Cramer's V

Cramér's V is an effect size measurement for the chi-square test of independence. It measures how strongly two categorical fields are associated.

Chi-square: **a data analysis** on the basis of **observations**, to determine if a difference between observed data and expected data is due to **chance**, or if it is due to a **relationship**

The effect size is calculated in the following manner:

1. Determine which field has the fewest number of categories.
2. Subtract 1 from the number of categories in this field.
3. Multiply the result by the total number of records.
4. Divide the chi-square value by the previous result. The chi-square value is obtained from the chi-square test of independence
5. Take the square root.

$$\textbf{Cramer's V} = \sqrt{(X^2/n) \,/\, \min(c-1, r-1)}$$

- X^2: The Chi-square statistic
- **n:** Total sample size
- **r:** Number of rows
- **c:** Number of columns

		Eye Color		
		Blue	Green	Brown
Gender	Male	6	8	12
	Female	9	5	10

```
library(rcompanion)

#create table
data = matrix(c(6, 9, 8, 5, 12, 10), nrow=2)

#view table
data

     [,1] [,2] [,3]
[1,]    6    8   12
[2,]    9    5   10

#calculate Cramer's V
cramerV(data)

Cramer V
  0.1671
```

Effect size (ES)	Interpretation
ES ≤ 0.2	The result is weak. Although the result is statistically significant, the fields are only weakly associated.
0.2 < ES ≤ 0.6	The result is moderate. The fields are moderately associated.
ES > 0.6	The result is strong. The fields are strongly associated.

		Eye Color		
		Blue	Green	Brown
Political Party Preference	Republican	8	5	6
	Democrat	2	8	3
	Independent	4	6	8

```
library(rcompanion)

#create table
data = matrix(c(8, 2, 4, 5, 8, 6, 6, 3, 8), nrow=3)

#view table
data

     [,1] [,2] [,3]
[1,]    8    5    6
[2,]    2    8    3
[3,]    4    6    8

#calculate Cramer's V
cramerV(data)

Cramer V
  0.246
```