illumination*, and why it is important to photo-realistic rendering.

Global illumination is the name given to sum up a collection of algorithms which take into account not only the light coming directly from a light source (known as *direct illumination*), but also all the subsequent cases in which light rays from that source are reflected by other elements in the scene, (*indirect illumination*).

This process adds to the final image a lot more informations. The easiest way to understand how it works is to imagine the final image - the render output - as obtained by superimposing separate render elements (being them shadows, colors, lights, information about transparency and so on) each on other according to a package of given rules explicit in the algorithm.

In other words, think of the final rendering as a set of separate images with different informations (if you are familiar with *Photoshop*, more or less it is what happens with the overlaying of different layers with a specific blending mode). In fact, you can also decide to export those layers (such as *alpha channel*, *material ID*, *diffuse*, *reflections* and so on) separately.

Indirect illumination is one of these layers, which adds to the overall result the information about the indirect light present in scene.

Above, the first image shows a rendering with direct light computation only (GI not enabled). The absence of GI generates unnatural darkness on areas where there is no direct light hitting an item. The second Rendering has been performed with the direct light and indirect light enabled (GI). The previously dark areas become lightened because of global illumination, the arrows show the path of light;

Indirect illumination
Light bounces

The indirect illumination controls are divided into two large sections:

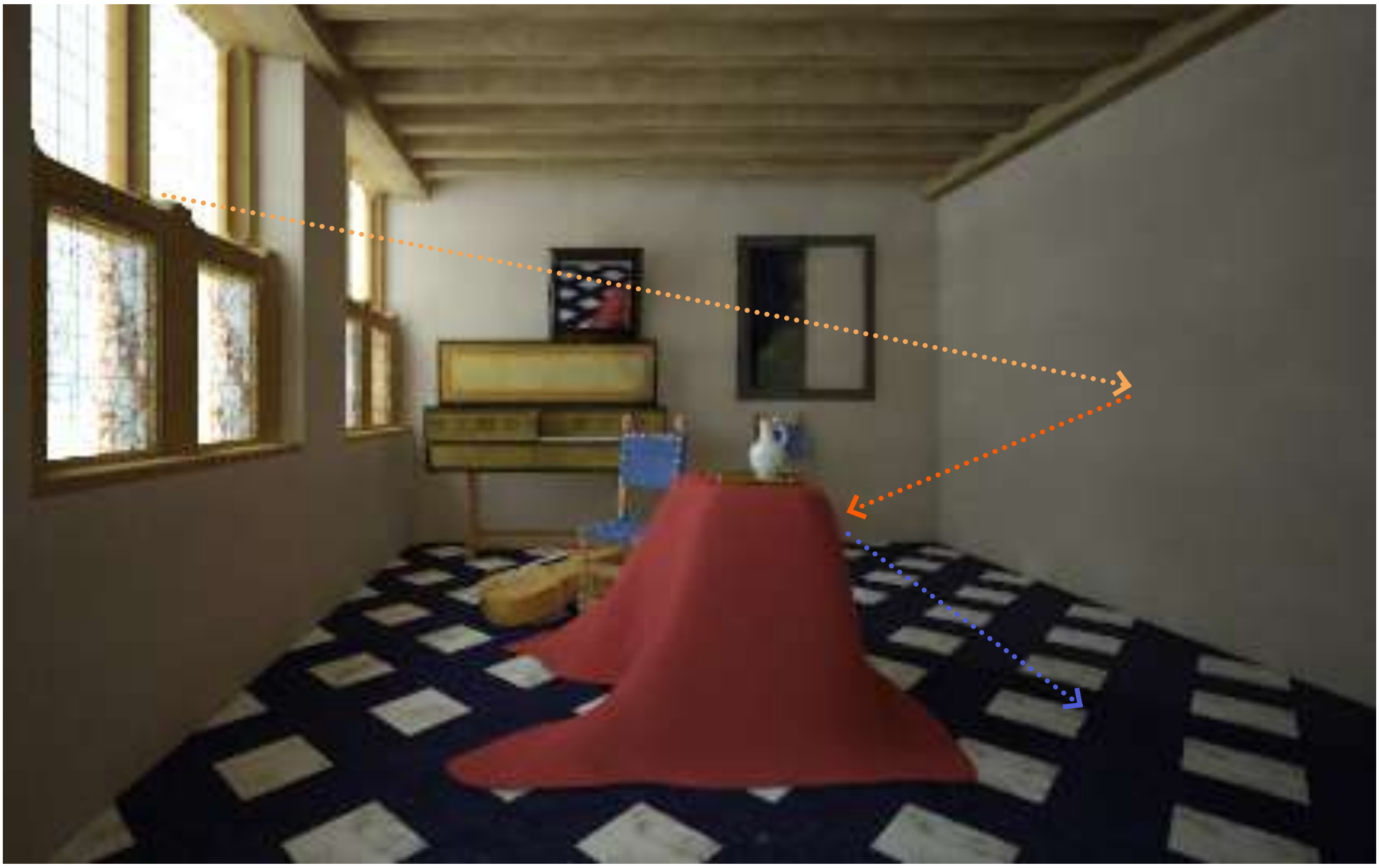
- *Primary bounces*

A primary diffuse bounce occurs when a shaded point is directly visible by the camera, or through specular reflective or refractive surfaces. It is the light which bounces after the direct light hits a surface. Usually these bounces have the greatest effect on the scene in terms of the indirect lighting.

- *Secondary bounces*

A secondary bounce occurs when a shaded point is used in GI calculations, after the primary bounce. As light bounces around a scene, its intensity - and therefore its affect on the final illumination - becomes less and less. With exteriors secondary bounces have a relatively insignificant effect, while in interior scenes become as important as primary ones, being them the ones able to enlight dark areas.

The image below shows the behaviour of light according to Global illumination algorithm: firstly the *direct light* (orange arrow)strikes the wall and lits it. Then the reflected light from the wall lits the carpet and the pavement: this first bounce (red) it's named *Primary bounce*. So the light reflecting from the carpet and the pavement lits the pavement and bottom of the wall (blue) and it's called *Secondary bounce*. Theoretically this process goes on and on and the photons keep bouncing, practically a render engine simplifies all of these bounces in a more or less sophisticated secondary bouncing, according to render engine chosen by the user (and explained in the following page).



Indirect illumination
Render engines (*Vray*)

The possibility to chose among several rendering engines can considerably alter the result of a render; any of them has its own method for calculating light info in a pixel of space, therefore some are more accurate than others and, most of all, more appropriated for some situations. Here I quickly introduce the main.

There are normally 4 options for Primary Engine (depending on the *Vray* version): *Irradiance Map*, *Photon Map*, *Brute force* and *Light Cache*, while only 3 options for Secondary Engine: *Photon Map*, *Brute Force* and *Light Cache*.

- *Light Cache*

The calculation starts from the camera; it computes 100 bounces by default (if you put it in the primary bounces, it's actually computing secondary bounces too.) Advantages : few settings + renders faster than other engines + good for interiors and exteriors.

- *Irradiance Map*

It efficiently speeds up GI calculations; basically the irradiance map calculations can find out which parts of the scene need accurate GI calculations and which parts don't: IR map computes indirect illumination only at some points in the scene, and interpolate for the rest of the points. very fast. noise reduced. some details in indirect lighting can be lost or blurred.

- *Brute Force*

This method computes the GI in every single shaded point. So even on very flat surfaces where lighting is very even, every point will be calculated. This is of course very slow, but also very exact. Great for exteriors, very slow for interiors + tends to produce noise.

good combinations:

primary = IR map
secondary = brute force

primary = IR map
secondary = light cache

primary = brute force
secondary = light cache

Primary : Irradiance Map;
Secondary : Brute Force

Primary : Irradiance Map;
Secondary : Photon Map

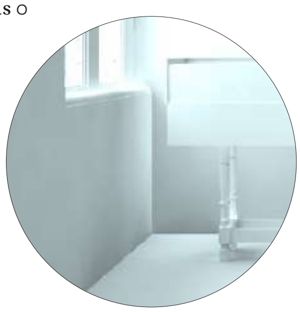
Indirect illumination
Ambient Occlusion

Ambient occlusion is a shading method used in computer graphics that helps to give realism to local reflection models, since it takes into account the light attenuation in occluded volumes. It's a global method, ie the illumination of each point is a function of the geometry of the scene. In any case it is a rough approximation of the whole GI; the appearance generated by ambient occlusion alone is similar to that of an object on a cloudy day.

Practically AO simulates shadows occurring in the cracks/crevices of any object, when GI is cast out onto a scene. The soft shadows produced by AO help to define the separation between objects (specially on the floor) in your scene, adding a high level of realism.

Subdivs determines the number of samples used for calculating AO(Low values might introduce noise)

amount 0
subdivisions 0
radius 0



amount 1
subdivisions 24
radius 20

amount 0
subdivisions 0
radius 0

amount 10
subdivisions 24
radius 1

amount 5
subdivisions 24
radius 1

amount 1
subdivisions 24
radius 1

amount 1
subdivisions 24
radius 10

amount 1
subdivisions 24
radius 20

Indirect illumination
Sky system

The *Sky texture map* is used as an environment map (a map ideally applied to an immense dome surrounding your scene) to help simulate outdoor lighting; it behaves very much like a *HDRI environment map* (we'll see them soon). The texture can change its appearance based on the position of the Sun.

In *Vray* Sun and Sky work together and sky is funcion of the Sun; in the following lines I quickly explain how to create a sky system in *Vray:*

- Enable *GI* (otherwise the sky can't work)
- in the *Vray options/ environment* : click on the *"m"* next to GI; go to *texture editor / Type* / select *TexSky / light source* : select sun1 (or the named sun you created for the scene); this setting tells your render engine where the sun direction is coming from.
- uncheck *Override Sun's Parameters* (so the sun and the sky work together)
- Repeat this process for the *Background*.

>>> bug troubleshoot <<< always fix *Gamma Correction*. No gamma correction = dark sky + inaccurate colors. In order to gamma correct images both the *inputs* (textures and colors) and *output* need to be adjusted. Go to *Global Switches* / check *Correct RGB* and *Correct LDR Textures*. To adjust the output change the *Gamma* value from <u>1 to 2.2</u>

N.B. The *sun&Sky system* works properly in conjunction with the *Physical Camera*. To balance its intense brightness (also to capture the correct colors of the sky) you don't have to adjust the intensity of the Sun; you must set a proper exposure of the scene with the physical camera instead, by adjusting the *F-stop*, *shutter speed* and *ISO*. (we'll see these features in the following pages)

notice how the temperature of the light changes according to the sky chosen in the three images below: in the first case the Vermeer music lesson has been used as a sky (why not?), in the second scene I used a 60s interior room and, in the third scene, a diffuse color.

environment
GI : texSky (Sun2)
Background : Vermeer music lesson

environment
GI : texSky (Sun2)
Background : 60s interior picture

environment
GI : texSky (Sun2)
Background : texSky (Sun2)

Indirect illumination
Sky system, Environmental light

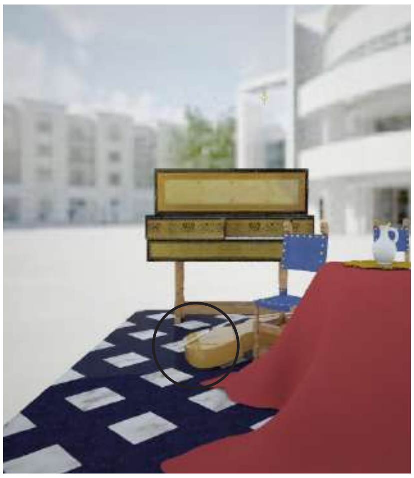
An *HDRI (High Dynamic Range Image)* is a panoramic photograph that covers the entire field of vision and contains a large amount of data (typically 32 bits per pixel per channel) which can be used to emit light into a scene. *HDRI images* can be used as *Environment light* source, providing the illumination for the scene based on the colors and intensity of the image.

If you want the objects to reflect the *HDR image Environment* as well, you can assign the same HDR image to the *Environment Background*, and make sure the *UVW* is set to Environment (Vray).

Bitmap (normal image) can be also used as Environment light source, although it can't generate the dynamic environment provided by HDRI; anyway, as long as you pick the right Bitmap and properly manage the Intensity, it can still be a very good Environment light source.

In the following images, notice the influence of the HDRI used as environmental light affect reflections and light temperature.

environment
GI & Background : HDRI 01



environment
GI & Background : HDRI 02

environment
GI & Background : HDRI 03

Indirect illumination
Sky system, Night Environment

The creation of a realistic, efficient night environment is often a big challenge, specially if you don't make use of the afvantages of environmental images; no matter how dark you want your scene to be, it is highly recommended to use the sky to emit some light (even more than what you need) and than setting exposure both in physical camera settings and post-production: it is always easier to subtract light that to add it.

an example of night HDRI. I used this image as envoronmental light (Vray sky) to produce the image on the left page and all the nocturnes.

The Vermeer's Music Lesson,
Lighting variation: in blue
Filippo Fanciotti
november 2017
Rhino, Vray, Photoshop
1230 x 1465 pixels
EPFL, ENAC, LAPIS

environment skylight HDRI 03
gamma 1

environment skylight HDRI 03
gamma 2

environment skylight HDRI 03
gamma texture manipulation>
color correction 214, 255, 255

Direct sources
Sun system

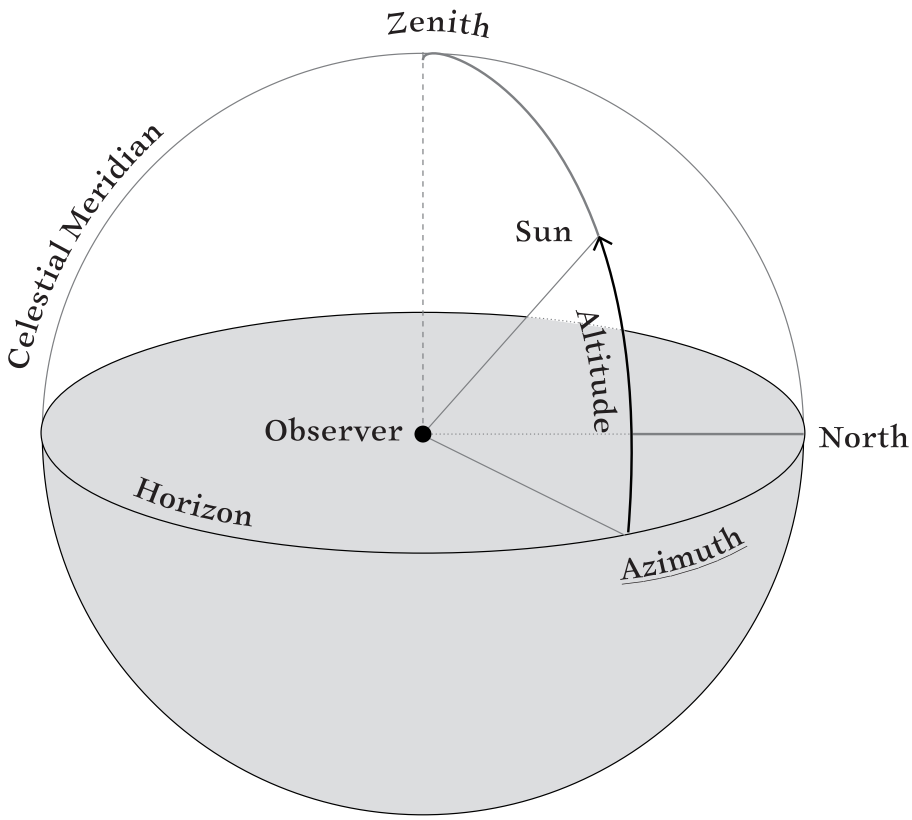
The Sun is a particulat type of directional light(we'll see them in the following pages); in most cases the only source you will put in your scene.

There are two ways to control the sun position:

- *Georeferenced position:* by specifying the location of the model in space and time in the year (including the hour of the day), the sun will automatically be oriented according to its very specific position. This tool is extremely useful to recreate a precise exposure condition, to control the shadows projection and the general orientation of an object.

- *Manual control*: allows to manually control the parameters hidden behind the option described above; the *Azimuth* balances the compass direction of the sun in degrees (North=0, East=90), while the *Altitude* sets the height of the sun above the horizon in degrees (Sunrise or Sunset=0).

While it doesn't matter where you put it in the scene, mind that the Sun is extremely sestitive and even smooth variations of its azimuth or altitude can lead to great changes.



Sun properties

- *Size* matters : a bigger sun affects the amount of blurriness of shadows, while a smaller one produces more defined shadows;

- *Turbidity* changes the amount of dust in the air (haziness). Lower values correspond to the haziness you can have under a clear blue sky (such in the country side), while higher values produce an orangish atmosphere (such in a city environment).

- *Intensity* affects the strenght of the sun. In some rendering engines like Vray you can manage the light intensity through the multiplier.

- *Ozone* changes the color of the sun itself from a slightly yellow tone (low value) to a slightly blue tone.

- *Bias* offsets the position of the shadows (if = 0.0 shadows may leak on the object).

- *Subdivs*: low values (such as 8) produce crispy shadows, higher values (24/32) produce smooth shadows (>longer rendering time).

- *Color* defines the color of the light source, in this case of the sun. Mind this paramater is hypersensitive : HSV (0,0,0) = total black; HSV (0,0,1) = blackish OK ; HSV (0,0,5) = overexposed result.

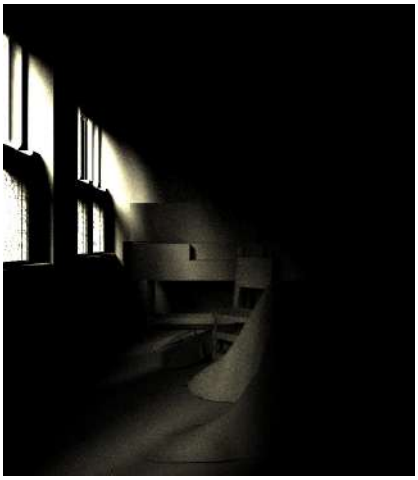
Direct sources
Sun system , Altitude variations

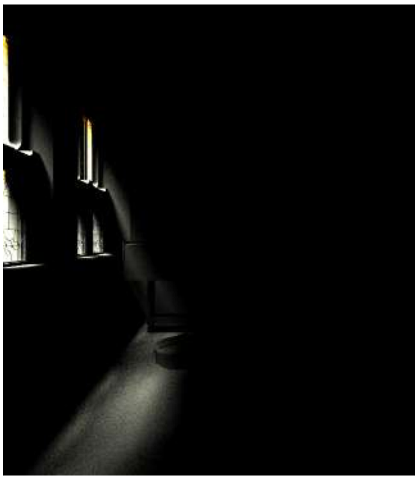
increasing the altitude you change the height of the sun above the horizon. measured in degrees (Sunrise/Sunset = 0° ; Zenith = 90°).

azimuth 184°
altitude 4°

azimuth 184°
altitude 35°

azimuth 184°
altitude 81°





Direct sources
Sun system, Azimuth variations

modifies the compass direction of the sun in degrees; it starts from the North (=0°) then East (=90°), South (=180°) and West (=270°).

azimuth 184°
altitude 4°

azimuth 0°
altitude 4°

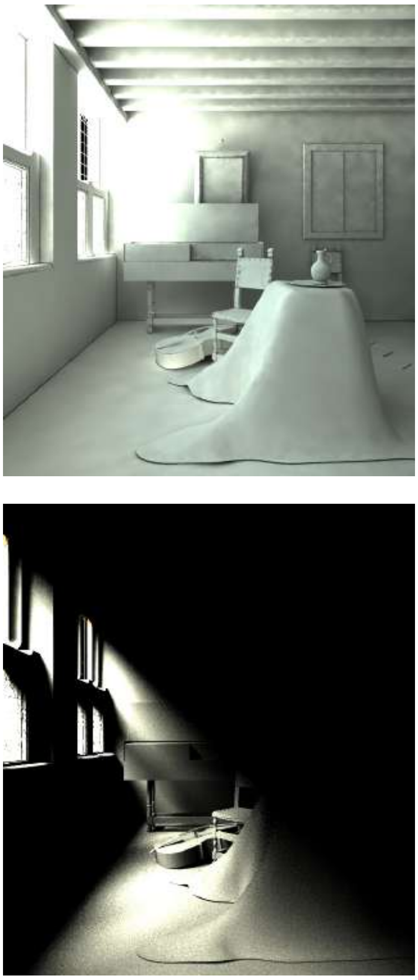
azimuth 270°
altitude 4°

Direct sources
Sun system , Ozone variations

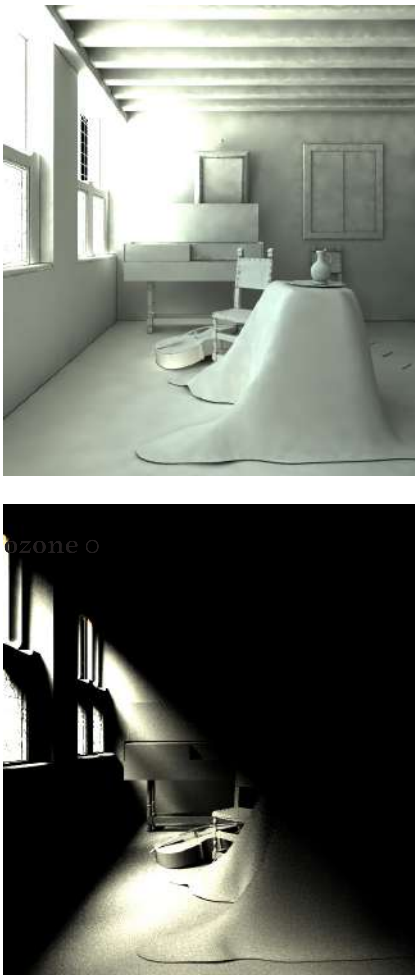
changes the color of the sun itself from a yellowish tone to a slightly blue tone.

As you may notice, in the following images the amount of Ozone doesn't affect much the total light of the scene; this is because the direct light (second raw of images below) is pretty marginal in this render if compared to GI, which of course is not influenced by any Sun parameters.

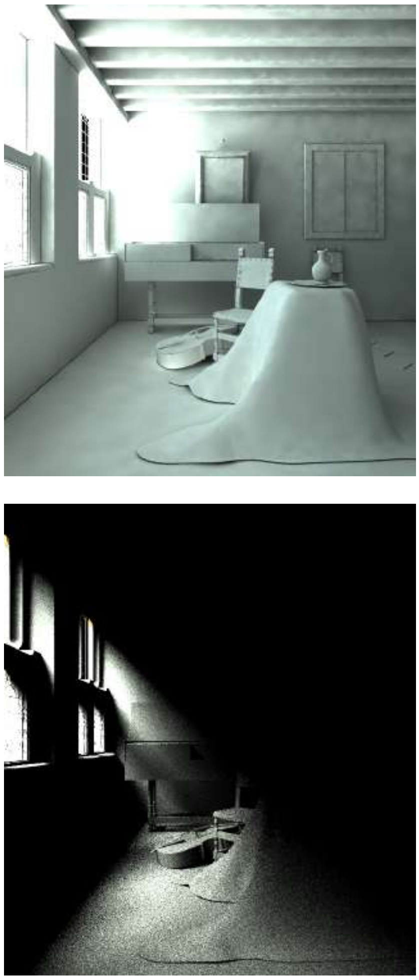
ozone 0.5



ozone 0



ozone 1



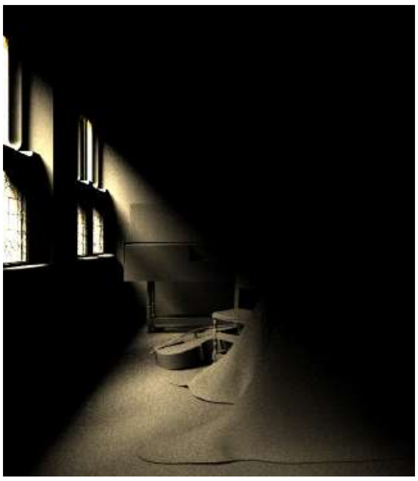
Direct sources
Sun system, Turbidity variations

This parameter changes the amount of dust in the air (haziness). Lower values = clear blue sky (such in the country side) ; Higher values = orangish atmosphere (city).

turbidity 2

turbidity 8

turbidity 20



Direct sources
Sun system, Size variations

The Sun's behaviour - just like any other dimensional light source - is affected by the size, with a particular influence of the shadows blurryness. Bigger Sun > blurrier shadows

size 100

size 10

size 1

Shadows

The images in the current page show the noise produced by a different value given to the shadow bias, being it a measure for the maximum amount of samples (rays) that the Render Engine will use to compute the quality of shadows.

There is not a singular way to control strength, quality or any other feature of shadows, as they are the result of the combination of many variables. Below I listed the main parameters - scattered in the settings menu - you have to care about in order to handle the shadows' appereance.

- *Subdivisions* control the quality of shadows. by default are set to 8: to improve quality (24 is a good value). Higher numbers > better shadows > more time to render. (When set it to 32, you can get the almost perfect shadow without any noise).

- *Radius* for Shadow edge > When using certain light sources, the shadow edge may appear too sharp. To improve it, increase/decrease the Radius under Shadow dialog box.

- *Size* of light sources > Increasing the size of the sun / light source the shadows will be softer (with 1.0 value they may appear crispy).

- *Ambient occlusion shading* they're are actually fake indirect shadows added into the render by rays that get cast out from each surface on your geometry.

shadow bias 40

- *color* affects shadows' darkness (you can even colorize your shadows) N.B. color is hypersensitive : HSV (0,0,0) = total black; HSV (0,0,1) = blackish OK ; HSV (0,0,5) = overexposed result

shadow bias 16

There are two main kinds of direct sources: the sun system (we've just discussed) and the so-called artificial lights.

Each type of light source has specific features and behavior, therefore it's fundamental to understand when using one instead of another. The main ones you can find are:

- Spot light
- Sphere light
- Rectangular light
- Omni light
- IES light
- Point light

[check the chart in appendix F for a comparison among the light types in Vray].

Lighting dialog box

Each light content is different. Other then color, brightness (through the multiplier button) and shadow, each light source also owns other parameters, the main are:

- *Intensity* defines the intensity of light. If managed through *Scalar*, *Luminance*, *Radiance* methods, the intensity of light depends on the size of the light source (of course for dimensional lights); on the other hand, with *Luminous or Radiant Power* systems, the intensity of the light doesn't depend on its size.

- *Decay* manages the behavior of light distancing away from the light source. With *Inverse Square intensity* light decays inversely proportional to the square of the distance from the light (this is the normal behavior of light). *No decay* is unnatural, but can be useful to force a light source to be constant from source to any point in space.

- *Sampling* is needed to control the render quality. *Photon Subdivs* is a parameter which sets the amount of photons of the light source; Lower values may produce some noise, but will speed up the rendering time; Higher values garantee smoother results, of course causing longer rendering time.

- *Shadow bias* controls the offset of shadows; *Bias* shifts the shadow toward or away from the shadow-casting objects. Mind that by setting too low values your shadows can leak, produce moiré patterns or make annoying out-of-place dark areas. On the other hand, too high values let shadows "detach" from the object.

- *Subdivisions* is the main parameter to manage the quality of the shadows. Lower values (i.e. in between 8 and 16) can produce noise (useful for faster render tests); Higher values (i.e. 24/32) will make you shadows smoother (longer time again). Normally, for a final render, I set up the subdivions up to 24.

How to make a abat-jour light

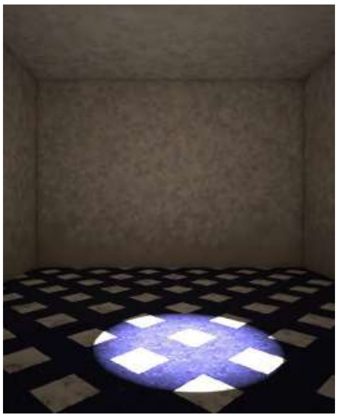
The page on the left shows the Vermeer music lesson with a night environment - the same used for the first lighting variation, so a night enviromental HDRI mapping the sky as main light source - with the introuduction of an artificial light source. Now, the software doesn't know what an abat-jour is, so each time we want to create a particular light we must combine the sources we have in order to mimic its behaviour or - like i did here -to create our own imaginary atmosphere. More specifically, here I created two point lights - one internally, one outside the lamp - with the same intensity; what gives the overall atmosphere this vibe is the *Inverse Square decay* parameter: as mentioned above, with this setting on light decays inversely proportional to the square of the distance from the light, which is the normal behavior of light) in combination with a photon map for secondary bouces (12 bumps).

point light internal lamp : 2000 (square inverse decay; subs 700) | point light external lamp : 2000 (square inverse decay; subs 700) | iso 70, Shutter speed 2, fnumber 16 | Secondary bounces : photon map (12 bounces)

Direct sources, some examples

the image on the left combines an invisible rectangular light - placed on the last window - together with the Sun. The extra light strengthens the shadows, artificially adding a second one as it happens in Vermeer's painting. As mentioned more times, there are several way to reach a certain result, here you have an experimental attempt to intensify an effect difficult to reach with only diffuse light.

Point light
intensity 1000 (scalar)



Spot light

Sphere light
intensity 1.0 (scalar)

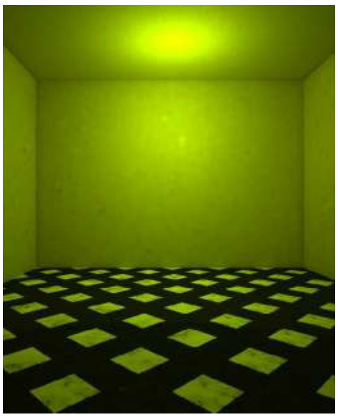
Sphere light
intensity 10 (scalar)

Point light
intensity 10000 (scalar)

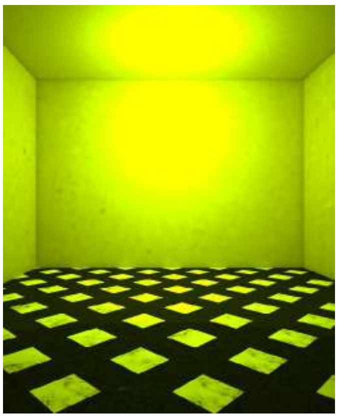
Rectangular light
intensity 10 (scalar)

Rectangular light
intensity 5 (scalar)

Rectangular light
intensity 10 (scalar)



Point light
intensity 10000 (scalar)
charteuse color



Point light
int. 100 W (rad. power)
charteuse color

Rectangular light
intensity 10 (scalar)
invisible + double sided

Rectangular light
intensity 10 (scalar)
invisible

Direct sources
cande light

in the following lines I'll show you how to create a candle light using both lights and materials. First of all you need the image of a candle fire, like the one I attach here on the right.

creation of the emissive flame

1. create rectangular surface (same size of flame.jpg, fig.2)
2. create a new material : new standard material > add emissive layer: use as map (flame.jpg, fig.2) ; use as transparency map (flame_black&white.jpg, fig.3). Here I used as emissive power a value of 10. Enable double sided and remove diffuse layer
3. add a point light behind the flame (in this case I used a candle with intensity 1.5)

creation of the glossy candle (When you light a candle the wax itself reflects the light inside and appear to glow)

1. new twosided material : both front and back based on diffuse white material, change the 'Val' number to 70 ('Hue' and 'Sat' = 0).
2. create a point light and place it within the candle (in this case I set the intensity to 10).

So, when it's about the light elements, we actually need:

- point light within candle:1.5
- point light behind flame : 10
- emissive power of flame : 10

As you can see in the image here above, a pure rendering baked from Vray for Rhino, no post-production was really needed to create this light. This result coudn't be reached with Photoshop, specially when it's about the shadows, the reflections on the surrounding elements.

fig.2 : flame.jpg

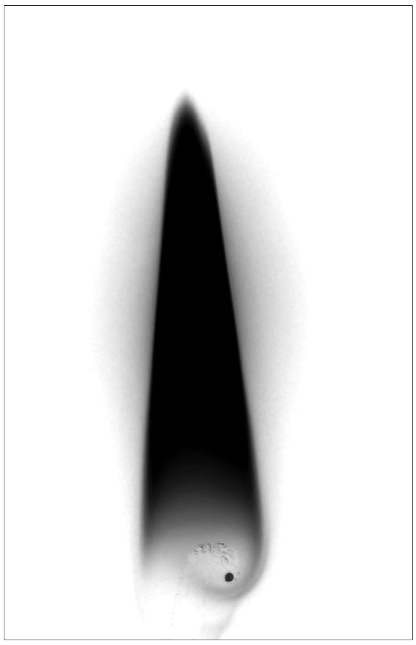


fig.3 : flame_black&white.jpg

Reaction to light
Exposure

In photography, exposure is the amount of light per unit area reaching a photographic film or electronic image sensor, as determined by three aspects :

- *Film speed (ISO)*

the sensitivity of the film/ sensor. This parameter determines the sensitivity of the film and so the brightness of the image. If the film speed (ISO) is high (film is more sensitive to the light), the image is brighter. Lower ISO values mean that the film is less sensitive and produces a darker image. The ISO values have a linear relationship (which is not the case with both aperture and shutter speed).

- *F-number*

the size of the opening that allows light to pass to the film or sensor. This parameter controls the aperture size of the camera. Lowering the f-number value increases the aperture size and so makes the image brighter, since more light enters the camera. In reverse, increasing the f-number makes the image darker, as the aperture is closed.

- *Shutter speed*

the amount of time that the light is allowed to affect the sensor. This parameter expresses the exposure time in which the light is allowed to affect the sensor of the Physical camera. The parameter expresses itself as 1/x (a value of 10 = a shutter speed of 1/10 of a second). Therefore a larger value actually means that the shutter speed is faster, and that will translate to a darker image.

ISO 140
F-number 16
Shutter speed 0.016

ISO 90
F-number 22
Shutter speed 1

ISO 90
F-number 16
Shutter speed 0.5

ISO 140
F-number 45
Shutter speed 0.125

ISO 140
F-number 22
Shutter speed 0.033

ISO 140
F-number 45
Shutter speed 0.125

Exposure, ISO

ISO 120
ISO 200

F NUMBER 22
F NUMBER 16

SHUTTER SPEED 0.5
SHUTTER SPEED 0.016

FILM SPEED (ISO)

the sensitivity of the film/sensor

larger ISO

↓

greater sensitivity to light.

↓

brighter result

F-NUMBER

the size of the opening that allows light to pass to the film or sensor.

Smaller values

↓

larger opening, more light

↓

brighter result

SHUTTER SPEED

the amount of time that the light is allowed to affect the sensor.

Longer amount of time

↓

more light allowed

↓

brighter result.

ISO 200

f-number 16

shutter speed 1

ISO 120

f-number 8

shutter speed 0.125

correct exposure

EV	*f*-number												
	1.0	**1.4**	**2.0**	**2.8**	**4.0**	**5.6**	**8.0**	**11**	**16**	**22**	**32**	**45**	**64**
–6	60	2 m	4 m	8 m	16 m	32 m	64 m	128 m	256 m	512 m	1024 m	2048 m	4096 m
–5	30	60	2 m	4 m	8 m	16 m	32 m	64 m	128 m	256 m	512 m	1024 m	2048 m
–4	15	30	60	2 m	4 m	8 m	16 m	32 m	64 m	128 m	256 m	512 m	1024 m
–3	8	15	30	60	2 m	4 m	8 m	16 m	32 m	64 m	128 m	256 m	512 m
–2	4	8	15	30	60	2 m	4 m	8 m	16 m	32 m	64 m	128 m	256 m
–1	2	4	8	15	30	60	2 m	4 m	8 m	16 m	32 m	64 m	128 m
0	1	2	4	8	15	30	60	2 m	4 m	8 m	16 m	32 m	64 m
1	1/2	1	2	4	8	15	30	60	2 m	4 m	8 m	16 m	32 m
2	1/4	1/2	1	2	4	8	15	30	60	2 m	4 m	8 m	16 m
3	1/8	1/4	1/2	1	2	4	8	15	30	60	2 m	4 m	8 m
4	1/15	1/8	1/4	1/2	1	2	4	8	15	30	60	2 m	4 m
5	1/30	1/15	1/8	1/4	1/2	1	2	4	8	15	30	60	2 m
6	1/60	1/30	1/15	1/8	1/4	1/2	1	2	4	8	15	30	60
7	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1	2	4	8	15	30
8	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1	2	4	8	15
9	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1	2	4	8
10	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1	2	4
11	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1	2
12	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1
13	1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2
14		1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4
15			1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8
16				1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15
17					1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30
18						1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60
19							1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125
20								1/8000	1/4000	1/2000	1/1000	1/500	1/250
21									1/8000	1/4000	1/2000	1/1000	1/500
EV	**1.0**	**1.4**	**2.0**	**2.8**	**4.0**	**5.6**	**8.0**	**11**	**16**	**22**	**32**	**45**	**64**
	f-number												

EV = ISO (values 1/100)

The first chart shows the right Exposure time (Shutter Speed, in seconds "s" or minutes "m"), for various Exposure Values (EV = Film Speed = ISO) and aperture size of the camera (f-speed).

The second chart shows the proper exposure value to set according to a specific environmental condition, such as weather and scenery (indoor, outdoor, ...)

Those two charts are extremely useful, since these are constant, fixed values: a given aperture/ shutter speed combination will always result in the same EV. Always.

source 1
source 2

Lighting Condition	EV_{100}
Daylight	
Light sand or snow in full or slightly hazy sunlight (distinct shadows)[a]	16
Typical scene in full or slightly hazy sunlight (distinct shadows)[a, b]	15
Typical scene in hazy sunlight (soft shadows)	14
Typical scene, cloudy bright (no shadows)	13
Typical scene, heavy overcast	12
Areas in open shade, clear sunlight	12
Outdoor, Natural light	
Rainbows	
Clear sky background	15
Cloudy sky background	14
Sunsets and skylines	
Just before sunset	12–14
At sunset	12
Just after sunset	9–11
The Moon,[c] altitude > 40°	
Full	15
Gibbous	14
Quarter	13
Crescent	12
Moonlight, Moon altitude > 40°	
Full	–3 to –2
Gibbous	–4
Quarter	–6
Aurora borealis and australis	
Bright	–4 to –3
Medium	–6 to –5
Milky Way galactic center	–11 to –9
Outdoor, Artificial Light	
Neon and other bright signs	9–10
Night sports	9
Fires and burning buildings	9
Bright street scenes	8
Night street scenes and window displays	7–8
Night vehicle traffic	5
Fairs and amusement parks	7
Christmas tree lights	4–5
Floodlit buildings, monuments, and fountains	3–5
Distant views of lighted buildings	2
Indoor, Artificial Light	
Galleries	8–11
Sports events, stage shows, and the like	8–9
Circuses, floodlit	8
Ice shows, floodlit	9
Offices and work areas	7–8
Home interiors	5–7
Christmas tree lights	4–5

SPOT	SPHERE	RECTANGULAR	OMNI	
=	=	=	=	
linear inverse inverse sq penumbre falloff	on / off	on / off	linear inverse inverse sq	e
area spec legacy	affect reflections	affect reflections	-	a
=	=	=	=	
bias radius subdivs color	bias color	bias color	bias radius subdivs color	s
more	more	more	more	

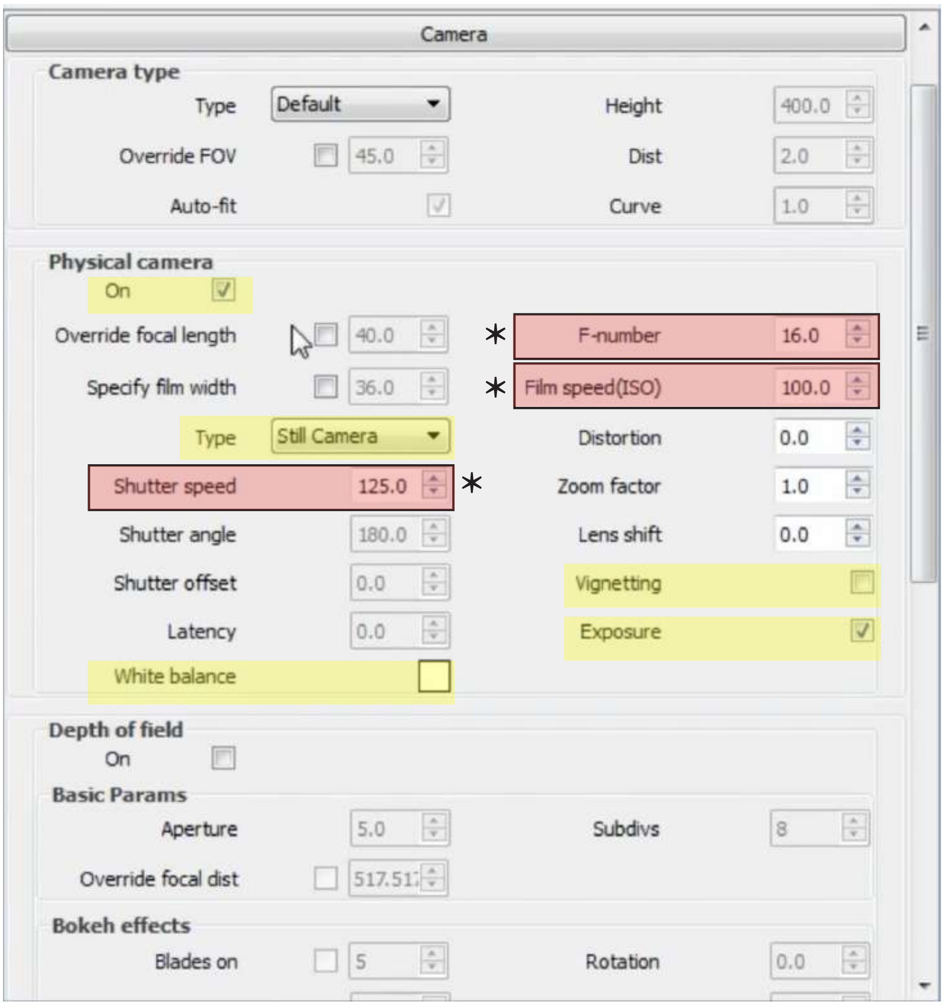
IES	DIRECTIONAL	POINT	LIGHT / PARAMETERS
=	=	=	INTENSITY
on / off	-	linear inverse inverse sq	DECAY
rea spec	-	-	AREA
=	=	=	SAMPLING
soft color bias subdivs	radius color bias subdivs	radius color bias subdivs	SHADOWS
more	more		about

Vray settings, Physical camera

allows the camera's reaction to light to mimic what a camera would do in the real world > much more natural reaction to light + control over the lighting of your scene.

- *Physical camera*: ALWAYS ON (if OFF nothing works)
- *Type*: Use still camera for rendering an image. The other two, cinematic and video, are for animations.
- *White Balance*: useful to compensate the color of the sun light in certain conditions. (always better to leave it pure white and fix the white balance in post).
- *Exposure*: ALWAYS ON (if OFF nothing works)
- *Vignetting*: produces a smooth dark effect around the image (better to do it in post).

*** these are the three aspects that dictate the resulting affect of the light.



APPENDIX C
Vray settings, Color mapping

It adjusts how color are displayed. When Vray determines a color value for a given pixel this value is then interpreted based on the type of mappings in use.

Types of Color Mapping

- *Reinhard* is a blend between Exponential Mapping and Linear Mapping. (The result is linear mapping when the Burn value is 1.0; and when the is 0.0, the result is Exponential Mapping.)

- *Linear Multiply* the color will not be changed from the generated value to the displayed value (the best one, it allows to include the whole color spectrum)

- Exponential, HSV Exponential, Intensity Exponential change color intensity to avoid brightness troubleshoot.

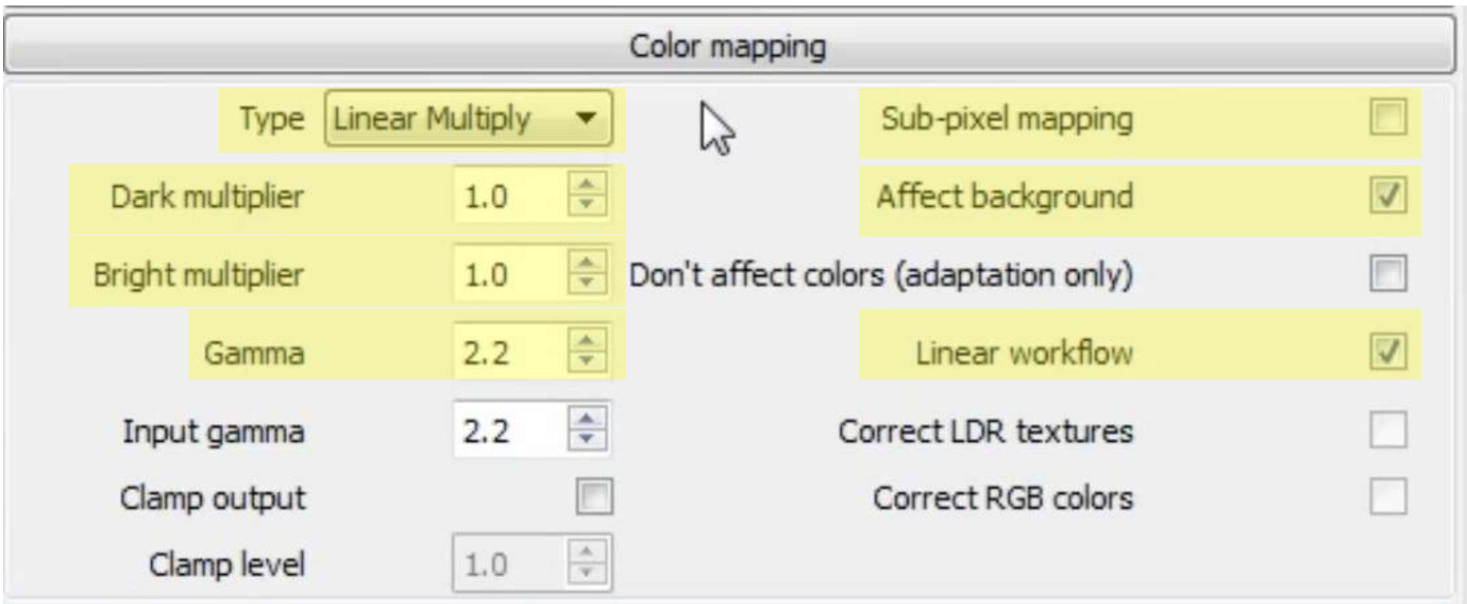
Parameters

- *Dark & Bright multiplier* : leave it to 1.0 (no surprises).

- *Gamma Correction* : bug > set it to 2.2.

- *Sub pixel mapping* : ON when you see white dots in the image

- *Affect background + Linear workflow* : ON (so anything happening in the rendering in fact of color correction happens in surroundings too)



APPENDIX C
Vray settings, Image Sampler

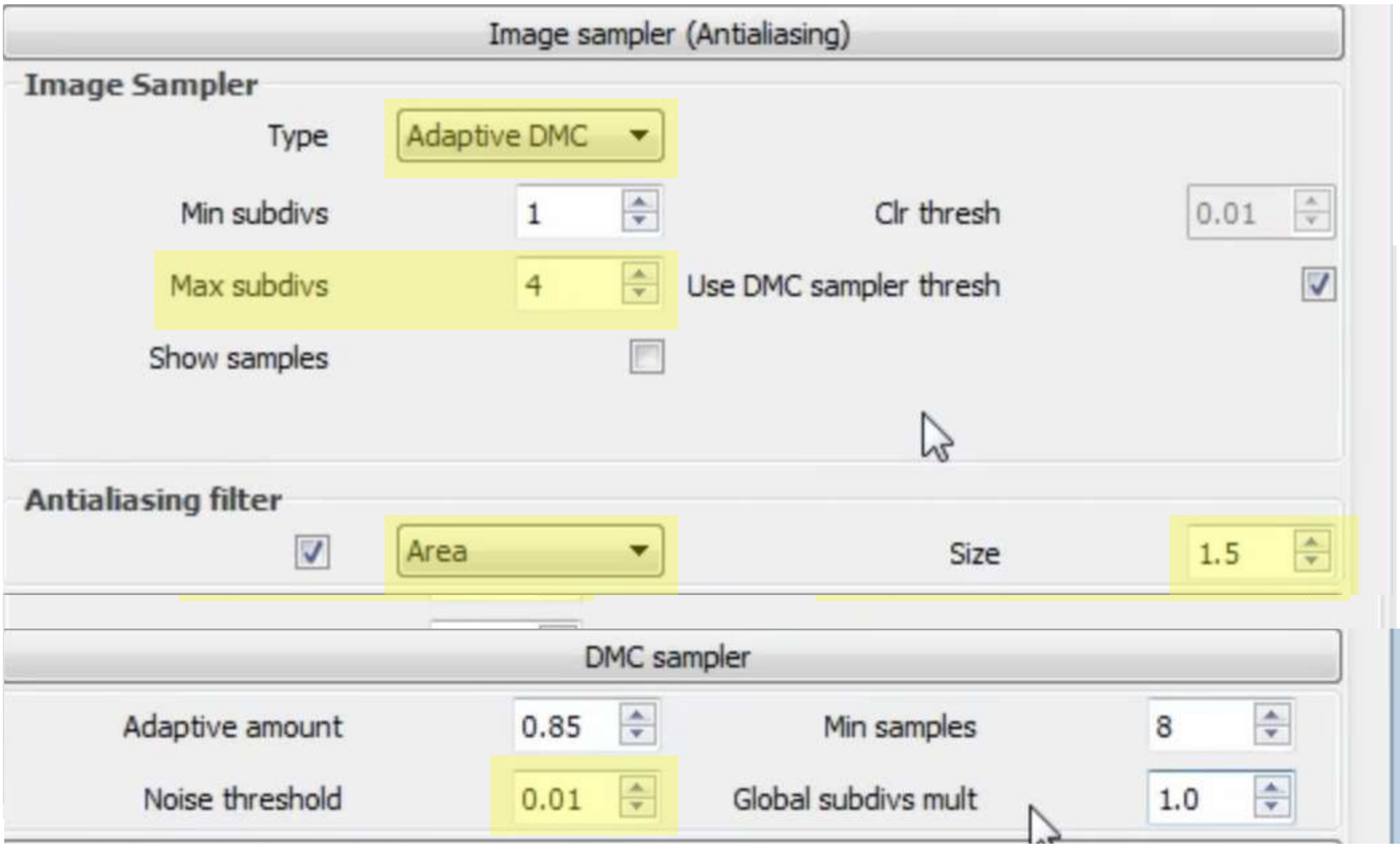
Has to do with blurriness, in particular how Pixels' edges blur into each other.

You're not able to perceive it when the image is very big (many pixels > small effect), therefore you can switch it off and save time.

- *Antialiasing filter* : *Area* is ok > set size to 1.5 (which means the infos containes in one sq pixel will blur into 1/2 of the nearby pixels).

Type :

- *Adaptive DMC* : the most accurate method of light calculation in Vray > useful for scenes with a lot of small details > longer time to render.
- *Adaptive subdivisions* : quicker (N.B. you may have RAM problems)
- *Fixed Rate* : very good but extremely slow



APPENDIX D
terminology

Some rendering vocabulary

- *Area Lights*

Area light is a term describing a non-point light source. These types of light sources produce area shadows.

- *Area Shadows (Soft Shadows)*

Area shadows are blurred shadows (or shadows with blurred edges) that are caused by non-point light sources (Area lights).

- *HDRI (High Dynamic Range Image)*

A High Dynamic Range Image is an image containing high-dynamic range colors (with components exceeding the range 0.0-1.0, or 0-255). This type of images is often used as an environment map to light the scene with natural light.

- *Importance Sampling*

Importance sampling is a technique for basing the number of samples required for evaluating a blurry value, on the effect that value has on the final result. For example, dark materials require fewer samples for evaluating GI than bright materials; dim area lights can do with less samples than bright lights etc.

- *Irradiance Map*

The irradiance map is a special cache where Vray keeps precalculated GI samples. During the rendering process when Vray needs a particular GI sample it computes it by interpolating the nearest precalculated GI samples stored in the irradiance map. Once computed, the Irradiance map can be saved in a file and reused in subsequent renderings. This can be especially useful for camera fly-through animations.

- *(Quasi) Monte Carlo Sampling*

Monte Carlo sampling is a method for numerical computation of integrals of functions by evaluating these functions at a number of random points. Quasi Monte Carlo sampling is a modification of this method, which instead of randomly generated points uses points forming a low-discrepancy sequence, which are more evenly distributed than purely random ones. This is the method used to evaluate complex things like global illumination, blurry reflections, depth of field, motion blur and image anti aliasing.

- *Photon, Photon Map*

This is a simulation of a real world photons (a photon is a light particle). In order to produce caustics effects Vray traces certain amount of photons that come out of the light sources. Then the results are stored in a photon map and used during the rendering process so that highly realistic caustic effects are produced.

- *Subdivs (Subdivisions)*

a measure for the maximum amount of samples (rays) that Vray will use to compute a certain value. The maximum number of samples is proportional to the square of the subdivs value. For example, if the subdivs value of a glossy reflection is 5, Vray will never make more than 5 x 5 = 25 samples to evaluate the reflection.

- *Cutoff Threshold*

specifies a threshold limit for the light intensity, N.B. Below this value the light source will not be computed; useful in scenes with many lights, where you want to limit the effect of the lights to some distance around them. Larger values cut away more from the light; lower values make the light range larger.

Lighting Units

- *Default (scalar)*

- color + multiplier determine the visible color of the light without any conversion. The light surface will appear with the given color in the final image when seen directly by the camera.

- *Luminous power (lm)*

- total emitted visible light power measured in lumen. When ON, the intensity of the light will not depend on its size. (I.e. A typical 100W incandescent light bulb emits about 1500 lumen of light.)

- *Luminance (lm/m2/sr)*

- visible light surface power measured in lumen per square meter per steradian. When ON, the intensity of the light depends on its size.

- *Radiant power (W) -*

total emitted visible light power measured in watts. When ON, the intensity of the light does not depend on its size.

- *Radiance (W/m²/sr) -*

visible light surface power measured in watts per square meter per steradian. When this setting is used, the intensity of the light depends on its size.

Decay

Decay controls the behavior of the light intensity from the distance of the light source. Normally the light intensity is inversely proportional to the square of the distance from the light (surfaces that are farther from the light are darker than surfaces which are closer to the light). The possible values are:

- *Linear*

the intensity doesn't decay with distance.

- *Inverse Square*

intensity decays inversely proportional to the square of the distance from the light. (This is the normal behavior of light.)

- *Penumbra Falloff*

determines the transition from full strength to no lighting inside the light cone.

- *Affect diffuse/specular*

determines if the light is affecting the diffuse/reflective properties of the materials.

- *Area Specular*

When Off the particular light will be rendered as a point light in the specular reflections.

THÉORIE ET TECHNIQUES
DE LA FIGURATION ARCHITECTURALE

IX

POST

¤

Filippo Fanciotti

POST-PRODUCTION HANDBOOK

Filippo Fanciotti

This handbook is about postproduction, that in our case I would like to redefine as that set of practices to modify the rendered image of a model, so no longer the thing itself, but its representation, we may say.

In this phase of the process we therefore act on the grid of pixels previously defined as render output, inserting in that matrix elements coming from other sources (*photomontage*) and altering the very nature of the pixels (*photo editing*). The software is Photoshop, useless to go around it. In the following pages you will find some tips and notes about the editing process on my work on the Vermeer's Music Lesson. Obviously it is not and does not want to be an exhaustive tutorial of the possibilities that you have using such a powerful software, but I hope with this guide to introduce and intrigue you to the topic, as well as showing you that even with a few steps you can get significant results.

The Music Lesson
Johannes Vermeer
1662-1665
oil on canvas
74.6 cm × 64.1 cm
Royal Collection, St. James's Palace, London

The Music Lesson #64 azimuth 4° (no Lady at the Virginals , no Gentleman)
FF

The image on the left is one of the many basic render outputs of the Vermeer Music Lesson, while on the right its transformation after some post-production work.

Render elements, practical use

Beyond their structure - briefly explained in the Materials handbook - now we will see the practical use of render elements in the post-production phase.

As mentioned, when imported in Photoshop, every channel/ render element becomes a layer, therefore giving the user the possibility to edit the output of the rendering.[1]

Mainly these special levels are used to perform two functions:

1) <u>create quick selection groups</u> according to the lowest common denominator (same material, same position in space, ...) to perform individual actions (for example, I want to select all faces oriented to the east and increase their brightness? I will make a quick selection with the *magic wound* by selecting the planes with the same color in the *normal channel*)[2]

2) <u>emphasize or decrease the effects resulting from a single rendering parameter</u>; for example if I am not satisfied with the brightness of a particular light source, if the shadows are a bit flat, or if the reflections are excessive and I want to dampen them, I will import the relative render element and play with the blending options (as shown in the next pages).

....

1 Note that Render elements require additional storage when rendering and thus increase the amount of RAM taken during the rendering.

2 Note that if you export them all together they will be read as channels once imported into photoshop, for the distinction between layers and channels please refer to adobe photoshop guide.

Here follows a list of the render elements I use most frequently, accompanied by an informal description of why.

1. <u>alpha/backgound</u> i.e. to quickly select the outside of a room, the surroundings of a building or "any part of the screen not modeled";

2. <u>diffuse</u> just flat colors and textures, excluding all the other material properties: very useful both for quick selections and to bring out a material in a flatter, abstract version if desired;

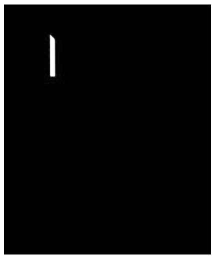
3. <u>render ID</u> extremely useful for quick selections: it assigns a different colored area to every object (surfaces or solids) in the scene;

4. <u>material ID</u>: every material created with Vray creates a different area/color: useful for quick selections in which the user wants to select non complanar object with the same properties;

5. <u>raw light</u> : The raw diffuse direct illumination before it's multiplied by the diffuse surface color, useful to highlight or decrease the light contrasts.

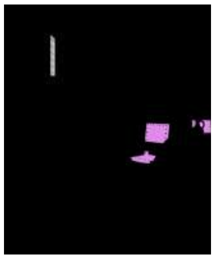
6. <u>reflections</u>: only the reflective parts of the reflective materials, useful to increase/decrease the reflections and obtains more or less realistic effects.

7. <u>normals</u> : to coplanar surfaces, even discontinuous ones, corresponds the same color (useful to select areas on which you want to insist to increase or decrease the depth effect, for example).


1

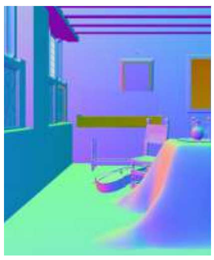

2


3


4


5


6


7

Blending options, in detail

Base | Blend Color | Resul Color

RGB (Normal)

+

Reflections (Color Dodge 100%)

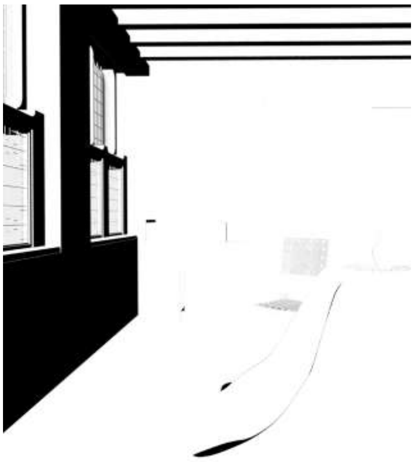
=

As reported in the *Adobe Photoshop User Guide*, the blending mode (a feature specified in the options bar) "controls the way pixels in the image are affected by a painting or editing tool". As in most cases with PS, the best way to understand this set of commands is to imagine them transported to the real world, thus thinking in terms of layers of color on a canvas:

- The *base color* is the original color in the image;
- The *blend color* is the color being applied with the painting or editing tool on top of the base color;
- The *result color* is the color resulting from the blend.

Here follows a complete list of fusion methods, as described by the program developers, the modes signed with ** are those I use the most.

+



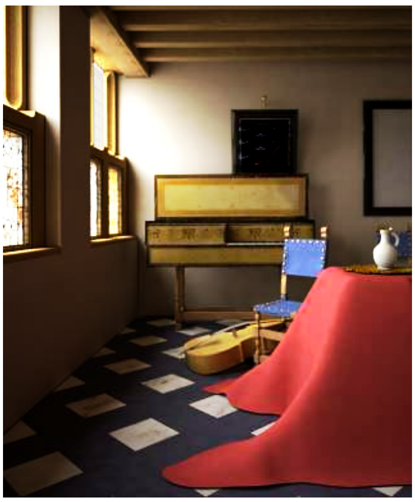
MatteShadow (Darken 30%)

=

+

RawGI (Overlay 100%)

=



- *Normal* **

Edits or paints each pixel to make it the result color. This is the default mode. (Normal mode is called *Threshold* when you're working with a bitmapped or indexed-color image.)

- *Dissolve*

Edits or paints each pixel to make it the result color. However, the result color is a random replacement of the pixels with the base color or the blend color, depending on the opacity at any pixel location.

- *Darken*

Looks at the color information in each channel and selects the base or blend color—whichever is darker—as the result color. Pixels lighter than the blend color are replaced, and pixels darker than the blend color do not change.

- *Multiply* **

Looks at the color information in each channel and multiplies the base color by the blend color. The result color is always a darker color. Multiplying any color with black produces black, while with white leaves the color unchanged. When you're painting with a color other than black or white, successive strokes with a painting tool produce progressively darker colors. The effect is similar to drawing on the image with multiple marking pens.

- *Color Burn*

Looks at the color information in each channel and darkens the base color to reflect the blend color by increasing the contrast between the two. Blending with white produces no change.

- *Linear Burn*

Looks at the color information in each channel and darkens the base color to reflect the blend color by decreasing the brightness. Blending with white produces no change.

- *Darker Color*

Compares the total of all channel values for the blend and base color and displays the lower value color. It does not produce a third color, which can result from the Darken blend, because it chooses the lowest channel values from both the base and the blend color to create the result color.

- *Lighten*

Looks at the color information in each channel and selects the base or blend color—whichever is lighter—as the result color. Pixels darker than the blend color are replaced, and pixels lighter than the blend color do not change.

- *Screen*

Looks at each channel's color information and multiplies the inverse of the blend and base colors. The result color is always a lighter color. Screening with black leaves the color unchanged, while with white produces white. The effect is similar to projecting multiple photographic slides on top of each other.

- *Color Dodge*

Looks at the color information in each channel and brightens the base color to reflect the blend color by decreasing contrast between the two. Blending with black produces no change.

- *Linear Dodge*

Looks at the color information in each channel and brightens the base color to reflect the blend color by increasing the brightness. Blending with black produces no change.

- *Lighter Color*

Compares the total of all channel values for the blend and base color and displays the higher value color. Lighter Color does not produce a third color, which can result from the Lighten blend, because it chooses the highest channel values from both the base and blend color to create the result color.

- **Overlay* **

Multiplies or screens the colors, depending on the base color. Patterns or colors overlay the existing pixels while preserving the highlights and shadows of the base color. The base color is not replaced, but mixed with the blend color to reflect the lightness or darkness of the original color.

- **Soft Light* **

Darkens or lightens the colors, depending on the blend color. The effect is similar to shining a diffused spotlight on the image. If the blend color (light source) is lighter than 50% gray, the image is lightened as if it were dodged., while if is darker than 50% gray, the image is darkened as if it were burned in. Painting with pure black or white produces a distinctly darker or lighter area, but does not result in pure black or white.

Blending options, in detail

- *Hard Light*

Multiplies or screens the colors, depending on the blend color. The effect is similar to shining a harsh spotlight on the image. If the blend color (light source) is lighter than 50% gray, the image is lightened, as if it were screened. This is useful for adding highlights to an image. If the blend color is darker than 50% gray, the image is darkened, as if it were multiplied. This is useful for adding shadows to an image. Painting with pure black or white results in pure black or white.

- *Vivid Light*

Burns or dodges the colors by increasing or decreasing the contrast, depending on the blend color. If the blend color (light source) is lighter than 50% gray, the image is lightened by decreasing the contrast. If the blend color is darker than 50% gray, the image is darkened by increasing the contrast.

- *Linear Light*

Burns or dodges the colors by decreasing or increasing the brightness, depending on the blend color. If the blend color (light source) is lighter than 50% gray, the image is lightened by increasing the brightness. If the blend color is darker than 50% gray, the image is darkened by decreasing the brightness.

- *Pin Light*

Replaces the colors, depending on the blend color. If the blend color (light source) is lighter than 50% gray, pixels darker than the blend color are replaced, and pixels lighter than the blend color do not change. If the blend color is darker than 50% gray, pixels lighter than the blend color are replaced, and pixels darker than the blend color do not change. This is useful for adding special effects to an image.

- *Hard Mix*

Adds the red, green and blue channel values of the blend color to the RGB values of the base color. If the resulting sum for a channel is 255 or greater, it receives a value of 255; if less than 255, a value of 0. Therefore, all blended pixels have red, green, and blue channel values of either 0 or 255. This changes all pixels to primary additive colors (red, green, or blue), white, or black.

- *Difference*

Looks at the color information in each channel and subtracts either the blend color from the base color or the base color from the blend color, depending on which has the greater brightness value. Blending with white inverts the base color values; blending with black produces no change.

- *Exclusion*

Creates an effect similar to but lower in contrast than the Difference mode. Blending with white inverts the base color values. Blending with black produces no change.

- *Subtract*

Looks at the color information in each channel and subtracts the blend color from the base color. In 8- and 16-bit images, any resulting negative values are clipped to zero.

- *Divide*

Looks at the color information in each channel and divides the blend color from the base color.

- *Hue* **

Creates a result color with the luminance and saturation of the base color and the hue of the blend color.

- *Saturation*

Creates a result color with the luminance and hue of the base color and the saturation of the blend color. Painting with this mode in an area with no (0) saturation (gray) causes no change.

- *Color* **

Creates a result color with the luminance of the base color and the hue and saturation of the blend color. This preserves the gray levels in the image and is useful for coloring monochrome images and for tinting color images.

- *Luminosity*

Creates a result color with the hue and saturation of the base color and the luminance of the blend color. This mode creates the inverse effect of Color mode.

The image on the left blends the RawLight Render Element above the RGB channel (basic render) using different blending modes just explained in detail.

Photo editing : corrections, fixing mistakes

Analyzing one by one the few adjustments made on the image turned out to be an extremely useful operation for educational purposes, because it allows me to deal with different editing issues you may encounter during your post-production journey.

1. mirror: a whitish halo above the mirror reflection. The mirror was "too mirroring", so to make the blurred effect typical of the antique mirrors, as in the painting, I created a layer on which I applied a white brushstroke and put it in 70% opacity to achieve the desired result (*blend mode normal*).

2. frame: wrong material IOR (check material handbook), I removed the white side reflections simply by copying with the *clone stamp* other parts of the frame.

3. chair lion heads: I refused to model them because they were too small and compositionally irrelevant for the whole painting. I looked for a lion's head similar to that of the fine Dutch chairs of the period, distorted with *free transformation tool*, then played with overlapping layers of color to obtain the desired shade.

4. chair bangs: a minor forgetfulness: using the *smudge tool* as a brush to dilute water on a watercolor, then drooling the blue pixels of the chair on the space/pixels below, I obtained uneven bangs that followed the direction of my gestures. To do this kind of work I highly recommend the use of a graphic tablet.

5. cello "effe" detail : since I forgot to model this detail (it happens!) I took a picture

of a real "effe" and distort it according to the perspective, thus decreasing the opacity of the element to merge it with the rest of the cello (*blend mode: multiply*).

6. *persian carpet* : as mentioned in the materials manual, due to the particular texture of this carpet and the peculiar folds of the same, I decided to manage the texture in Photoshop.

So I created a *layer mask* tracing the surface of the carpet (red area), cut from Vermeer's painting the original carpet, then I pasted it inside the created mask and adjusted it following the slightly different folds that my model had. The tools used were mainly the grid with the *transformation controls* and the *clone stamp*, plus some layers of bleaching and darkening brushes to enhance lighting effects, but I will dedicate a special chapter to this topic.

7. *marble tiles* : a common mistake that emerges during rendering is that of treat ing a visualization model as a technical drawing. *Snaps* are such a great thing when working, but perfectly touching surfaces means no light passing through, therefore no shadows , and in the end everything will seem flat and fake if you don't try to emulate the little discrepancies, as it happens everywhere in reality. This is exactly what happened to the marble slabs of the floor of my model: so to overcome the problem of having a unique surface where they no longer stood out from each other, I decided to take the joints and trace them (with the help of construction perspective lines) with a white brush, and in some cases (as in the piece where the number 07 lies) to create a white or black area on a separate layer, then play with opacity to simulate a more worn surface (white spot), or slightly tilted against the light (black spot).

8. *spot removals*: textures with points that contrast sharply with the rest of the mapping, although seamless, can produce annoying repetitions when applied on large surfaces. In these cases the *clone stamp* or the *Healing Brush Tool* can come to the aid by sensing the pixels and removing repeated dots (it's a widely used tool to remove black dots and other imperfections in the photo-retouching of faces, if you think about it, the aim and so the procedure is exactly the same).

By definition, "a Photomontage is the process and the result of making a composite photograph by cutting, gluing, rearranging and overlapping two or more photographs into a new image"[1].

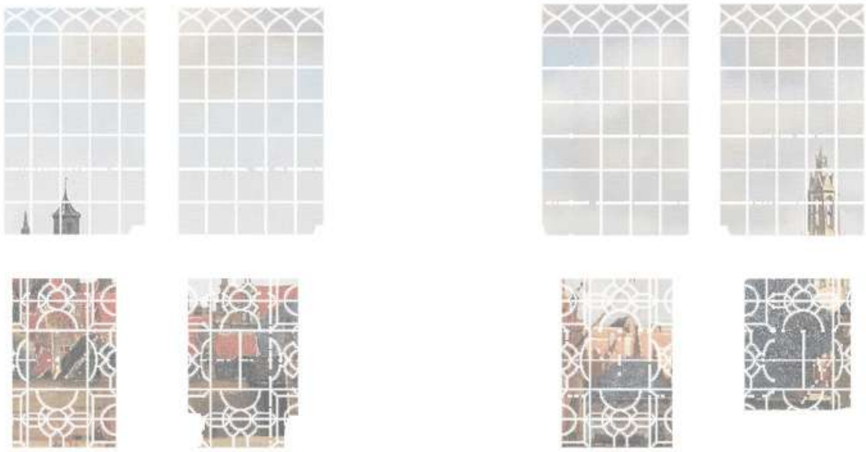
When talking about photomontages, the most important factor to keep in mind is the coherence of the elements chosen to be inserted in your artwork, whether they are people (although this is not the case), inanimate objects, backgrounds or other stuff.

Understanding and defining the expressive language with which you are working is fundamental to orient the choice of alien elements to insert in the picture.

1 Clark, Lloyd Douglas; Brown, Brian A. "Apparatus and Method for Application of Selective Digital Photomontage to Motion Pictures"

In this case, being lucky enough to work with Vermeer (who in addition to many interior scenes also produced a couple of exterior views) in creating a background for the counter-field I inserted his view of Delf.

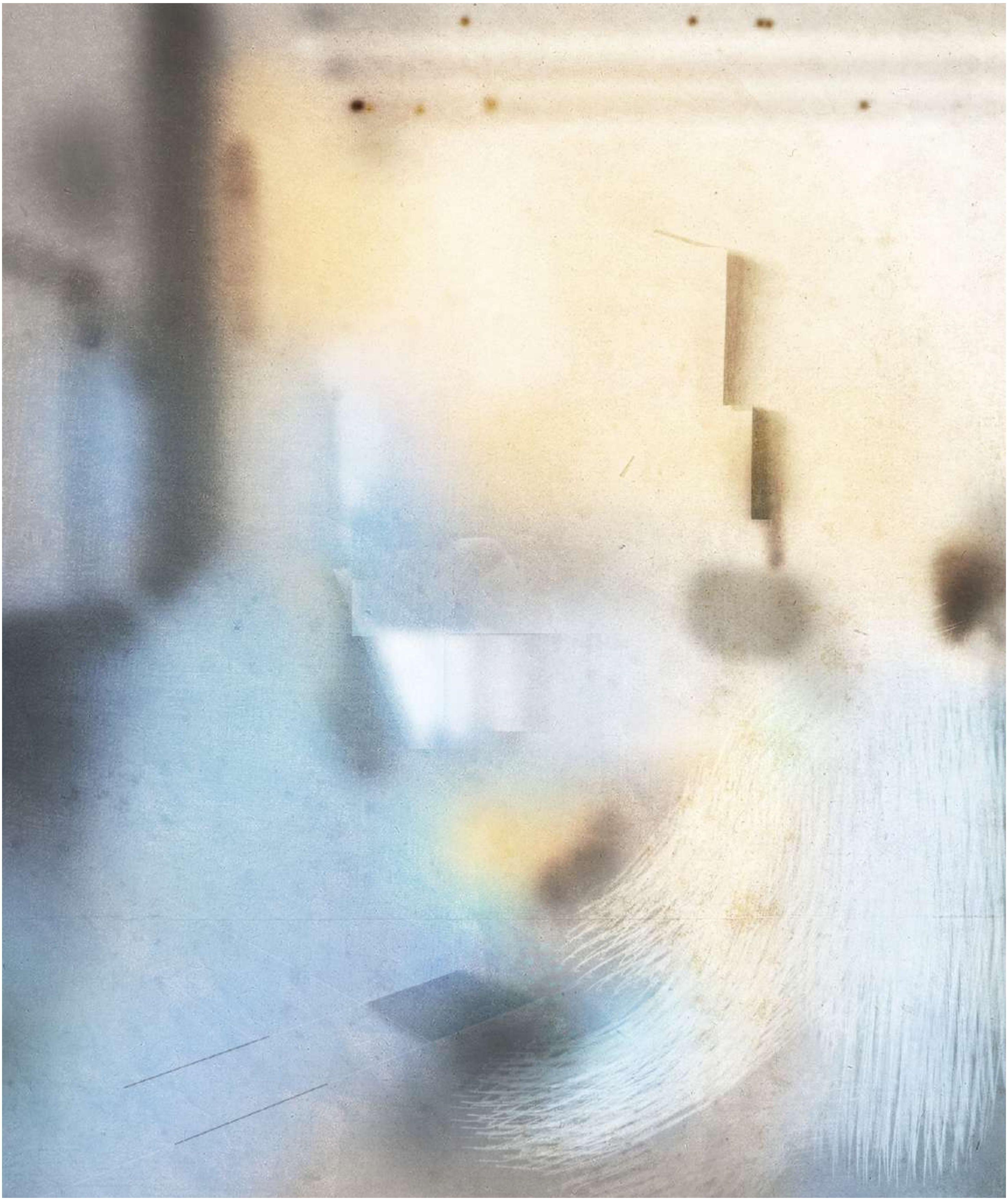
Therefore, by introducing an element in harmony with the painter's style I didn't risk to produce a cacophony, as probably would have happened by inserting a real photograph (obviously without retouching it very much, therefore wasting a lot of time and in any case not reaching the painter's masterly verisimilitude).



in the previous page, The Vermeer’s Music Lesson, camera variation: reverse shot
Filippo Fanciotti, 2017

in this page:
1. detail of the reverse shot without the photomerged background.
2. Details of the windows.
3. Johannes Vermeer, view of Delft, 1660.

Photo ediding, Light effects



This is without a doubt the most difficult part of these five handouts to explain. The reason is that it is the one, pass me the word, more artistic, less procedural and strongly influenced by your personal sensitivity, taste and accumulated experience.

The strange image on the left is an exportation of all the layers of effects applied on the top of the image, after the adjustments shown in the previous pages. This package of actions is aimed to change, we might informally say, its *patina*, although technically we are againg altering the simple appearance of its pixels.

The truth is that these are layers of colour, black and white brushstrokes, in some cases imported images placed in opacity above the other layers, all combined with blending modes designed ad hoc to achieve a very personal expressive purpose, a kind of pictorial effect, which I share with you here as an example, but with the invitation to distance yourself from it and experiment until you find your own; search for brushes in the web, use them as if you are painting, play with layers and blending options, ...

Below you will finally find four different types of operations, with an excerpt here on the side and the isolated effects package:

01. light and shadows;
02. color nuances;
03. filters;
04. adjustments.


01 lights and shadows


02 colour nuances


03 filters

1. *light and shadowss*:
normally I create a layer (or even a folder of layers) of brushstrokes in which I enhance lights and shadows in the painting. Sometimes - just like in the example here - I directly use black and white, sometimes with the eyedropper I sample a pair of colors (normally a light one, such as golden/yellow and a dark one, such as a dark brown), then I set the blend mode of the layer to *Soft Light* and I start playing with brushes, hightlighting some parts of the composition. Here you can see that I wanted to highlight in particular the shadows behind the mirror, so in that area I used the brush with an opacity of almost 100%, in other parts I wanted to do the same, but with less intensity. Generally I never shade with an opacity greater than 40% black, while for highlights I can reach even 60%. Anyway, I play with the layer opacity and the superimposition of layers of operations like this until I get the desired result. About the brush, in 99% of cases I simply use the very basic *Soft Round Pressure Opacity Brush*.

2. *colour nuances:*
from a technical point of view the process is very similar to the one just described, with the difference that I no longer think for single elements (shading a pitcher, the back of the carpet and so on), but for areas of colour; what I want to emphasize here, in fact, is the temperature of the light or, more improperly, the atmosphere.
Generally - and this example is no exception, although I was only emulating what emerges from the analysis of the light in the painting - I use complementary colours: orange stains where the light touches the surfaces, blue spots in the shaded areas.

3. *filters:*
we could open a very long parenthesis on the use of filters in Photoshop (I don't know if you've ever tried to explore the *filter gallery* or download *actions* from the web), if not, take a look at it: you will discover a very wide world of options among the most diverse (some exquisitely kistch) with which to experiment and, above all, to learn to distance yourself quickly.
I am not going to deal with this issue here, I will instead confine myself to share what I've done here, confessing that it's more or less what I do in most situations. usually I take a piece of dirty and aged paper, or a worn canvas, even better if with a lot of irregularities, I extend it to cover the whole size of the painting, and then I start to modify it with the clone stamp and other tools (in short, if there are stains, I want them to be where I want them to be). the success of the effect is given to the use of a proper *blending mode* or, like in this case, to the combination of different papers with different blending modes.

4. *adjustments*:
these special layers applie color/tonal adjustments to your image without irreversibly changing pixel values.
The difference between making an alteration directly on the layer (with interventions such as correcting curves and so on) and doing so on one of these dedicated layers is that the changes are stored only in the *adjustment layer* and apply to all the layers below it. In this way you can both correct multiple layers by making a single adjustment, rather than adjusting each layer separately, with the help of a *Clipping mask*.
- Nondestructive edits are the main advantage you have by using this tool, which means you can re-edit the adjustment layer at any time, as well as reducing the effect of the adjustment by lowering its opacity.
- Selective editing is the second big advantage: you can paint on the adjustment layer's mask to affect only a part of the image, even varying the adjustment by painting on the mask with different tones of gray.
The adjustments in this image (check the screenshot on the right) are the ones I use the most, which are:

- Brightness/Contrast

increases tonal values and expands image highlights, or decreases values and expands shadows. The contrast slider expands or shrinks the overall range of tonal values in the image.

- Hue and saturation

Adjust the *hue*, *saturation*, and *lightness* of a specific range of colors in an image or simultaneously adjust all the colors in an image through three different sliders.

- Vibrance

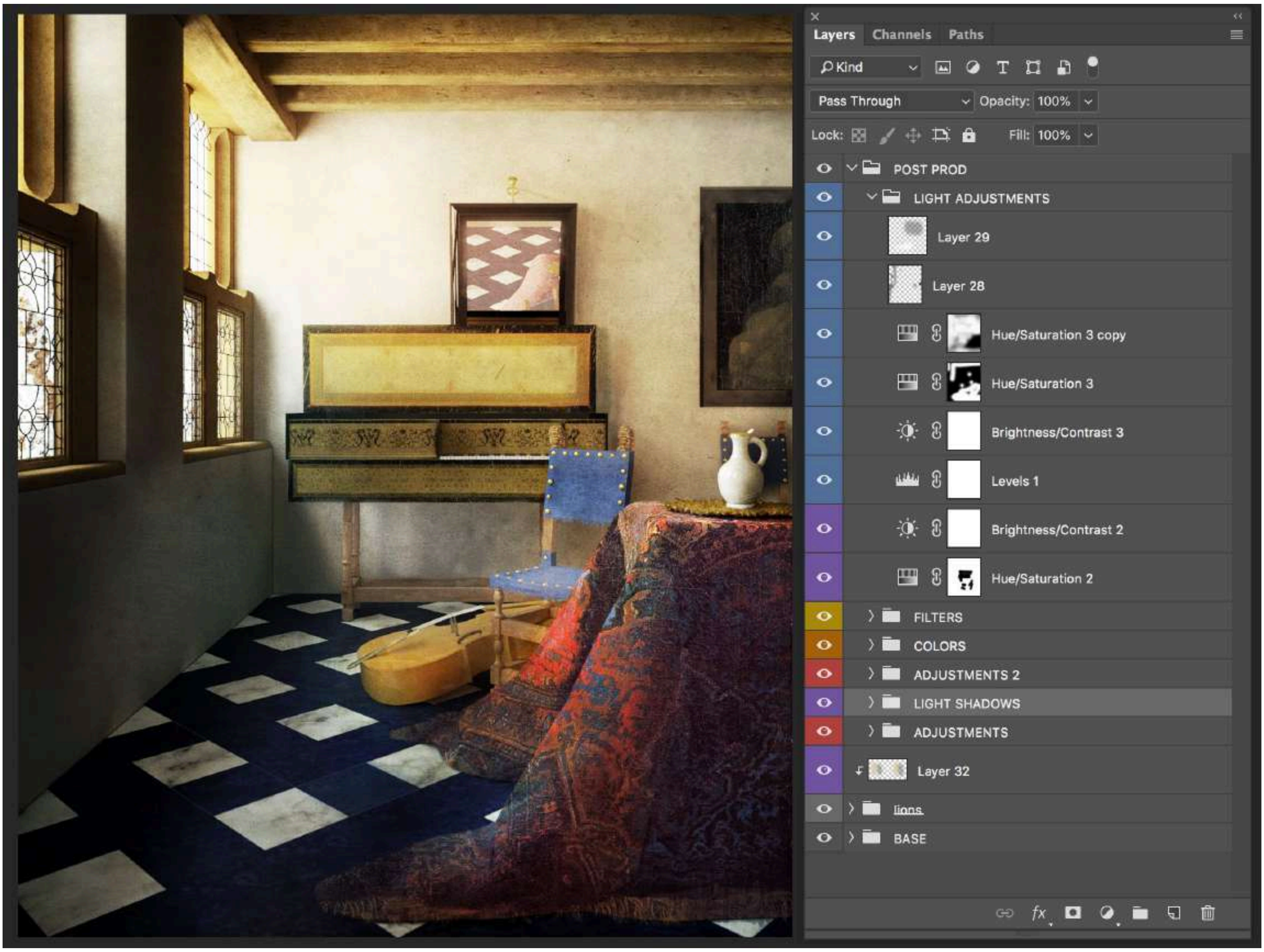
increases the saturation of less-saturated colors more than the colors that are already saturated, therefore avoiding oversaturated areas.

1. Levels
correct the tonal range and color balance working on shadows, midtones, and highlights.
The *Levels histogram* is a visual guide for adjusting the image key tones.
Moving the *black input slider* maps the pixel value to level 0, while moving the *white point slider* maps the pixel value to level 255. The remaining levels are redistributed in between. This redistribution increases the tonal range of the image, therefore affecting the overall contrast.
The *middle Input slider* adjusts the gamma. It moves the midtone (level 128) and changes the intensity values of the middle range of gray tones without dramatically altering the highlights and shadows.

- Curves

Initially, the image's tonality is represented as a straight diagonal line on a graph. When adjusting an RGB image, the upper-right area of the graph represents the highlights and the lower-left area represents the shadows. The horizontal axis of the graph represents the input levels (original image values) and the vertical axis represents the output levels (new adjusted values). As you add control points to the line and move them, the shape of the curve changes, reflecting your image adjustments. The steeper sections of the curve represent areas of higher contrast while flatter sections represent areas of lower contrast.[1]

1 for the Adjustment layers, I used as source the online Adobe Photoshop Userguide.



04 adjustment layers