Simplex Plot

In[ ]:=
```
(* Geometric transformation to simplex *)
{err, trans} = FindGeometricTransform[
   {{1, Tan[Pi / 3]} / 2, {0, 0}, {1, 0}}, {{0, 0}, {0, 1}, {1, 0}}];
(* Edges of simplex *)
triangle = Graphics[{Thickness[0.005], Darker[Gray],
    GeometricTransformation[Line[{{0, 0}, {0, 1}, {1, 0}, {0, 0}}], trans]}];
(* Some random data *)
dummyData = Select[RandomReal[1, {100, 2}], Total[#] ≤ 1 &];
(* Plot the points *)
points = ListPlot[dummyData, PlotStyle → PointSize[0.03]];
(* Or plot the lines *)
lines = ListLinePlot[dummyData, PlotStyle → Black];
(* Show all together *)
(* The trick is to extract the "First" part of the plots, and transform it *)
```

In[ ]:=
```
cols = ColorData[97, "ColorList"][[{2, 1, 3}]]
```

Out[ ]=

{■, ■, ■}

Data processing

Type 1 Conformists

In[ ]:=
```
SetDirectory[NotebookDirectory[] <> "typeI_conformist_b2/"]
```

Out[ ]=
```
/Users/chaitanyagokhale/Documents/Working/Srishti/Overleafdata/
  matecopying_multiplemorphs/New_Revised_Figures/Fig_3_overlays/
  typeI_conformist_b2
```

In[ ]:=
```
filenames = FileNames[];
```

In[ ]:=
```
SetDirectory[NotebookDirectory[]]
```

Out[ ]=
```
/Users/chaitanyagokhale/Documents/Working/Srishti/Overleafdata/
  matecopying_multiplemorphs/New_Revised_Figures/Fig_3_overlays
```

In[ ]:=
```
filecounter = Range[0.0, 1.0, 0.05] /. {0. → "0.0", 1. → "1.0"}
```

Out[ ]=
```
{0.0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45,
 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0}
```

```
In[ ]:= filenames // Sort
Out[ ]=
{out_c0.05.csv, out_c0.0.csv, out_c0.15.csv, out_c0.1.csv,
 out_c0.25.csv, out_c0.2.csv, out_c0.35.csv, out_c0.3.csv,
 out_c0.45.csv, out_c0.4.csv, out_c0.55.csv, out_c0.5.csv,
 out_c0.65.csv, out_c0.6.csv, out_c0.75.csv, out_c0.7.csv, out_c0.85.csv,
 out_c0.8.csv, out_c0.95.csv, out_c0.9.csv, out_c1.0.csv, params.csv}

In[ ]:= rawtype1conf = {};
rawtype1conf =
  Table[Import[NotebookDirectory[] <> "typeI_conformist_b2/" <> "out_c" <>
     ToString[filecounter[[i]]] <> ".csv", "CSV"], {i, 1, Length[filecounter], 1}];

In[ ]:= rawtype1conf // Dimensions
Out[ ]=
{21, 1275, 4}
```

Type 2 Conformists

```
In[ ]:= SetDirectory[NotebookDirectory[] <> "typeII_conformist_f1.2/"]
Out[ ]=
/Users/chaitanyagokhale/Documents/Working/Srishti/Overleafdata/
  matecopying_multiplemorphs/New_Revised_Figures/Fig_3_overlays/
  typeII_conformist_f1.2

In[ ]:= NotebookDirectory[]
Out[ ]=
/Users/chaitanyagokhale/Documents/Working/Srishti/Overleafdata/
  matecopying_multiplemorphs/New_Revised_Figures/Fig_3_overlays/

In[ ]:= filenames = FileNames[];

In[ ]:= filecounter = Range[0.0, 1.0, 0.05] /. {0. → "0.0", 1. → "1.0"}
Out[ ]=
{0.0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45,
 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0}

In[ ]:= filenames // Sort
Out[ ]=
{out_c0.05.csv, out_c0.0.csv, out_c0.15.csv, out_c0.1.csv,
 out_c0.25.csv, out_c0.2.csv, out_c0.35.csv, out_c0.3.csv,
 out_c0.45.csv, out_c0.4.csv, out_c0.55.csv, out_c0.5.csv,
 out_c0.65.csv, out_c0.6.csv, out_c0.75.csv, out_c0.7.csv, out_c0.85.csv,
 out_c0.8.csv, out_c0.95.csv, out_c0.9.csv, out_c1.0.csv, params.csv}

In[ ]:= rawtype2conf = {};
rawtype2conf =
  Table[Import[NotebookDirectory[] <> "typeII_conformist_f1.2/" <> "out_c" <>
     ToString[filecounter[[i]]] <> ".csv", "CSV"], {i, 1, Length[filecounter], 1}];
```

In[ ]:=
```
rawtype2conf // Dimensions
```
Out[ ]=
```
{21, 1275, 4}
```

Analytics

Type 1 Conformists

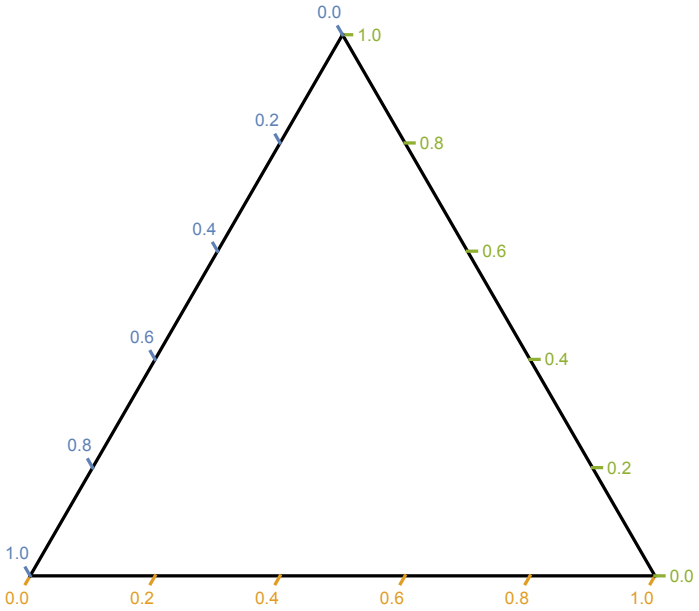
In[ ]:=
```
α = 0.8; β = 2; γ =.; u = 0;
q1 = 2; q2 = 2.5; q3 = 3;
p[γ_, y_, q_] := (1 - γ) q/(q1 + q2 + q3) + α γ (y^β/(y^β + (1 - y)^β));
```

In[ ]:=
```
gammas = ReplacePart[Table[i, {i, 0, 1, 0.05}], 21 → 0.99]
```
Out[ ]=
```
{0., 0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45,
 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 0.99}
```

```
internal = {};
notransinternal = {};
Table[
  dy1[y1_, y2_] := y1 (p[γ, y1, q1] q1 - (p[γ, y1, q1] q1 y1 +
        p[γ, y2, q2] q2 y2 + p[γ, (1 - y1 - y2), q3] q3 (1 - y1 - y2)));
  dy2[y1_, y2_] := y2 (p[γ, y2, q2] q2 - (p[γ, y1, q1] q1 y1 +
        p[γ, y2, q2] q2 y2 + p[γ, (1 - y1 - y2), q3] q3 (1 - y1 - y2)));
  y1 =.;
  y2 =.;
  sol = NSolve[{dy1[y1, y2] == 0, dy2[y1, y2] == 0}, {y1, y2}, Reals];
data = {y1, y2} /. sol;
  relData = Select[data, #[[1]] > 0 && #[[2]] > 0 && Total[#] < 1. && Total[#] > 0 &];
  AppendTo[internal, {γ, If[relData == {}, Missing[], trans[relData[[1]]]]}];
  AppendTo[notransinternal,
   {γ, If[relData == {}, Missing[], relData[[1]]]};, {γ, gammas}
 ];
```

In[ ]:=
```
tlp = TernaryListPlot[{0.3, 0.3, 0.3},
  (*AxesStyle→cols[[{1,3,2}]], Axes→True,*)FrameTicks → Range[0, 1, 0.2],
  FrameTicksStyle → cols[[{1, 3, 2}]], FrameStyle → Thickness[0.005]]
```

Out[ ]=

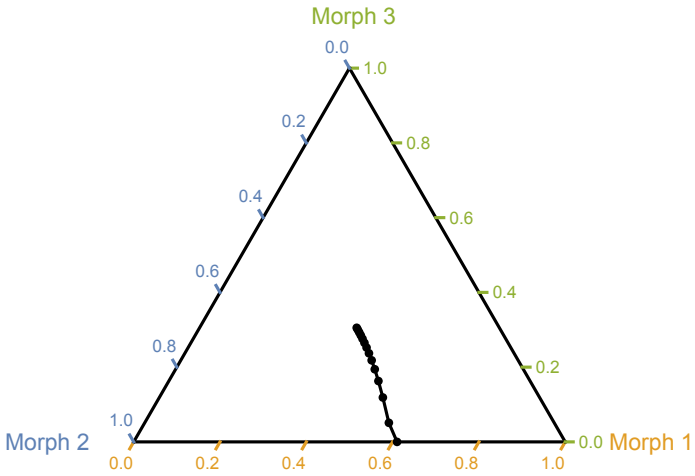


In[ ]:=
```
internal
```

Out[ ]=
```
{{0., Missing[]}, {0.05, Missing[]}, {0.1, Missing[]},
 {0.15, Missing[]}, {0.2, Missing[]}, {0.25, Missing[]}, {0.3, Missing[]},
 {0.35, {0.610274, 1.43441×10^-13}}, {0.4, {0.591299, 0.0441966}},
 {0.45, {0.577408, 0.102845}}, {0.5, {0.56708, 0.141019}},
 {0.55, {0.558631, 0.168298}}, {0.6, {0.551431, 0.188966}},
 {0.65, {0.545159, 0.205271}}, {0.7, {0.539621, 0.218523}},
 {0.75, {0.534681, 0.229542}}, {0.8, {0.530243, 0.238871}},
 {0.85, {0.526229, 0.246887}}, {0.9, {0.52258, 0.253858}},
 {0.95, {0.519247, 0.259983}}, {0.99, {0.516781, 0.264376}}}
```

In[ ]:=
```
inteqdyn = Show[tlp, ListPlot[internal[[All, 2]], Joined → True,
   Axes → False, PlotStyle → Directive[Black, Thickness[0.005]],
   Mesh → All, MeshStyle → Directive[PointSize[Medium], Black]],
  Graphics[
   Text[Style["Morph 1", FontFamily → "Calibri", 12, cols[[1]]], {1.2, 0}]],
  Graphics[
   Text[Style["Morph 2", FontFamily → "Calibri", 12, cols[[2]]], {-0.2, 0}]],
  Graphics[Text[Style["Morph 3", FontFamily → "Calibri", 12, cols[[3]]],
    {0.6 - 0.09, Sqrt[3]/2 + 0.12}]]]
```

Out[ ]=



Type 2 conformists

```
In[ ]:= f = 1.2;
typ2p[γ_, y_, q_] :=
  (1 - γ) q/(q1 + q2 + q3) + γ If[y > 0.5, (1 - f) y + f, If[y < 0.5, (1 - f) y, 0.5]];

internal = {};
notransinternal = {};
Table[
  dy1[y1_, y2_] :=
   y1 (typ2p[γ, y1, q1] q1 - (typ2p[γ, y1, q1] q1 y1 + typ2p[γ, y2, q2] q2 y2 +
        typ2p[γ, (1 - y1 - y2), q3] q3 (1 - y1 - y2)));
  dy2[y1_, y2_] :=
   y2 (typ2p[γ, y2, q2] q2 - (typ2p[γ, y1, q1] q1 y1 + typ2p[γ, y2, q2] q2 y2 +
        typ2p[γ, (1 - y1 - y2), q3] q3 (1 - y1 - y2)));
  y1 =.;
  y2 =.;
  sol = NSolve[{dy1[y1, y2] == 0, dy2[y1, y2] == 0}, {y1, y2}, Reals];
data = {y1, y2} /. sol;
  relData = Select[data, #[[1]] > 0 && #[[2]] > 0 && Total[#] < 1. && Total[#] > 0 &];
  AppendTo[internal, {γ, If[relData == {}, Missing[], trans[relData[[1]]]}];
  AppendTo[notransinternal,
   {γ, If[relData == {}, Missing[], relData[[1]]]};, {γ, gammas}
 ];
```

NSolve : NSolve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

NSolve : NSolve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

NSolve : NSolve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

General : Further output of NSolve::ratnz will be suppressed during this calculation.

```
In[ ]:= internal
Out[ ]=
{{0., Missing[]}, {0.05, Missing[]}, {0.1, Missing[]}, {0.15, Missing[]},
 {0.2, Missing[]}, {0.25, Missing[]}, {0.3, Missing[]}, {0.35, Missing[]},
 {0.4, Missing[]}, {0.45, Missing[]}, {0.5, Missing[]}, {0.55, Missing[]},
 {0.6, Missing[]}, {0.65, Missing[]}, {0.7, Missing[]}, {0.75, Missing[]},
 {0.8, Missing[]}, {0.85, Missing[]}, {0.9, {0.58979, 0.159161}},
 {0.95, {0.563869, 0.198582}}, {0.99, {0.545018, 0.227252}}}
```

Numerics

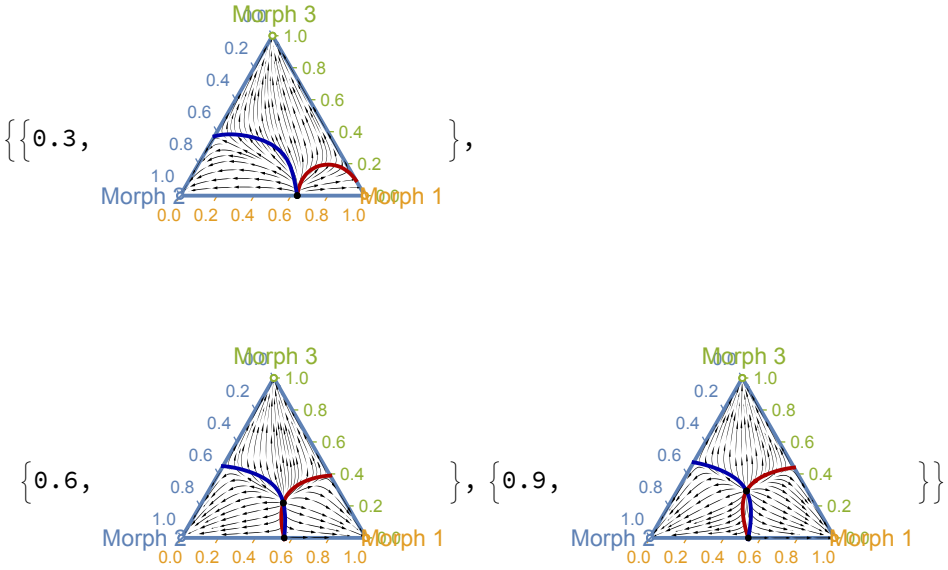
Type 1 Conformists

```
In[ ]:= imglist = {};
For[γ = 0.3, γ ≤ 0.9, γ = γ + 0.3,
```

```
 dy1[y1_, y2_] := y1 (p[ϒ, y1, q1] q1 -
      (p[ϒ, y1, q1] q1 y1 + p[ϒ, y2, q2] q2 y2 + p[ϒ, (1 - y1 - y2), q3] q3 (1 - y1 - y2)));
 dy2[y1_, y2_] := y2 (p[ϒ, y2, q2] q2 -
      (p[ϒ, y1, q1] q1 y1 + p[ϒ, y2, q2] q2 y2 + p[ϒ, (1 - y1 - y2), q3] q3 (1 - y1 - y2)));
 y1 =.;
 y2 =.;
 sol = NSolve[{dy1[y1, y2] == 0, dy2[y1, y2] == 0}, {y1, y2}, Reals];
data = {y1, y2} /. sol;
 relData = Select[data, #[[1]] > 0 && #[[2]] > 0 && Total[#] ≤ 1 && Total[#] ≥ 0 &];
 p1 = ListPlot[relData, PlotStyle → {Black, PointSize[0.025]}];
 (*p2=ListPlot[relData,PlotStyle→{White,PointSize[0.015]}];*)
 p3 = ListPlot[{{{1, 0}}, {{0, 1}}, {{0, 0}}},
   PlotStyle → {{Directive[cols[[1]], PointSize[0.03]]}, {Directive[cols[[2]],
       PointSize[0.03]]}, {Directive[cols[[3]], PointSize[0.03]]}}];
 p4 = ListPlot[{{1, 0}, {0, 1}, {0, 0}}, PlotStyle → {White, PointSize[0.015]}];
 points = Show[p1, p3, p4];
 cplt =
  ContourPlot[y1 ((p[ϒ, y1, q1] q1 - (p[ϒ, y1, q1] q1 y1 + p[ϒ, y2, q2] q2 y2 + p[ϒ,
             (1 - y1 - y2), q3] q3 (1 - y1 - y2)))) == 0, {y1, 0.0001, 0.9999},
   {y2, 0.0001, 0.9999}, RegionFunction → Function[{y1, y2}, y1 + y2 ≤ 1],
   PlotRange → All, ContourStyle → Darker[Red]];
 cplt2 =
  ContourPlot[y2 ((p[ϒ, y2, q2] q2 - (p[ϒ, y1, q1] q1 y1 + p[ϒ, y2, q2] q2 y2 + p[ϒ,
             (1 - y1 - y2), q3] q3 (1 - y1 - y2)))) == 0, {y1, 0.0001, 0.9999},
   {y2, 0.0001, 0.9999}, RegionFunction → Function[{y1, y2}, y1 + y2 ≤ 1],
   PlotRange → All, ContourStyle → Darker[Blue]];
 sp = StreamPlot[{dy1[y1, y2], dy2[y1, y2]}, {y1, 0, 1}, {y2, 0, 1},
   Frame → True, StreamStyle → Black, StreamColorFunction → None,
   StreamPoints → Fine, StreamMarkers → {"PinDart"}, StreamScale → Large,
   RegionFunction → Function[{x, y, vx, vy, n}, x + y ≤ 1 && x ≥ 0 && y ≥ 0],
   RegionFillingStyle → None];
 psim = Show[tlp,
   Graphics[GeometricTransformation[First[Show[sp]], trans]],
   Graphics[GeometricTransformation[First[Show[cplt, cplt2]], trans]],
   Graphics[GeometricTransformation[First[Show[points]], trans]],
   (*Graphics[Text["Copying intensity\n ϒ = "<>ToString[ϒ],{0.1,0.7}]],*)
   Graphics[
    Text[Style["Morph 1", FontFamily → "Calibri", 12, cols[[1]]], {1.2, 0}]],
   Graphics[
    Text[Style["Morph 2", FontFamily → "Calibri", 12, cols[[2]]], {-0.2, 0}]],
   Graphics[Text[Style["Morph 3", FontFamily → "Calibri", 12, cols[[3]]],
     {0.6 - 0.09, √3/2 + 0.12}]]
  ]; (*,
 Graphics[GeometricTransformation[First[parpl],trans]]*)
 AppendTo[imglist, {ϒ, psim}]
]
```

In[ ]:= imglist

Out[ ]=



Type 2 Conformists

Connecting to data

In[ ]:= diamond = Graphics[{Black, Rotate[Rectangle[], 45 Degree]}];

In[ ]:= Lighter[cols, 0.7]

Out[ ]=

{ , , }

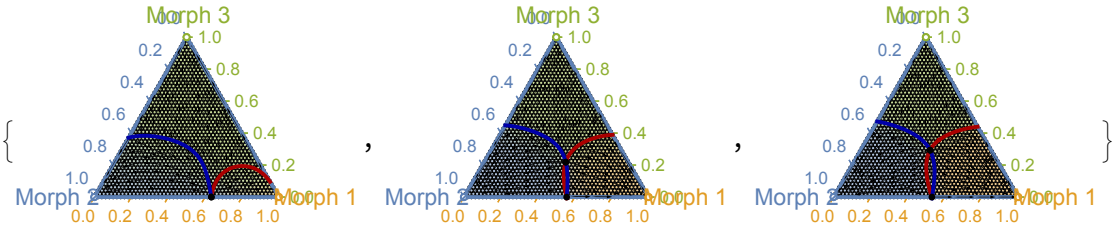
Type 1 Conformists

```
In[ ]:= dataplotstype1conformists =
  Table[Show[Graphics[{EdgeForm[{Black, Thin}], Table[{Blend[Lighter[cols, 0.5],
        {rawtype1conf[[j, 2 ;;]][[i]][4], 1 - rawtype1conf[[j, 2 ;;]][[i]][3] -
          rawtype1conf[[j, 2 ;;]][[i]][4], rawtype1conf[[j, 2 ;;]][[i]][3]}],
       RegularPolygon[trans[{rawtype1conf[[j, 2 ;;]][[i]][2],
          1 - rawtype1conf[[j, 2 ;;]][[i]][2] - rawtype1conf[[j, 2 ;;]][[i]][1]}],
        {0.01, 11}, 6]}, {i, 1, Length[rawtype1conf[[j, 2 ;;]]]}],
    Frame → False, PlotRange → {{-0.05, 1.05}, {-0.05, √3/2 + 0.05}}],
   ListPlot[{internal[[All, 2]][[j]]}, Joined → True, Axes → False,
    PlotMarkers → {diamond, Scaled[0.05]}, PlotStyle → Opacity[0.5]],
   tlp], {j, 1, Length[filecounter], 1}];
```

```
(*dataplots=
  Table[Show[triangle,ListPlot[datatransformedlist[[i]],InterpolationOrder→2,
     PlotStyle→PointSize[Medium],Axes→False,AspectRatio→1],
    ListPlot[{internal[[All,2]][[i]]},Joined→True,Axes→False,
     PlotMarkers→{◆,Scaled[0.05]}]],{i,1,Length[filenames],1}];*)
```

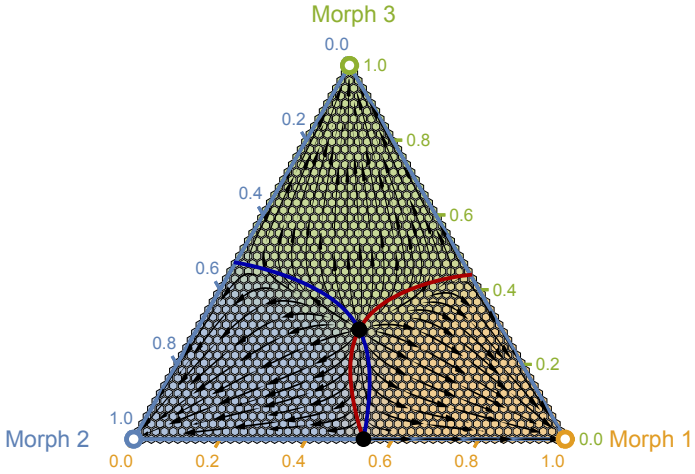
In[ ]:=
```
imagestoplot =
 {Show[dataplotstype1conformists[[7]], imglist[[All, 2]][[1]], PlotRange → All],
  Show[dataplotstype1conformists[[13]], imglist[[All, 2]][[2]], PlotRange → All],
  Show[dataplotstype1conformists[[19]], imglist[[All, 2]][[3]], PlotRange → All]}
```

Out[ ]=



In[ ]:=
```
imagestoplot[[3]]
```

Out[ ]=

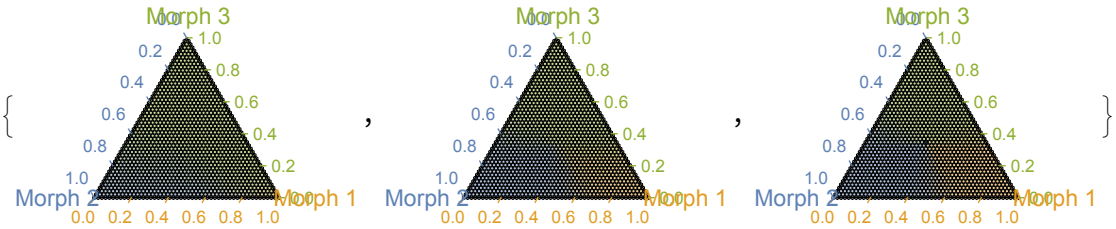


Type 2 Conformists

In[•]:=
```
dataplotstype2conformists =
  Table[Show[Graphics[{EdgeForm[{Black, Thin}], Table[{Blend[Lighter[cols, 0.5],
        {rawtype2conf[[j, 2 ;;]][[i]][[4]], 1 - rawtype2conf[[j, 2 ;;]][[i]][[3]] -
          rawtype2conf[[j, 2 ;;]][[i]][[4]], rawtype2conf[[j, 2 ;;]][[i]][[3]]}],
       RegularPolygon[trans[{rawtype2conf[[j, 2 ;;]][[i]][[2]],
          1 - rawtype2conf[[j, 2 ;;]][[i]][[2]] - rawtype2conf[[j, 2 ;;]][[i]][[1]]}],
       {0.01, 11}, 6]}, {i, 1, Length[rawtype2conf[[j, 2 ;;]]]}]},
    Frame → False, PlotRange → {{-0.05, 1.05}, {-0.05, Sqrt[3]/2 + 0.05}}],
   ListPlot[{internal[[All, 2]][[j]]}, Joined → True, Axes → False,
    PlotMarkers → {diamond, Scaled[0.05]},
    PlotStyle → Opacity[0.5]], tlp, Graphics[
    Text[Style["Morph 1", FontFamily → "Calibri", 12, cols[[1]]], {1.2, 0}]],
   Graphics[
    Text[Style["Morph 2", FontFamily → "Calibri", 12, cols[[2]]], {-0.2, 0}]],
   Graphics[Text[Style["Morph 3", FontFamily → "Calibri", 12, cols[[3]]],
     {0.6 - 0.09, Sqrt[3]/2 + 0.12}]], PlotRange → All], {j, 1, Length[filecounter], 1}];
```

In[•]:=
```
{dataplotstype2conformists[[7]],
 dataplotstype2conformists[[13]], dataplotstype2conformists[[19]]}
```

Out[•]=



In[•]:=
```
dataplotstype2conformists[[19]]
```

Out[•]=