Annexe A

Affichage multi–passes

Nous avons présenté dans le chapitre 4, une méthode de ré–éclairage basée sur des algorithmes de radiosité hiérarchique. L'affichage se fait élément par élément, en multipliant la texture par un facteur d'affichage. Nous utilisons le matériel graphique et notamment la librairie OpenGL®. L'affichage se fait typiquement en initialisant la fonction *glColor* en passant en paramètre les trois composantes du facteur d'affichage. Cette fonction nécessite des paramètres de couleur compris entre zéro et un. Si le facteur d'affichage est supérieur à un, il est automatiquement mis à un. Par cet affichage, nous n'obtenons pas l'éclairage désiré si le facteur est supérieur à un.

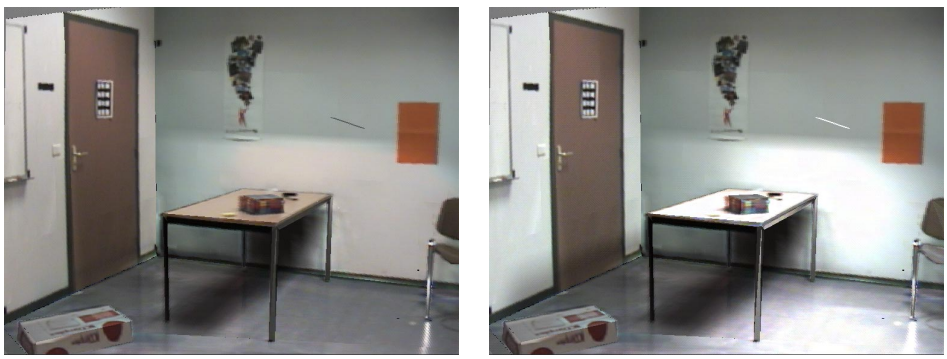
Pour éviter cette limitation, nous avons utilisé une méthode d'affichage en multi–passes. L'algorithme d'affichage est décrit sur la figure A.1. Pour tenir compte du fait que le facteur est supérieur à un, nous allons superposer n affichages, où $n-1$ est la partie entière du facteur d'affichage. La $n^{\text{ème}}$ passe correspond au reste du facteur d'affichage moins sa partie entière. La texture sera modulée par le facteur d'affichage non limité à un. Un exemple de l'importance de cet affichage en multi–passes est montré sur la figure A.2. Elle montre le résultat d'une insertion de lampe virtuelle dans une scène réelle. Nous n'avons pas utilisé d'affichage en multi–passes en (a), alors que nous l'avons utilisé en (b). La différence est clairement visible. Il manque de la luminosité en (a). Toutes les valeurs du facteur d'affichage ont été limitées à un. En (b), l'éclairage affiché rend bien compte de l'éclaircissement des textures dû à l'insertion de la lampe virtuelle.

Des problèmes similaires ont été rencontrés par d'autres chercheurs.
Debevec *et al.* [DBY98] utilisent une approche similaire pour combiner des textures pondérées, et n'en créer qu'une seule. Soler et Sillion [SS98] utilisent également un affichage multi–passes pour moduler correctement les textures avec l'éclairage direct.

```
Affichage Multi–passes
   glBegin(GL_BLEND)
   glTexEnvf(GL_TEXTURE_ENV,
         GL_TEXTURE_ENV_MODE,
         GL_MODULATE)
   NumIter = 1
   MaxIter = AfficherScène(NumIter)
   glBlendFunc(GL_ONE, GL_ONE)
   tant que NumIter < MaxIter faire
      AfficherScène(NumIter)
      glBlendFunc(GL_ONE, GL_ONE)
      NumIter++
   glDisable(GL_BLEND)
```

```
AfficherScène ( NumIter )
   MaxIter = 0
   pour chaque feuille
      if(NumIter == 0) alors
         Maxiter = Max (Maxiter, Bi / Di)
      glTexImage2D( …, Texture)
      pour chaque sommet
         color = (Bi / Di) - NumIter
      si color > 1 alors color = 1
      si color < 0 alors color = 0
      glColor(color)
      retourner Maxiter
```

FIG. A.1: Algorithme d'affichage en multi–passes.



(a) (b)

FIG. A.2: (a) Insertion d'une lampe virtuelle, sans utiliser un affichage multi–passes. (b) Utilisation d'un affichage multi–passes (5 passes en 0.3 secondes).

Annexe B

Programme de capture automatique de photographies

B.1 Propriétés contrôlables de l'appareil photographique Kodak DC260

L'appareil photographique numérique Kodak DC260 que nous utilisons n'est pas contrôlable manuellement pour toutes ses fonctions. Certaines propriétés sont contrôlables par simple choix dans des menus, ou directement par pression des boutons. En appuyant directement sur des boutons, on contrôle la position du zoom et la prise des photographies. La mise au point est faite automatiquement sur le centre de la scène capturée. Par contre, par une demi–pression, on peut choisir une mise au point pour un autre cadrage, et la conserver en revenant sur le cadrage choisi.

Dans les fonctions du menu, on trouve :

- le contrôle des propriétés des images comme la taille, la résolution ou la cadence de capture (en rafale ou en instantané),
- le contrôle du flash,
- le contrôle de la balance des couleurs en choisissant un type d'éclairage. Cette balance automatique peut être désactivée,
- la possibilité de choisir manuellement la distance focale parmi des valeurs pré–définies,
- un choix sur le type d'exposition (automatique ou longue durée). L'exposition longue durée varie entre une demie seconde et seize secondes. Le temps d'exposition ne peut être contrôlable en–dessous d'une demie seconde.

D'autres propriétés peuvent être directement contrôlables par des scripts. Parmi les propriétés contrôlables par script, on retrouve la distance focale. D'autres propriétés non contrôlables directement sur les menus, comme l'ouverture du diaphragme, peuvent être contrôlées depuis les scripts. En revanche, le temps d'exposition n'est pas contrôlable en–dessous d'une demie seconde.

Nous pouvons fixer une ouverture, mais pas le temps d'exposition. Malheureusement l'appareil choisit automatiquement certains paramètres pour que la photographie aient les « meilleures » couleurs. Même si l'ouverture est fixée, il compensera par le choix automatique d'un temps d'exposition. Ceci veut dire que pour une même scène prise sous un point de vue légèrement différent, les couleurs ne seront pas cohérentes. L'appareil photographique se sera automatiquement adapté au nouveau niveau d'éclairage perceptible dans le cadrage.

Nous ne pouvons donc pas contrôler le paramètre conjugué ouverture/temps. L'appareil possède cependant un mode appelé *EV*. Ce n'est pas le mode *EV* traditionnellement utilisé en photographie. Le mode traditionnel permet justement de calculer le paramètre conjugué ouverture/temps, car il existe un relation entre la valeur de *EV*, le temps d'exposition et l'ouverture du diaphragme. Celui du Kodak DC260 est relatif à la photographie prise en mode automatique. Quand $EV = 0$, la photographie correspond à une ouverture et un temps d'exposition le mieux adapté d'après les critères de l'appareil. Les valeurs de *EV* peuvent varier mais elles seront toujours relatives à l'image choisie automatiquement en $EV = 0$. Les *EV* sont pré–définies et distribuées uniformément autour de 0. Les différentes valeurs sont : $-2, -1.5, -1, -0.5, 0, 0.5, 1, 1.5, 2$. Ceci nous permet de prendre neuf photographies avec des temps d'exposition différents.

Nous avons essayé de savoir si l'appareil faisait varier l'ouverture ou le temps d'exposition pour des *EV* différents. Nous avons fixé l'ouverture avant la modification de l'*EV*, et nous avons lu la valeur d'ouverture après la prise de photographies. Comme elle était restée la même que celle que nous avions fixée arbitrairement sur plusieurs prises, nous en avons déduit que c'était le temps d'exposition qui variait.

B.2 Script de capture de photographies sur une plage étendue

En utilisant la capacité de programmation de l'appareil photographique et le contrôle des valeurs de *EV*, nous avons écrit un script qui prend automatiquement neuf photographies à des *EV* différents.

```
name "Exposure Bracketing"
mode 0
menu "Kodak Scripts"
label "My Exposure Bracketing"


# Variable declaration and definition
declare u : uTemp, uError, uStorage, uImageTaken, uImageAvail,
  uSsiz, uCameraType
declare u : uSelectStop, uSelectCapture, uSelect
declare i : iFlagOn, iFlagOff, iInitialEV, iImageRaw,
  iInitialAper
declare i : iErrorCode, iBracketValue, iTemp, iInitialShut
declare i : iAper

declare s : sProductName, sVendorName, sCameraType, sTemp,
  sStop
declare b : bCameraType
declare f : fTemp

# Variable initialization
iErrorCode = 0
iFlagOn = 1
iFlagOff = 0
uCameraType = 0


# Get camera name
  GetProductInfo ("ptid", sProductName)
  GetProductInfo ("vdid", sVendorName)
  if sProductName == "KODAK DIGITAL SCIENCE DC220"
    uCameraType = 220
    sCameraType = "DC220"
  end

  if sProductName == "KODAK DIGITAL SCIENCE DC260"
    uCameraType = 260
    sCameraType = "DC260"
  end
  if uCameraType == 0
    iErrorCode = 10
    goto ErrorProc
  end

DisplayLine ("Nine (9) pictures will be captured at different
  levels of exposure.")
Wait (3000)

# Get initial camera settings
  GetCameraState ("xcmp", iInitialEV)
  GetCameraState ("ssiz", uSsiz)
```

```
  GetCameraState("aper", iInitialAper)
  DisplayLine("Initial aperture is ", iInitialAper, " .")

# Check available memory
  uStorage = 1
  iImageRaw = -1
  GetStorageStatus (uStorage, uImageTaken, uImageAvail,
  iImageRaw)

  if uImageAvail < 4
    if uSsiz > 2
      iErrorCode = 20
      goto ErrorProc
    end
    if uCameraType == 220
      SetCameraState ("ssiz", 3)
      GetStorageStatus (uStorage, uImageTaken, uImageAvail,
        iImageRaw)
      if uImageAvail < 4
        iErrorCode = 20
        uError = 4 - uImageAvail
        goto ErrorProc
      end
    end
    if uCameraType == 260
      SetCameraState ("ssiz", 2)
      GetStorageStatus (uStorage, uImageTaken, uImageAvail,
        iImageRaw)
      if uImageAvail < 4
        SetCameraState ("ssiz", 3)
        GetStorageStatus (uStorage, uImageTaken,
          uImageAvail, iImageRaw)
        if uImageAvail < 4
          iErrorCode = 20
          uError = 4 - uImageAvail
          goto ErrorProc
        end
      end
    end
    Alert ("Due to insufficient memory, the camera's
      resolution and/or quality has been reduced.")
  end



# Ask what aperture
  SetOption (1, "3", iFlagOff)
  SetOption (2, "4", iFlagOff)
  SetOption (3, "5.6", iFlagOff)
  SetOption (4, "8", iFlagOff)
  SetOption (5, "11", iFlagOff)
```

```
  SetOption (6, "16", iFlagOff)
  SetOption (10, "Return", iFlagOff)
  GetOption (uSelectStop)

  if uSelectStop == 1
    iAper = 300
  end
  if uSelectStop == 2
    iAper = 400
  end
  if uSelectStop == 3
    iAper = 560
  end
  if uSelectStop == 4
    iAper = 800
  end
  if uSelectStop == 5
    iAper = 1100
  end
  if uSelectStop == 6
    iAper = 1600
  end
  if uSelectStop == 10
    goto GetCaptureType
  end

  SetCameraState("aper", iAper)

# Start Bracket Exposure
  DisplayClear ()
  SetOption (1, "Begin Capture", iFlagOn)
  SetOption (10, "Return", iFlagOff)
  GetOption (uSelect)
  if uSelect == 10
    goto GetCaptureType
  end

  DisplayClear ()
    DisplayLine ("Nine consectutive pictures will automatically
      be taken.")
  Wait (5000)
  Alert ("Position the camera to take the desired picture.
    Press CONTINUE to start capturing the exposure bracket.")
  Wait (1000)

  SetCaptureMode (still)


  iBracketValue = -200
  DisplayClear()
  DisplayLine("EV is ", iBracketValue)
```

```
  Wait(2000)
  uError = SetCameraState ("xcmp", iBracketValue)
  if uError != 0
    iErrorCode = 50
    goto ErrorProc
  end

Capture :


  uError = StartCapture ()
  if uError == 12
    # system is busy
    Wait (1000)
    Display (".")
    goto Capture
  end
  if uError != 0
    iErrorCode = 60
    goto ErrorProc
  end
  iBracketValue = iBracketValue + 50

  if iBracketValue > 200
    goto FinishCapture
  end
  DisplayClear()
  DisplayLine("EV is ", iBracketValue)
  Wait(2000)

  # take picture at upper bracket
  uError = SetCameraState ("xcmp", iBracketValue)
  if uError != 0
    iErrorCode = 50
    EndCapture()
    goto ErrorProc
  end
  goto Capture

FinishCapture :
  DisplayClear()
  DisplayLine("Stop capture.")
  Wait(2000)

  EndCapture ()

ErrorProc :
  if iErrorCode > 1
    DisplayClear ()
    if iErrorCode == 10
      Alert ("Error : camera not supported.")
```

```
    end
    if iErrorCode == 20
      Alert ("Insufficient memory : ", uError, "
        pictures must be removed to perform exposure
        bracket.")
    end
    if iErrorCode == 50
      Alert ("Error : set camera state <", uError, ">.")
    end
    if iErrorCode == 60
      Alert ("Error : start capture <", uError, ">.")
    end
  end

Finish :
  # set camera to initial values
  SetCameraState ("xcmp", iInitialEV)
  SetCameraState ("aper", iInitialAper)
  SetCameraState ("ssiz", uSsiz)
  if iErrorCode == 0
    Alert ("Bracket capture is complete. Switch to review
      mode to view the pictures.")
  end

Done :
  exitscript
```

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