Bar Chart Cube Design

Introduction

A **Bar Chart Cube** is a 3x3x3 **Rubik's Cube** used to generate bar charts. A **bar chart** or **bar graph** is a chart with rectangular bars with lengths proportional to the values that they represent. Bar charts are used for comparing two or more values. The bars can be horizontally or vertically oriented.
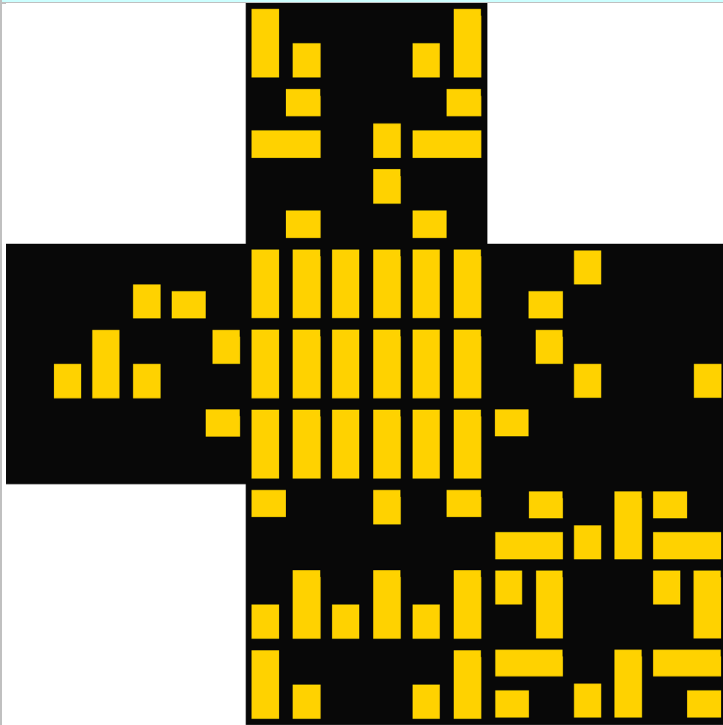
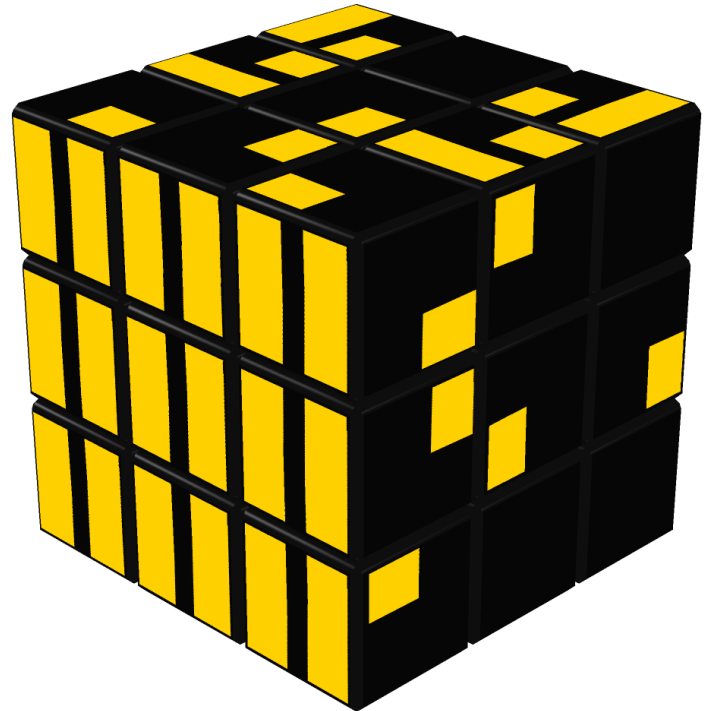| Bar Charts – Useful Links	
http://en.wikipedia.org/wiki/Bar_chart	http://commons.wikimedia.org/wiki/Bar_chart

There are **virtual cubes** that can be *virtually* rotated and twisted on a computer screen and **real cubes** that can only be *physically* rotated and twisted by hand. A **texture** is laid down on a virtual cube whereas real **stickers** are stuck down on a real cube. A Bar Chart Cube is designed by placing bars on a texture which is then laid down on a virtual cube (see http://www.randelshofer.ch/ for more details). Charts can be displayed on a *selected* cube face by rotating and twisting some parts of the cube. When this has been achieved, we say that the cube has been *solved*. The following example shows the *initial* state of the cube where fully filled bar patterns are displayed on the front face.

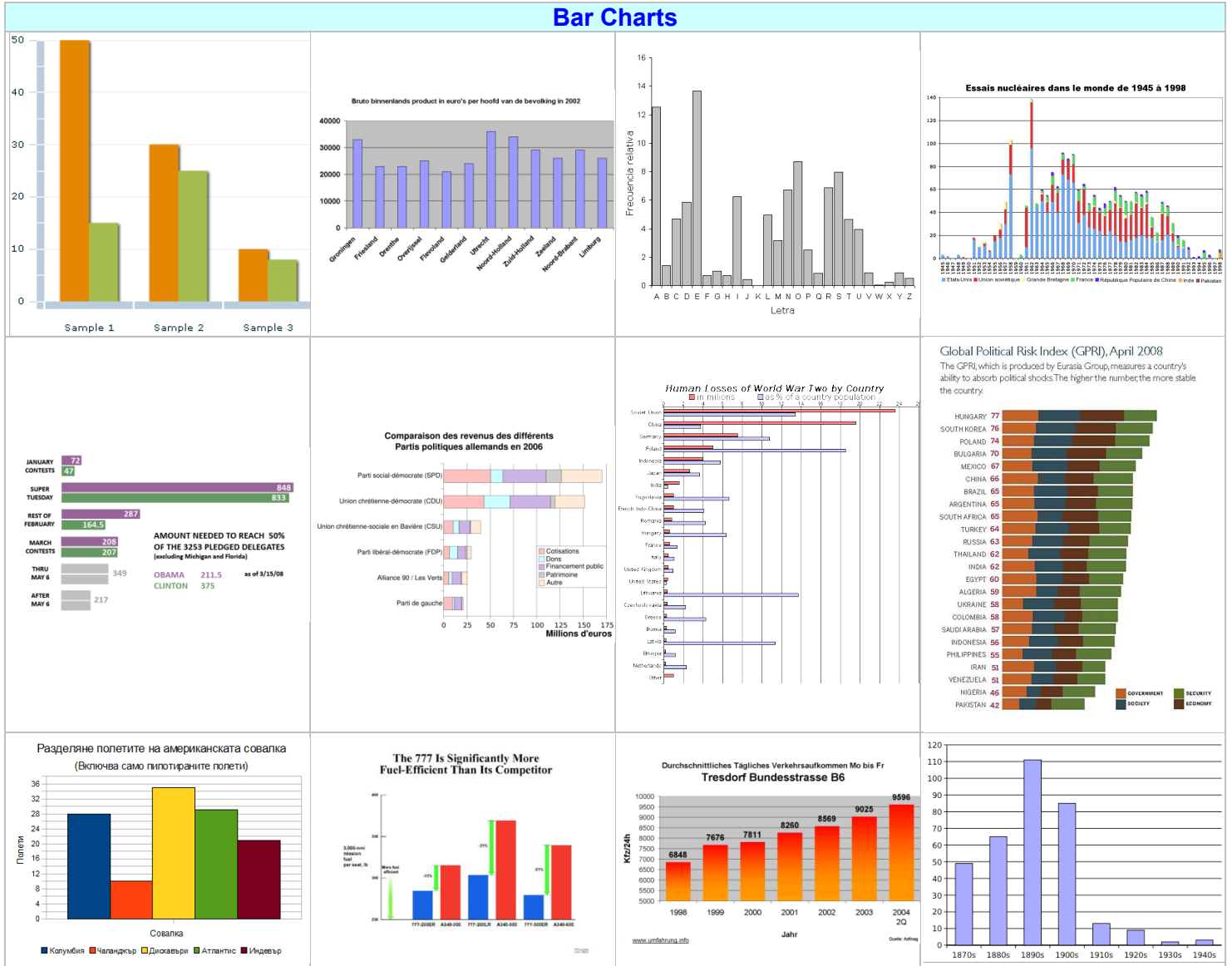| Bar Chart Cube – Initial State	
Cube Texture	Virtual Cube

Bar Chart Cube Features

There are just 9 *different* blocks that are to be displayed on each cubie when 2x2 bar patterns are used. As there are only 6 center cubies available, 3 blocks out of 9 should then be removed and replaced with other blocks. In *this* design, Patterns 7, 8 and 9 are replaced with Patterns 4, 5 and 6, respectively (see Basic Patterns).

Examples of Bar Charts

Bar Charts

Bruto binnenlands product in euro's per hoofd van de bevolking in 2002

Essais nucléaires dans le monde de 1945 à 1998

Comparaison des revenus des différents Partis politiques allemands en 2006

Human Losses of World War Two by Country

Global Political Risk Index (GPRI), April 2008

The GPRI, which is produced by Eurasia Group, measures a country's ability to absorb political shocks. The higher the number, the more stable the country.

Разделяне полетите на американската совалка
(Включва само пилотираните полети)

The 777 Is Significantly More Fuel-Efficient Than Its Competitor

Durchschnittliches Tägliches Verkehrsaufkommen Mo bis Fr
Tresdorf Bundesstrasse B6

Examples of Bar Chart Cube Synthesized Algorithms

Bar Chart Cube Synthesized Algorithms (To be completed)	
Setup Algorithms	
Setup Algorithms	

Bar Chart Cube Synthesized Algorithms (To be completed)

Setup Algorithms

Setup Algorithms

Bar Chart Cube Basic Patterns

The 6 Basic Patterns

Pattern 1 (P1)

Pattern 2 (P2)

Pattern 3 (P3)

Pattern 4 (P4)

Pattern 5 (P5)

Pattern 6 (P6)

Replaced Patterns

Pattern 7: replaced with P4

Pattern 8: replaced with P5

Pattern 9: replaced with P6

There are just 9 different blocks that are to be displayed on each cubie if 2x2 bar patterns are considered. As there are only 6 center cubies available, 3 blocks should then be removed and replaced with other blocks. In this design, Patterns 7, 8 and 9 are replaced with Patterns 4, 5 and 6, respectively.

Bar Chart Cube Design

There are 6 basic patterns (P1, P2, P3, P4, P5 and P6) that can be displayed *independently* on each cubie.

Top Layer Layout

Patterns on the **T**op **L**ayer are sorted out as follows:

1- 2 **T**op **L**eft corner cubes: [P1, P2, P3], [P4, P5, P6]
2- 3 **T**op **C**enter edge cubes: [P1, P2], [P3, P4], [P5, P6]
3- 2 **T**op **R**ight corner cubes: [P1, P2, P3], [P4, P5, P6]

So, now there are 4 corner and 9 edge cubes left that can be used for the 2 remaining layers.

Middle Layer Layout

Patterns on the **M**iddle **L**ayer are sorted out as follows:

1- 3 **M**iddle **L**eft edge cubes: [P1, P2], [P3, P4], [P5, P6]
2- 6 **M**iddle **C**enter cubes: [P1, P2, P3, P4, P5, P6]
3- 3 **M**iddle **R**ight edge cubes: [P1, P2], [P3, P4], [P5, P6]

So, now there are 4 corner and 3 edge cubes left that can be used for the **B**ottom **L**ayer.
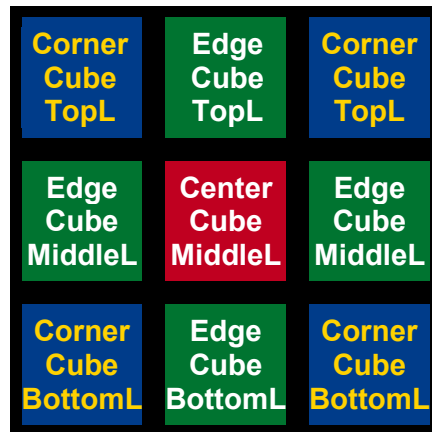
Bottom Layer Layout

Patterns on the **B**ottom **L**ayer are sorted out as follows:

1- 2 **T**op **L**eft corner cubes: [P1, P2, P3], [P4, P5, P6]
2- 3 **T**op **C**enter edge cubes: [P1, P2], [P3, P4], [P5, P6]
3- 2 **T**op **R**ight corner cubes: [P1, P2, P3], [P4, P5, P6]

Bar Chart Cube Layout Table		
Top **L**eft – Corner cubes	**T**op **C**enter – Edge cubes	**T**op **R**ight – Corner cubes
[P1, P2, P3], [P4, P5, P6]	[P1, P2], [P3, P4], [P5, P6]	[P1, P2, P3], [P4, P5, P6]
Middle **L**eft – Edge cubes	**M**iddle **C**enter – Center cubes	**M**iddle **R**ight – Edge cubes
[P1, P2], [P3, P4], [P5, P6]	[P1, P2, P3, P4, P5, P6]	[P1, P2], [P3, P4], [P5, P6]
Bottom **L**eft – Corner cubes	**B**ottom **C**enter – Edge cubes	**B**ottom **R**ight – Corner cubes
[P1, P2, P3], [P4, P5, P6]	[P1, P2], [P3, P4], [P5, P6]	[P1, P2, P3], [P4, P5, P6]

Terminology

In a 3x3x3 **Rubik's Cube**, there are 8 *Corner Cubes*, 12 *Edge Cubes*, 6 *Center Cubes* and 6 *Cube Faces*. There are also 4 Corner Cube faces, 4 Edge Cube faces and 1 Center Cube face *per Cube Face*, as shown below.

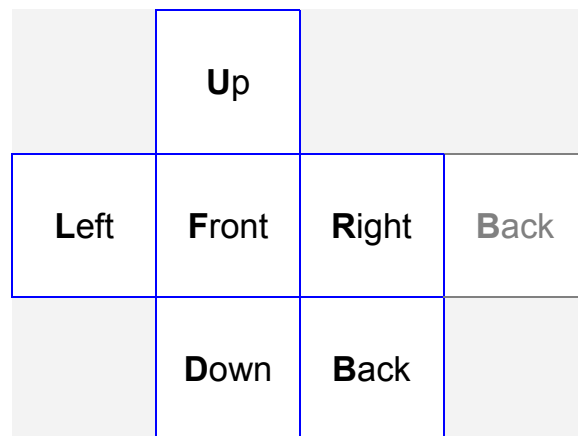| Corner Cube TopL	Edge Cube TopL	Corner Cube TopL
Edge Cube MiddleL	**Center Cube MiddleL**	**Edge Cube MiddleL**
Corner Cube BottomL	**Edge Cube BottomL**	**Corner Cube BottomL**

There are 1 face per Center Cube, 2 faces per Edge Cube and 3 faces per Corner Cube.

There are also 3 horizontal *Layers* called *Top*, *Middle* and *Bottom Layers*.

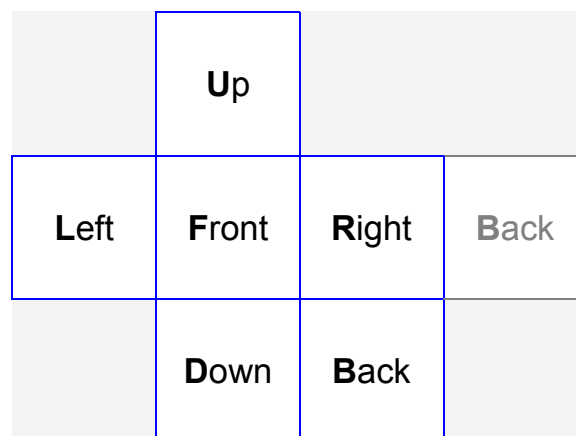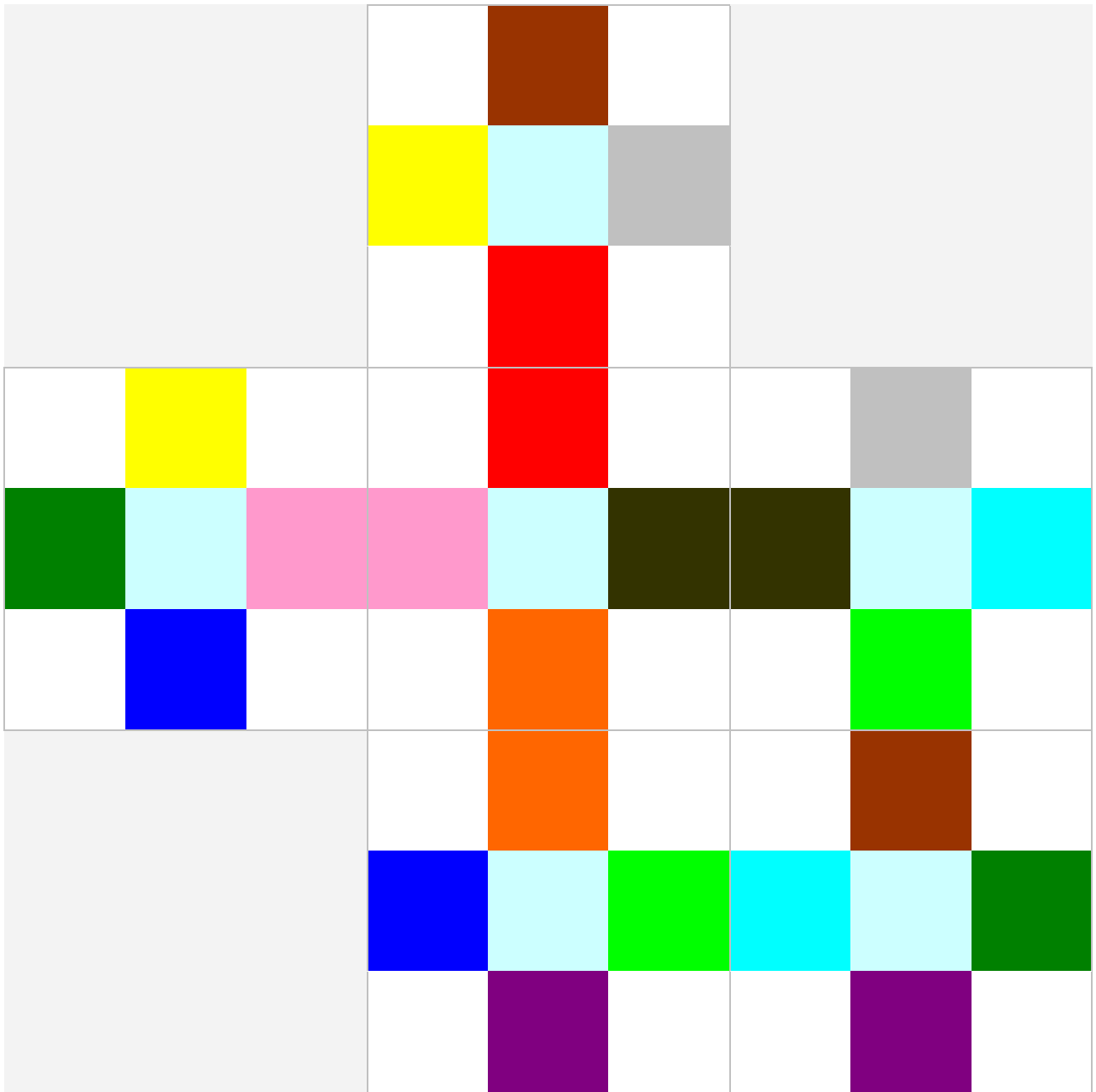| Cube Lexicon		
English	**Français**	**Deutsch**
Cube	Cube	Würfel
cubie, cube	cube, petit cube	Würfelteil, Teil des Würfels
face	face	Seite, Seitenfläche
front face	face avant	vordere Seite, vorne
back face	face arrière	hintere Seite, hinten
left face	face gauche	linke Seite, links
right face	face droite	rechte Seite, rechts
top face	face supérieure	obere Seite, oben
bottom face	face inférieure	untere Seite, unten
sticker	étiquette (autocollante), plaquette	Kleber, Farbkleber
tile	tuile, plaquette	Plättchen, Farbplättchen
center cube, center	cube central, centre	Mittelwürfel, Mittelstein, Mitte
edge cube, edge	cube-arête, arête	Kantenwürfel, Kantenstein, Kante
corner cube, corner	cube de coin, coin	Eckwürfel, Eckstein, Ecke
layer	couronne	Schicht, Scheibe
top layer	couronne supérieure	obere Schicht, obere Scheibe
middle layer	couronne intermédiaire	mittlere Schicht, mittlere Scheibe, Mittelschicht, Mittelscheibe
bottom layer	couronne inférieure	untere Schicht, untere Scheibe
orientation, direction	orientation	Orientierung
to solve	résoudre	lösen, zusammen drehen
to twist	pivoter	drehen
to rotate	tourner, effectuer une rotation	drehen
clockwise	dans le sens horaire	im Uhrzeigersinn
anticlockwise, counter-clockwise	dans le sens anti-horaire	im Gegenuhrzeigersinn

Corner Cubes Final Check

There are 8 Corner Cubes and 3 faces per Corner Cube. In the diagram below, each Corner Cube is displayed in 8 different colors and with the same color applied to each of its 3 faces. This diagram can be used as a convenient *visual aid* to check Design Rules (DRC).

Edge Cubes Final Check

There are 12 Edge Cubes and 2 faces per Edge Cube. In the diagram below, each Edge Cube is displayed in 12 different colors and with the same color applied to each of its 2 faces. This diagram can be used as a convenient *visual aid* to check Design Rules (DRC).

Texture Template

This is a texture template that can be printed out and used for writing down numbers and letters by hand *prior to* texture design. All is needed are pencil, rubber…and time.

Up	
Left	**F**ront	**R**ight	**B**ack
	Down	**B**ack